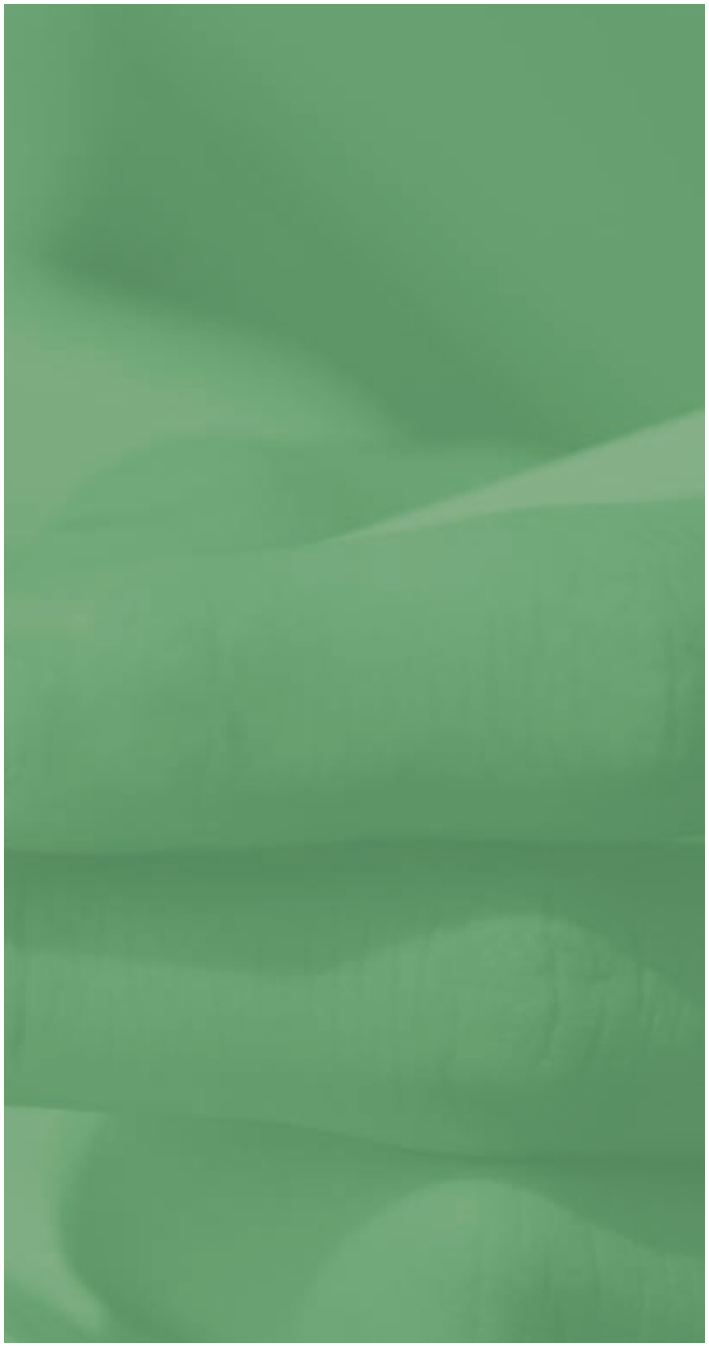
The role of vocational education and training in the labour market outcomes of people with disabilities



Cain Polidano

Kostas Mavromaras

A NATIONAL VOCATIONAL EDUCATION AND TRAINING RESEARCH AND EVALUATION PROGRAM REPORT

NCVER

Australian Government
Department of Education, Employment and Workplace Relations

NCVER

The role of vocational education and training in the labour market outcomes of people with disabilities

Cain Polidano
Melbourne Institute of Applied Economic and Social Research

Kostas Mavromaras
*National Institute of Labour Studies**

*This work was mostly undertaken at the Melbourne Institute of Applied Economic and Social Research

Publisher's note

To find other material of interest, search VOCED (the UNESCO/NCVER international database <http://www.voced.edu.au>) using the following keywords: disability, labour market, vocational education, disadvantaged, discrimination, participation, supply and demand, employment.

The NVETRE program is based upon priorities approved by ministers with responsibility for vocational education and training (VET). This research aims to improve policy and practice in the VET sector. For further information about the program go to the NCVER website <http://www.ncver.edu.au>. The author/project team was funded to undertake this research via a grant under the NVETRE program. These grants are awarded to organisations through a competitive process, in which NCVER does not participate.

The views and opinions expressed in this document are those of the author/project team and do not necessarily reflect the views of the Australian Government, state and territory governments or NCVER.

ISBN 978 1 921413 65 0 print edition
978 1 921413 58 2 web edition

TD/TNC 98.03

Published by NCVER
ABN 87 007 967 311

Level 11, 33 King William Street, Adelaide SA 5000
PO Box 8288 Station Arcade, Adelaide SA 5000, Australia

ph +61 8 8230 8400 fax +61 8 8212 3436
email ncver@ncver.edu.au
<http://www.ncver.edu.au>
<http://www.ncver.edu.au/publications/2215.html>

About the research

The role of vocational education and training in the labour market outcomes of people with disabilities

Cain Polidano, Melbourne Institute of Applied Economic and Social Research
and Kostas Mavromaras, National Institute of Labour Studies*

The Australian Bureau of Statistics (ABS) 2003 Survey of Disability, Ageing and Carers found that nearly one in five Australians has a disability, with only about half of those of working age participating in the labour market, by comparison with over 80% of 15 to 64-year-olds without a disability. A low level of education generally among people with a disability is one of the factors contributing to their lower rate of labour market participation.

Using data from the Household, Income and Labour Dynamics in Australia (HILDA) survey, this study examined whether completing a vocational education and training (VET) qualification helped people with a disability to get a job and stay in employment. While the study found completing a VET qualification provided no further employment benefits for those already employed, for people who are not working, completing a VET qualification significantly increased the likelihood of subsequent employment—more so for people with a disability than without. The authors suggest that the accessibility of VET, by comparison with other post-school education pathways, may make this pathway more attractive for people with a disability, while the attainment of demonstrated competencies or skills is a positive signal to employers.

This study, which makes use of the longitudinal aspect of the Household, Income and Labour Dynamics in Australia survey, is an important contribution to policy deliberations about the provision of education and training opportunities for people with a disability. It suggests that helping people with a disability get a 'first job' is likely to reduce the scarring effect that being out of work has on future employment prospects.

Key findings

- While people with a disability find it considerably harder to retain employment, VET completion strongly improves their chances of getting and keeping a job.
- Childhood onset of a disability is more disruptive than onset in later life. This is in line with the hypothesis developed by the economist Heckman that disruption of skill acquisition at an early age has cumulative effects.
- People for whom the onset of a disability occurs later in life are more likely to be employed. This may be due to skill acquisition before the onset of disability but, more importantly, it may be because they have work experience. However, they are less likely to participate in VET.
- Attrition from VET courses occurs at a greater rate among people with a mental health condition, who report that they are often unable to access help from others.

Tom Karmel
Managing Director, NCVER

Informing policy and practice in Australia's training system …

* This work was mostly undertaken while at the Melbourne Institute of Applied Economic and Social Research.

Contents

Tables

Executive summary

Background

The disadvantaged position in the labour market of people with disabilities has been well documented in most Western developed economies, including Australia. This study aims to provide evidence on the influence of vocational education and training (VET) in the Australian labour market on the relative position of people with and without a disability.

Findings from previous studies show that people with disabilities have a much lower labour market participation rate than their counterparts without a disability (Mavromaras, Wang-Sheng Lee & Black 2006; Wilkins 2004). Further, when they are employed, people with a disability find it harder to retain their jobs, and when they are out of work they find it harder to become re-employed. There is also evidence that, compared with people without a disability, those with a disability were less likely to participate and complete a VET course (Cavallaro et al. 2003) and that people with a mental illness had particularly low rates of completion (Karmel & Nguyen 2008). The main aim of this report is to identify the degree to which the completion of a VET qualification can ameliorate the employment disadvantage of people with a disability, an exercise that is vitally important for the design of policies that enable people with a disability to overcome labour market disadvantage.

This report is based on multivariate regression methods that use the longitudinal nature of the 2001–07 Household, Income and Labour Dynamics in Australia (HILDA) survey data to analyse individual employment status, before and after the completion of a VET qualification. The main question is whether the completion of a VET qualification increases the likelihood of employment and, if so, whether this differs by disability status. The longitudinal aspect of the survey data allows for the measurement of employment outcomes for a period of up to three years after completing a VET course. The presence of longer-term employment probability improvements means that, not only may VET be able to help people with a disability to re-engage in the labour market, but it may also help to keep them in employment.

Employment outcomes benefits from VET

The report examines the relationship between disability and employment and finds that the presence and the severity of disability are negatively associated with employment participation, in terms of both being employed and regaining employment. Conversely, the presence and the severity of disability are found to be positively associated with losing employment and being out of work. These are not novel results in the literature, but they are the most up-to-date results for the Australian labour market, confirming and quantifying a serious facet of labour market disadvantage suffered by people with disabilities.

The relationship between the completion of a VET qualification and subsequent employment status changes is also examined, with a focus on VET qualifications at the level of certificates III and above. The report finds that completing a VET qualification significantly increases the employment probability of all labour market participants. It also finds considerable state

dependence[1] at a level which accords with international estimates from both the United Kingdom and the United States labour markets.

The examination of employment outcomes is concluded by looking at whether the employment disadvantage suffered by people with disabilities is ameliorated by the completion of a VET qualification. For those who were in employment (either with or without a disability, VET completion had no effect on their subsequent employment probabilities throughout the three years covered by the data. By contrast, for those not working at the start of the period during which they completed their VET, its completion improves subsequent employment probabilities, much more for people with a disability. For an average person out of work and who has a disability, completing VET is estimated to increase the probability of employment from 9% to 29% in their first year after completion. By contrast, for an average person out of work who does not have a disability, completing a VET course is estimated to increase their probability of employment from 52% to 62% in their first year after completion.

The report suggests that the greater effectiveness of VET in improving the employment probabilities of people with disabilities is due to the nature of VET as a post-school pathway. We argue that VET is more accessible than all other post-school educational pathways and that this attribute is of particular value for people with disabilities who may experience added difficulties in obtaining education and in subsequently utilising education qualifications in the labour market. VET may also be more beneficial to those with a disability because it provides assurances to employers that a job candidate's disability does not hinder their ability to perform tasks that are relevant to their prospective job.

A point of note is that completing a VET qualification not only helps those out of work find employment, but it also helps them find continuous employment. For an average person out of work with a disability, completing a VET qualification is estimated to lead to a ten-percentage-point increase in their chances of being in work for up to three consecutive years after VET completion. For an average person out of work without a disability, completing a VET qualification is estimated to lead to a seven-percentage-point improvement in their chances of being continuously in work for three years after completion. The longer-term employment benefits of VET completion suggest that, not only does VET help prepare people for work, but it equips them with the skills to maintain employment.

Potential barriers to participation and completion of VET

Despite the greater employment benefits from completing a VET qualification for people with a disability, no significant differences in the participation and completion rates of VET between people with and without a disability are found. However, for people with a mental health condition, the group that suffers the greatest employment disadvantage of any disability group (independent of education), the report finds that if they report that they are 'often unable to find help from others', they also drop out of VET at a greater rate. There is no estimated discrepancy in completion rates for those who report that they are usually able to find help. This finding is consistent with the findings from a previous National Centre for Vocational Education Research (NCVER) study by Miller and Nguyen (2008). They found that the academic progress of VET students with a mental illness was often hampered by a reluctance to use student support services. In some cases, they found that students could not use student support services because they declined to declare their disability. Our study confirms the importance of ensuring adequate help for people with a mental health condition.

[1] The degree to which being employed today increases the chances of being employed tomorrow. Refer to box 1 for a more detailed explanation of state dependence

Introduction

Studies both in Australia and overseas have shown that having a disability is associated with adverse labour market outcomes. In particular, people with a disability are less likely to be in paid employment (Baldwin & Johnson 1994; Wilkins 2004; Jones, Latreille & Sloane 2006; Mavromaras, Lee & Black 2006). Most recent estimates from the Household, Income and Labour Dynamics in Australia (HILDA) survey suggest that only 59% of working-age people with a disability are in paid work, compared with 84% of people without a disability.[2]

Improving labour market outcomes for people with a disability is a part of the Australian Government's social inclusion agenda, as spelled out in a paper on developing a National Mental Health and Disability Employment Strategy (Commonwealth of Australia 2008). In this paper the government acknowledges the strong links between workplace participation and social inclusion, personal financial independence, social networks, self-confidence and self-esteem.

Improving the labour market outcomes for people with a disability confers broad economic and social benefits of a direct and indirect nature. Moving people off income support reduces the pressure on government budgets. According to recent statistics, there are more than 700 000 people in Australia who are registered Disability Support Payment (DSP) recipients (Department of Family, Housing, Community Services and Indigenous Affairs 2006), a number suggesting the importance of research surrounding their circumstances.[3] Further, increasing workplace participation among those with a disability addresses labour market problems associated with both skills shortages and an increasingly ageing workforce, and contributes towards promoting the more general goal of maintaining Australia's standard of living (Commonwealth of Australia 2002).

In recent times, the Australian Government's efforts to increase workplace participation among people with a disability concentrated on Welfare to Work reforms. A key feature of these reforms was the strong emphasis on evaluating a person's work capacity, rather than their disability, thus extending the focus on individually tailored employment support and tightening the eligibility criteria for people whose work capacity is only partially reduced by their disability (Commonwealth of Australia 2005).

The Welfare to Work reforms also identified the need for additional education and training for people with a disability (Australia Government 2005) and has been carried forward into the Australian Government's National Mental Health and Disability Employment Strategy (Commonwealth of Australia 2008). Recent data (2007) from the Household, Income and Labour Dynamics in Australia survey show that the proportion of people with no Year 12 school completion is below 25% for the whole population and over 40% for people with disabilities. As observed in previous studies (Cavallaro et al. 2003; Mavromaras, Lee & Black 2006), low levels of education are a potential barrier to obtaining and retaining employment for many people with a disability.

---

[2] Estimated using Wave 7 from the Household, Income and Labour Dynamics in Australia survey and excludes people who are currently in full-time study or who are not working because they are caring for children.

[3] There has been an increasing trend in the number of Disability Support Payment claimants from below 150 000 in 1972 to more than 700 000 in 2006. The number of DSP recipients is an underestimate of the number of people with disabilities. For example, in the 2005–06 financial year, when 61 400 DSP claims were granted, there were an additional 38 700 claims rejected, most of them because the impairment was not considered sufficiently severe.

The primary aim of this study is to measure the employment benefits from completing a vocational education and training (VET) course for people with a disability. VET may help address not only the shortfall of education for people with disabilities, but also a number of other barriers to employment, such as actual and perceived disadvantage and discrimination associated with disability, and the lack of soft skills that are often encountered among people who have experienced longer periods out of work. In this study, we do not attempt to measure the extent to which VET addresses individual barriers to employment: answering such questions would be more suited to a qualitative framework of research. Instead we focus on measuring how VET may change the propensity to participate in employment at the population level; we use quantitative statistical analysis. We investigate whether any changes in the propensity to gain employment that follow the completion of a VET qualification may vary by prior labour market status, and whether such changes are short- or long-lived. We differentiate the analysis by disability status, as this is the focus of the report. Our core questions are the following:

- ✧ What is the effect of disability on employment?
- ✧ What is the effect of VET on employment?
- ✧ Does the effect of VET on employment vary by disability status and if so, how?

A secondary aim of this study is to examine whether there are barriers to participation and completion of VET for people with a disability which may prevent them from accessing any employment benefits from VET. Previous studies have found that people with a disability are less likely to complete a VET course than those without a disability (Cavallaro et al. 2003) and that people with a mental illness are particularly at risk of non-completion of a VET course (Karmel & Nguyen 2008).

Answers to the questions addressed in this report will help us to assess the efficacy of VET programs in addressing labour market disadvantage for people with a disability and will also help to identify potential barriers that people with a disability face regarding participation in and completion of VET qualifications.

This report is structured as follows. The next chapter introduces the relevant aspects of the Household, Income and Labour Dynamics in Australia survey. It also presents and discusses the definitions of disability and education that we use. The following chapter presents descriptive statistics to provide the necessary empirical background for the questions we ask and the analysis that follows. The next chapter explains the methods that we use for the multivariate statistical analysis, while the one following this presents and discusses estimation results for people with and without disabilities in two main parts: first, the estimation of the impact of VET on employment outcomes; and, second, the estimation of the interrelated processes of participation in and completion of VET. The final chapter has our concluding remarks. An appendix contains more detailed estimation results and additional information on the econometric aspects of the report.

Data and definitional issues

This project uses data from the Household, Income and Labour Dynamics in Australia survey. This is a representative dataset of Australian households, which tracks the same individuals through time (panel dataset) from 2001 to 2007 (currently). Panel data enable the researcher to observe and analyse change at the individual level. Being able to track individual changes is important in the context of this study because we are interested in following the progress of VET students and analysing the benefits of VET after its completion. As well as providing a longitudinal perspective, the survey includes rich information on labour market outcomes, education and training, socio-demographic information, and personal health conditions. Other representative Australian datasets with detailed information on disability, such as the Survey of Disability and Ageing and Carers (SDAC) 2003, do not have information on individuals' course completion.

There are two important definitional issues in the context of this study: the definition of VET and the treatment of disability.

Vocational education and training

People with a VET qualification are defined in this study as those who have completed an Australian Qualifications Framework (AQF) certificate I to IV, have completed a diploma or advanced diploma, or those who have completed an 'undefined certificate'. People may not be able to identify their certificate level if, for example, they hold a trade certificate.

An important distinction in this study is between the stock of VET (VET qualifications that were present at the start of the survey in 2001) and the flow of VET (completion of VET identified in the Household, Income and Labour Dynamics in Australia survey between 2002 and 2007). To understand the effect of VET on employment outcomes for people with a disability, it is important that we measure benefits only for those whose disability preceded the completion of their VET qualification. Because there is no information in the survey on when qualifications present at the start of the survey were completed, we use the flow variable to measure the employment benefits of VET. In each wave of the survey from 2002, respondents are asked whether they have obtained a qualification since their last interview. As this question compares their state in the present interview with that in their previous interview, information on the flow of VET is very accurate.

To identify VET participation and completion in the Household, Income and Labour Dynamics in Australia survey, the following rules are applied. An individual is identified as having participated in VET if they report being currently enrolled in VET or were enrolled since their last interview. An individual is identified as having completed the course if they are no longer studying and were awarded a VET qualification subsequent to their previous interview. A limitation of this survey is that we cannot identify whether an individual who ceased studying without a qualification is a module completer (a component of a course that does not lead to a certificate) or a dropout.

Disability

In the Household, Income and Labour Dynamics in Australia survey, the definition of someone with a disability is 'someone who has a long-term health condition, impairment, or disability that

restricts everyday activities, and has lasted or is likely to last, for 6 months or more'. A pertinent point to keep in mind is that this definition excludes the vast majority of the outcomes of workplace-related illnesses and injuries, as very few of them force an absence from work for more than a fortnight. This also excludes other transient health shocks, especially those caused by illnesses or injuries that do not lead to permanent incapacity. Transient health shocks are a different issue and they lead to distinct responses in terms of labour market behaviour (see Cai, Mavromaras & Oguzoglu 2008), which are not the subject of this report.

Severity of disability

Severity of disability is controlled for in this analysis by using a self-reported measure of the extent to which disability limits the type, or amount, of work that an individual can do. The variable is measured on an 11-point scale where 0 means that if there is a disability, it leaves work capacity unaffected and 10 means that it makes work impossible.[4] A limitation of this measure is that it assumes that (i) individuals can judge the extent to which their disability limits their capacity to work; and (ii) respondents in employment may make the judgment based on the characteristics of their present job and not necessarily on their more general ability to work, as their present job gives them their best guess in the presence of future uncertainty. It is possible that differences in responses may reflect not only differences in the severity of disability, but also personal differences, such as differences in attitudes to work, labour market prospects, and (or) employment history.[5] To some degree, these differences are captured in the multivariate analysis by using panel data models that control for unobserved differences between individuals and which may affect labour market outcomes (see the technical discussion on 'unobserved heterogeneity' in appendix A for more information).

Notwithstanding these controls, individuals who report 'not being able to work' because of their disability are not omitted from the sample, because doing so would potentially bias our estimation results. Another reason against omitting those who report being completely unable to work is that such a response does not necessarily represent permanent incapacity—many of these individuals report participating in the labour market in subsequent periods.

Type of disability

Different types of disability are likely to have varying impacts on employment outcomes, as they may restrict both the capacity to find work as well as productivity in the workplace. In the Household, Income and Labour Dynamics in Australia survey respondents who have a disability are asked to choose, from a range, which type(s) of disability they presently have. Therefore, it is possible that an individual will report having more than one type of disability. For the purposes of this study, we classify disabilities into the six groups available in the HILDA survey:

- ✧ sensory: sight (that cannot be corrected with glasses), speech, or hearing impairment
- ✧ physical: deformity, limited use of limbs, difficulty gripping, health condition that affects physical activity, recurring pain, and long-term conditions that restrict activity
- ✧ intellectual: learning difficulties
- ✧ psychological: mental illness that requires help, or nervous (emotional) condition that requires treatment
- ✧ other: long-term stroke, or head injury, and other long-term health conditions
- ✧ multiple: more than one of the above disability types.

[4] The question of severity is only asked of those who have reported a disability. The sequential nature of these questions is modelled below.

[5] A more objective approach would be to use measures of restrictions in core activities (self-care, mobility, and communication); however, these are only available in Wave 4 of HILDA.

Onset of disability

It is possible that the timing of disability onset can affect employment outcomes in a number of ways. On the one hand, those whose disability occurred at an early age may be worse off than those who experienced a later onset because schooling, network formation, and accumulation of work experience may be disrupted. Conversely, those who experienced onset at an early age may have had more time to adapt to their specific needs and limitations. Results presented by Wilkins (2004) and Mavromaras, Lee and Black (2006) favour the latter explanation. This is that later onset is associated with more adverse employment outcomes; however, the relationship is not a simple one, as there are some indications that very early onset can also be associated with more adverse outcomes.[6]

In the Household, Income and Labour Dynamics in Australia survey, disability onset is identified for each disability type. For the purpose of this study, we take 'onset' to mean the time of the first disability onset. Consistent with Wilkins (2004), we treat age of onset as a categorical variable:

- ✧ child (0–14 years)
- ✧ youth (1–24 years)
- ✧ prime-age adult (25–44 years)
- ✧ older adult (45–64 years)
- ✧ unknown.

An individual's onset is classified as 'unknown' if, either they were unable to identify a year of disability, or, if their response to this question was missing.

[6] This is a particularly difficult area in which to derive conclusive statistical results. Most of the evidence we have relies on either short-panel, or just cross-section data. Clearly these are not ideal data, as the issue hinges on long-run behaviour and outcomes: the ideal data would be from a long-run panel. However, the use of long-run panels runs into statistical difficulties because in the long run, attrition renders them ineffective for the study of individuals. For example, one of the longest panel studies available, the German Socioeconomic Panel that started in the early 1980s had lost more than 85% of its original subjects by 2006. A well-established result in the literature is that disadvantage (social, health, and other) leads to higher attrition from panels; hence, even if there were such a long-running Australian panel available to study, we would still find it very difficult to reach conclusions on this issue because of attrition.

The sample

Table 1 Number of observations in each wave of the sample, 15–64 years of age

	Included in the sample		Excluded from the sample			
	Without	With disability	Changed disability status	Full-time student	Missing disability type	Full-time carer
2001	8 250	1 194	0	979	1 035	343
2002	7 559	999	463	972	646	266
2003	6 976	1 403	1 069	892	18	217
2004	6 499	1 488	1 200	832	16	212
2005	6 651	1 524	1 277	874	14	199
2006	6 712	1 511	1 289	885	12	171
2007	6 716	1 480	1 214	918	17	152
Total	**49 363**	**9 599**	**6 512**	**6 352**	**1 758**	**1 560**

Source: Household, Income and Labour Dynamics in Australia, 2001–07.

Data used in the analysis for this report are only a part of all data available in the Household, Income and Labour Dynamics in Australia survey. Reflecting the focus of this report on labour market outcomes, the sample includes only those individuals who were of working age (between 15 and 64 years) at the time of their interview. To improve the robustness and efficiency of the results, individuals who are not likely to enter the labour market in a given period because of their circumstances are excluded, as well as those whose disability status is unclear. These exclusions are summarised in table 1 and are discussed below.

A key point of note is that because the survey is a panel dataset, the same individuals are surveyed each year (unless they leave the survey), and in our sample individuals are allowed to enter and leave as their circumstances change from year to year. Therefore, someone who is excluded in one year because they report as full-time carers may be included in the following year if they no longer report as out of the labour market because of caring duties. To maximise the use of available information, all individuals who meet the inclusion criteria in a given year are used in the analysis, regardless of whether these individuals are observed in every wave of the survey. We thus analyse what is called an unbalanced panel dataset.

Allowing individuals to leave and re-enter the sample as their circumstances change means that the number of individuals in the sample fluctuates from year to year (first two columns of table 1). For example, in 2002 there are 7559 individuals without a disability in the sample, but in 2003, the number falls to 6976. On average, over the seven waves of HILDA, there are 8300 individuals in the survey: 1300 individuals with a disability and around 7000 individuals without a disability. Because the same individuals are surveyed each year (unless they exit the survey), there are roughly 50 000 observations available on the 8300 people in the sample.

Excluded observations

Although we do not distinguish between unemployed and not in the labour force, we omit individuals who, because of their circumstances, may not have a reasonable chance of moving to employment in a given year: 6352 observations of full-time students and 1560 observations of people who are not in the labour force because they report as caring for children (table 1).[7]

We endeavoured to use all observations in the first seven waves of the survey (2001–07); however, some cases were omitted because of missing data. Information on disability onset and type of

[7] Although we omit individuals who report as full-time students and carers in a given year, the same individual may return to the sample in a following year if their circumstances changed.

condition is not available in the first two waves of the survey (2001–02). For individuals who reported a disability after 2002, the type and onset of their condition in Waves 1 and 2 is assumed to be the same as that reported in Wave 3 (2003). However, if the onset or condition type for people who reported a disability in Waves 1 or 2 is not observed in Wave 3 (either because they left the sample, did not respond to the question, or no longer reported a disability), then individuals are removed from the sample. Also removed are people who reported having a disability, but did not report their disability type. In total 1758 observations were removed from the sample because of missing data (table 1), mainly from the first two waves. As a result, there are fewer people with a disability included in the first two waves of the sample (table 1). A point of note is that many individuals with a disability could not determine the year of onset, or the year of onset was not observed. Rather than omitting them, these individuals were treated as a separate category in the analysis related to disability onset.

Repeated observations on individuals in the survey (called panel information) allow us to construct a new measure of disability and to address novel questions. The prime objective is to examine the potential impact of VET completion by disability status. To make a comparison between persons with and without a VET completion between two consecutive survey interviews, the sample is restricted to persons who were, during *both* interviews, either with or without a disability and then estimate the possible differential labour market outcomes between those who obtain a VET qualification and those who do not. This is a simple data design, which, combined with the appropriate panel data model methodology, allows us to estimate the effect of VET on employment outcomes by disability status. To achieve this design, all contiguous pairs of observations which contain a different disability status for the same person are excluded from the data. Where a person changes their disability status within the observation period (seven interviews between 2001 and 2007), the pair of observations that contain the change in disability status will be excluded from the data. All other pairs remain in the data. Having arranged all pairs of observations in this manner, we then observe the presence or not of qualification completion between the two interviews (which is revealed by whether or not a person is awarded a VET qualification between the two interviews).[8] This simple design allows us to compare those who did with those who did not complete a VET qualification during a period when their disability status was unambiguous.

[8] For example, consider an individual declared to be without a disability in the years (interviews) 2001–04 and then with a disability in 2005–07. The data for this individual will consist of pairs (2001, 2002), (2002, 2003), (2003, 2004), where the disability variable takes the value 0, and (2005, 2006), (2006, 2007), where the disability variable takes the value 1. Note that the pair for (2004, 2005) will be excluded for this specific individual. For each of the pairs there will be a variable which will take the value 1 if a qualification was completed at any time between the two interviews and 0 if not. Given this definition of disability, individuals who change their disability status from the previous year are omitted from the sample (6512 in table 1), but may rejoin the sample if their disability status remains unchanged in the following years.

Descriptive statistics

Labour market outcomes

Table 2 Labour market status of people with and without a disability, 15–64 years of age

	2001	2002	2003	2004	2005	2006	2007
	%	%	%	%	%	%	%
Without disability							
Employed	81	83	83	85	86	86	87
Unemployed	5	4	3	3	3	3	3
Not in the labour force	15	13	13	12	11	11	11
Number of individuals	8250	7559	6976	6499	6651	6712	6716
With disability							
Employed	45	40	44	47	49	49	49
Unemployed	6	5	4	4	4	5	5
Not in the labour force	49	55	51	48	47	46	47
Number of individuals	1194	999	1403	1488	1524	1511	1480

Notes: Not in the labour force is defined as out of work and does not want to work or is not actively looking for work. Columns may not sum to 100 because of rounding errors.

Source: Household, Income and Labour Dynamics in Australia, 2001–07.

It is well established in the literature that people with a disability have inferior labour market outcomes. For estimates in the Australian context see Wilkins (2004) and Mavromaras, Lee and Black (2006). This is confirmed in the present study. Using the Household, Income and Labour Dynamics in Australia survey (2001–07), table 2 shows that 49% of working-age people who reported a disability for at least two consecutive interviews are employed, compared with 87% of working-age people who did not report at least two consecutive periods of disability. While it is partly due to the higher unemployment rate among people with a disability, table 2 shows that, in the main, this difference is due to a lower rate of labour market participation of people with a disability. To a lesser degree, it can also be attributed to a higher rate of registered unemployment for people with a disability.

The reasons behind the labour market participation disadvantage of people with a disability have been documented elsewhere (see for example Productivity Commission 2004), as being the result of both labour market demand and supply factors. On the demand side, employers may hire fewer people with a disability because they do not possess sufficiently accurate information about the individual productivity of all job candidates at the time of hiring. Where information is costly to obtain, employers may have to make their hiring choices with less-than-perfect information on all candidates. Given that work-limiting disabilities reduce productivity on average, employers may choose to favour people without disabilities at the time of hiring. This is often referred to in the literature as 'statistical discrimination' and forms only a part of the more general problem of imperfect information in the labour market. There are practical methods that can handle this type of problem, including probation periods, training before and after hiring, adapting the job content, and other, but they all carry their costs and need the commitment of both employers and employees.

Table 3 Highest education qualifications of people with and without a disability, 15–64 years of age

	2001	2002	2003	2004	2005	2006	2007
	%	%	%	%	%	%	%
Without disability							
Postgraduate – master's or doctorate	3	3	4	4	4	4	4
Graduate diploma or graduate certificate	5	6	6	6	6	6	6
Bachelor	14	15	15	16	16	16	16
Advanced diploma or diploma	9	9	10	10	10	10	10
Certificate III or IV	19	20	20	20	21	21	21
Certificate I or II	1	1	2	2	2	2	2
Certificate level undefined	0	0	0	0	0	0	0
Year 12	16	15	15	16	17	17	17
Year 11 and below	31	30	28	26	25	24	23
Number of individuals	8250	7559	6976	6499	6651	6712	6716
With disability							
Postgraduate – master's or doctorate	2	2	2	2	3	3	3
Graduate diploma or graduate certificate	4	3	4	5	4	5	5
Bachelor	7	7	7	9	8	8	8
Advanced diploma or diploma	8	8	7	8	7	8	8
Certificate III or IV	21	21	21	20	22	22	23
Certificate I or II	1	1	2	2	2	2	2
Certificate level undefined	1	1	1	1	1	1	1
Year 12	10	10	12	11	12	11	12
Year 11 and below	46	47	44	43	42	40	39
Number of individuals	1194	999	1403	1488	1524	1511	1480

Notes: Columns may not sum to 100 because of rounding errors.
Source: Household, Income and Labour Dynamics in Australia, 2001–07.

Another reason why the demand for labour may disadvantage people with disabilities is because they tend to have less education than people without a disability. Differences in education between people with and without a disability are most stark at the lower end of the education spectrum. Table 3 shows that in 2007 Australian people with at least two consecutive interviews where they reported a disability are around 16 percentage points less likely to have completed secondary school (or equivalent; that is, Year 11 and below) than people without consecutive periods of disability. By contrast, the percentage of people with a disability whose highest qualification is VET (certificate I to diploma/advanced diploma) is comparable to the percentage of people without a disability whose highest qualification is VET. The lower educational attainment of people with a disability is particularly pronounced at the lowest end of the education spectrum: those with qualifications of Year 11 and below, although this category is becoming smaller by the year. It is worrying, however, that the decreasing trend is much slower among people with disabilities: about 15% reduction with and 25% reduction without a disability between 2001 and 2007.

On the supply side, there are many reasons why people with a disability may be less likely to participate in the labour market. First and foremost, a large proportion of people with disabilities have health limitations that do not allow them to work in any way that could be sustainable (typically Disability Support Pension) and they are permanently out of the labour force (Mavromaras, Lee & Black 2006). There are many people with disabilities who present with only a partial work limitation, so that they can and do engage in the labour market. This group of labour market participants may often perceive themselves as having lower productivity on the one hand, but also as being discriminated against, with their disability being the main obstacle to achieving

stable, long-run employment. It is principally people who belong to this category who may benefit from obtaining further education and this is where the role of VET can become crucial because of the flexibility of delivery and content that VET offers to students.

State dependence of employment outcomes

Employment tends to be a persistent state (see box 1). That is, if a person is employed at one point in time, they are likely to be employed at a later time point. However, persistence in employment may be weaker for individuals with a disability than it is for those without a disability. While the causes for persistence or 'state dependence' are not well known, information-based discrimination is an often-cited cause for the damaging effect (scarring effect) that being out of work has on future employment prospects (Pissarides 1992; Blanchard & Diamond 1994). It is commonly hypothesised that being out of work reduces your future employment prospects because, when faced with imperfect knowledge on the capacity of prospective employees, employers will discriminate against those out of work. For those out of work with a disability, discrimination may be particularly adverse because it may signal that their disability limits their ability to work.

Table 4 provides a general description of the probabilities of transition from one employment state to another in consecutive years.

Table 4 Probability of employment state, given employment state in previous year (t-1), HILDA waves 1–7

	Employment status in t	
	Out of work	Employed
Employment status in period t-1	*%*	*%*
Without disability		
Out of work	42	58
Employed	8	92
Number of observations	7 817	41 546
With disability		
Out of work	74	26
Employed	25	75
Number of observations	5 128	4 471

Notes: These probabilities are conditional probabilities. A conditional probability is the probability of being in employment state t, given an individual's previous employment status. It is calculated as the ratio of the joint probability and the marginal probability of the previous employment status. 'Out of work' refers to those either unemployed or not in the labour force.

It is clear that disability is associated with not working. The lack of employment stability among those with a disability is apparent. Only 75% of people with disabilities who were employed in the previous interview are also employed in the current interview, against 92% of those without disabilities. Exactly the opposite holds for exiting the out-of-work status, where 58% of those without a disability manage to gain employment, against 26% of those with a disability. The picture that arises from table 4 is one where people with disabilities are more likely to be out of work, less likely to return to work, and those in work are more likely to exit.

Box 1 The concept of state dependence: A core issue in empirical labour economics

The problem of state dependence runs deep into the core attempts of empirical social science to understand what determines social outcomes in general. In an excellent exposition, James Heckman (1991) distinguished two pertinent issues by asking the following questions: (a) Do initial endowments have a temporary, persistent effect on outcomes (that is, is there 'heterogeneity')?; and (b) Are the effects of initial endowments attenuated or accentuated by subsequent experiences of the process being studied, or by related processes (that is, is there state dependence)?. How this problem relates to the present analysis needs some explanation. In the context of employment, we know that if we pick at random a sample of people who are employed today and another sample of people who are not employed today and we then observe both samples again in one year's time, the proportion of employed people in one year's time will be higher in the sample of those who were initially employed than in the sample of those who were initially not employed. This observation may lead to the conclusion that past (un)employment *causes* future (un)employment. If we dig a bit deeper into the data, however, we will find that the characteristics of the two initial samples are different, and that some of these differences in characteristics will be related to the propensity to be employed when observed again. The empirical problem in understanding what causes future employment hinges on our ability to apportion the observed higher, future employment propensity of those who are presently in employment to (i) either 'heterogeneity' (that is, differences in characteristics that influence employment such as gender, education, and other), or to (ii) 'state dependence' (that is, the degree to which being employed today increases the chances of being employed tomorrow). There can be many reasons why not working can give rise to state dependence, such as human capital deterioration during economic inactivity (Heckman 1981), information-based discrimination, and scarring effects before or during hiring (Pissarides 1992; Blanchard & Diamond 1994), psychological adverse impacts of not working (Clark, Georgellis & Sanfey 2001) and other factors. The econometric models for dealing with state dependence and heterogeneity can be complex, and their foundations go some way back (Lancaster 1979; Heckman 1981; Elbers & Ridder 1982 to mention just a few) and can be very powerful when there are appropriate panel data at hand, such as the Household, Income and Labour Dynamics in Australia survey used in this report.

It is useful to put the empirical problem of state dependence into the context of the present report's research questions and the data used to address them. We do this in two steps. The first step looks at the general question of the presence or not of state dependence. Table 4 shows that people who experienced employment in their previous HILDA interview are more likely to be in employment in their current interview. The core question that we want to answer here is whether this higher employment probability is because they are who they are (that is, because people who were in employment in their previous interview differ systematically from people who were not: this is what Heckman calls heterogeneity); or, because they were in employment in the previous interview (that is, because having been out of work damaged their chances of regaining employment: this is what Heckman calls state dependence). The presence of state dependence affects the possible employment benefits of completing a VET course and has implications for policy design.

The second step looks at the empirical findings about employment state dependence and addresses the question of whether these findings may differ for those who complete a VET qualification in the period between the previous and current interviews. This answers the general question of whether VET influences employment probabilities. This question is refined further by looking at the differences between those with and those without a disability in both their employment state dependence and the effect that VET completion may have on employment outcomes, including state dependence.

Employment benefits from VET

Over and above the main aim of this study, which is to examine how undertaking a VET course may affect future employment prospects for those with a disability, we are also interested in examining how undertaking VET affects the future prospects of those without a disability. While

VET may help to prepare people for work, it is important to know whether VET may also help them to stay in work. Looking at this type of longer-term employment benefit is important and becomes feasible when panel data are used.

The longer-term employment benefits associated with completing a VET course are presented in tables 5 and 6 as the difference in employment rates through time between those who did and those who did not complete a VET course in any given year. What tables 5 and 6 show is that the employment benefits from completing a VET course seem to persist over time for those with and without a disability. For example, for people with a disability (table 6), those in 2002 who report having completed a VET course since their previous interview are estimated to have an employment rate 20 percentage points higher in 2002 than those who did not report completing a VET course. This difference in rates of employment is estimated to persist, but to narrow to 13 percentage points by 2007. These results suggest that, as well as helping people with a disability prepare for work, VET completion also equips them with the skills that enable them to stay in employment.

Another important point that we can garner from tables 5 and 6 is that the employment benefits from completing a VET course appear to be greater for people with a disability than for people without a disability. By comparison with the case described above, people without a disability who in 2002 reported having completed a VET course since their last interview are estimated to be seven percentage points more likely to be in employment in 2002 and four percentage points more likely in 2007 than those who did not complete a VET course. The larger impact of VET on employment for people with a disability may be because they come from a lower average education base (as shown in table 3).

Table 5 Employment rates for those *without* a disability who did and did not report completing a VET course since their last interview, 15–64 years of age

		2002	2003	2004	2005	2006	2007
		%	%	%	%	%	%
Completed a VET course since last interview							
2002	No	78	79	80	82	82	83
	Yes	85	86	87	87	85	87
2003	No	-	79	80	82	82	83
	Yes	-	85	87	87	85	87
2004	No	-	-	80	82	82	83
	Yes	-	-	82	87	85	86
2005	No	-	-	-	81	82	83
	Yes	-	-	-	83	84	87
2006	No	-	-	-	-	82	83
	Yes	-	-	-	-	86	87

Notes: Columns may not sum to 100 because of rounding errors.
Source: Household, Income and Labour Dynamics in Australia, 2001–07.

Table 6 Employment rates for those *with* a disability who did and did not report completing a VET course since their last interview, 15–64 years of age

		2002	2003	2004	2005	2006	2007
		%	%	%	%	%	%
Completed a VET course since last interview							
2002	No	45	53	53	56	55	56
	Yes	65	77	74	64	70	69
2003	No	-	53	53	55	55	56
	Yes	-	65	74	65	74	69
2004	No	-	-	53	55	55	56
	Yes	-	-	67	64	72	68
2005	No	-	-	-	55	55	56
	Yes	-	-	-	70	75	69
2006	No	-	-	-	-	55	56
	Yes	-	-	-	-	67	68

Notes: Columns may not sum to 100 because of rounding errors.
Source: Household, Income and Labour Dynamics in Australia, 2001–07.

For those with previously low levels of qualifications considering post-school education possibilities, VET is a more accessible training option than is higher education. Further, VET may be an important avenue for re-skilling individuals whose careers have been disrupted by the onset of a disability. As well as 'hard skill' acquisition, people with a disability may develop 'soft skills' through the completion of a VET course. For example, VET may help develop people- and time-management skills and help to build the necessary confidence for labour market participation. In addition to signalling the possession of certain skills, completing a VET course may also signal to potential employers that the disability of prospective job candidates is less likely to limit their work capacity. In an environment of imperfect information, completion of a VET qualification may also provide the potential employer with an external validation of the general abilities and motivation of a job candidate. This last point may be crucial if doubts about skills, abilities, and motivation are stronger in relation to job candidates with disabilities.

Employment benefits for those in and out of work

From the conditional probabilities presented in table 7, it is clear that the employment benefits in the year after completing a VET course are limited to helping those out of work in the previous period to find a job. For those with a disability who were out of work in the previous period, undertaking a VET course is estimated to increase their chances of employment in the following year by 24 percentage points (49% less 25%). This compares with an increase of 20 percentage points in the chances of finding work for those without a disability (77% less 57%).

Table 7 Probability of employment state, given employment state in previous year (t-1), with and without VET, HILDA Waves 1–7

	Employment status in t	
	Out of work	Employed
Employment status in period t-1	*%*	*%*
Without disability		
Out of work, didn't complete VET	43	57
Out of work, completed VET	23	77
Employed, didn't complete VET	8	92
Employed, completed VET	12	88
Number of observations	7 817	41 546
With a disability		
Out of work, didn't complete VET	75	25
Out of work, completed VET	51	49
Employed, didn't complete VET	25	75
Employed, completed VET	27	73
Number of observations	5 128	4 471

Notes: These probabilities are conditional probabilities. A conditional probability is the probability of being in employment state t, given an individual's previous employment status and whether or not they completed VET. It is calculated as the ratio of the joint probability and the marginal probability of the previous employment and education status. 'Out of work' refers to either unemployed or not in the labour force.

Multivariate analysis

While descriptive statistics provide valuable initial insights, they do not allow us to understand more complex relationships where more than two variables may be involved simultaneously. An example in the context of this analysis is whether the labour market disadvantage faced by people with a disability is due to their disability, or to their lower level of academic qualifications on average. Multivariate analysis, unlike descriptive statistics, allows for simultaneous correlation in a variable of interest with multiple explanatory factors.

We model participation in VET and completion of VET (given participation) to examine the employment outcomes that may result from VET. These outcomes are principally the employment status that follows completion of a VET qualification and the degree of employment state dependence that may be present. We distinguish between people with and without a disability. Most of these processes and outcomes are represented by binary variables which take the value 1 for a positive outcome and 0 otherwise. For example, if an individual is observed to be employed, the employment outcome is coded 1 for that interview and 0 if they were observed to be either not in the labour force or unemployed. Where completion of a VET qualification occurs between the previous and the current interview, the VET completion variable takes the value 1 for the current interview data (and 0 if no completion was observed). This necessitates the use of limited dependent variable estimation methods, such as probit or logit. Estimations are principally done using the probit method, noting that in practical terms the two methods produce very similar results. Modelling VET participation and completion jointly involves estimating a bivariate probit model of VET participation and VET course completion (given participation). Some of the key intuitive features of these models are discussed below, while their more technical aspects are explained in appendix A.

In treating employment as a binary outcome, we ignore the distinction between not in the labour force and being unemployed. This is done because the number of unemployed people with a disability is too small in our samples for separate analysis. Whether those who are not in the labour force behave differently from the unemployed has been a topic of conjecture in the literature. Clark and Summers (1982) argue that the distinction is meaningless because there is frequently movement between the two states. On the other hand, Flinn and Heckman (1983) provide evidence that unemployed youths behave differently from youths who are not in the labour force. There are, however, some instances where the two categories should be treated differently, especially when we deal with cases where some individuals choose not to work because of their circumstances. For example, some people may be out of work because they are caring for children. To account for this possibility in the data, people who are not working and are caring for children aged 15 years or under, or who are studying full-time have been removed from the sample.

Modelling employment outcomes from VET

A dynamic random-effects panel probit model is used to analyse employment outcomes from VET. This is a panel data estimation method commonly used in examining employment outcomes (see for example, Knights, Harris & Loundes 2002), where there is the possibility that state dependence may be present. The dynamic modelling framework allows us to test whether past employment influences present employment (state dependence). The dynamic model is then used to estimate the

degree to which VET completion influences employment outcomes and whether this influence differs by disability status. Although we model the dynamic effects to extend up to four interviews before the current interview, the analysis that is presented extends to only two interviews back, primarily due to the sample size constraints that arise when lags in the variables are introduced.[9] A key feature of the modelling approach is that we control for bias due to the presence of unobserved factors, such as motivation, which may be correlated with both employment outcomes and explanatory variables, including VET completion.

State dependence

The modelling adopted in this study is based on the Heckman (1981) approach and takes into account the 'initial conditions' problem which arises when a lagged dependent variable is included on the right-hand side of a regression model. The initial conditions problem arises because the employment outcome in the initial period (part of the lagged dependent variable) is likely to be correlated with unobserved factors that affect employment in the subsequent period (dependent variable), which means the model results will be biased. The method used to overcome this problem is based on the Heckman approach and involved modelling employment in the initial period in a separate equation and using the data from the first period of the panel data as an approximation. Estimation allows for the correlation between the error terms of the two equations (see appendix A for more information). For identification purposes it is advisable that the employment equation that approximates the initial period differs from the main equation through the inclusion of historical explanatory variables. These variables were the (log) of years experience in employment and whether the individual was born in a non-English speaking country.

State dependence is modelled by including the previous year's employment as an explanatory variable in the right-hand side of the model. Controlling for previous employment status is important because it is likely to be correlated with participation in education and training (that is, those who are out of work may be more likely to participate) and employment in the current year. Therefore, without controls for previous employment, estimated benefits of VET are likely to be in error because they will include part of the effect of past employment status on current employment status. In addition to including in the main equation the lagged employment status variable, we also include a number of interaction terms between the lagged employment variable and the variables that represent VET completion (and their lags) and disability. Some interaction terms are estimated and their effects are summed and discussed.

Employment benefits from VET

In this study, employment benefits are measured in two ways. The first involves analysing the effect that holding a VET qualification has on employment outcomes, regardless of disability onset or when the qualification was completed. This is done by including a variable for highest qualification in the initial period in both of the employment equations. The second involves analysing employment outcomes for people with and without a disability in the years following immediately after completing a VET qualification. Because the main purpose of this study is to examine the employment benefits of completing a VET qualification for people who already have a disability, the report focuses on the second way.[10]

---

[9] With seven waves of data we can observe a maximum of 6 transitions per individual (1–2, 2–3 ... 6–7). The number of total transitions that we estimate is 6 times N, where N is the number of people included in the survey. By introducing one lag we reduce the maximum transitions per individual to 5 (1–2–3, 2–3–4, 3–4–5, 4–5–6 and 5–6–7) and the number of total transitions to 5 times N. The introduction of 4 lags reduces the number of transitions per individual to 3 and the number of total transitions to 3 times N. The longer the lag we attempt to estimate, the lower is the ability of our data to provide precise estimates. The problem is accentuated for the cases where disability status changes during the observation period.

[10] It is probable that the employment outcomes of VET after the onset of disability are likely to be quite different from completing VET before the onset, because individuals who experience the latter may encounter a disruption to their career path after completing training.

Examining any employment benefits from VET through time is an important consideration because it gives us an insight into the nature of possible employment benefits. If VET only provides a signal to employers of possible work readiness or a short-term boost in confidence, then VET completers may only experience immediate employment benefits and not longer-term benefits. For example, completing VET may give people with a disability the confidence to seek and find work in the first year after completion, but if it doesn't improve their skill levels, they may lose their jobs in subsequent years. On the other hand, if VET does improve skill levels of people with a disability, then we may expect that the difference in employment rates between those who completed VET and those who did not will persist over several years.

In this analysis, we test short-term benefits of VET completion by including a variable that measures whether an individual completed a VET qualification within the last year, and longer-term benefits by including two lagged variables of completion. This treatment tests for benefits at one to two years and at two to three years after completion. Benefits beyond two to three years could not be tested because of data limitations (discussed further in appendix A). A completion in one of these time periods is coded 1 and 0 otherwise.[11]

Controlling for unobserved factors

VET completion may be endogenous if there are unobserved factors that affect both completion of VET and employment outcomes. In this case, the estimated employment benefits from VET completion will be in error because they will contain not only the treatment effect of completing VET, but also the effects of unobserved differences, such as motivation, between VET completers and non-completers.

In the first instance, we control for any correlation between all time-varying explanatory variables except for age, including VET and lagged VET completion, and unobserved constant factors (such as personality traits) by including Chamberlain (1984) or Mundlak (1978) correction terms (see box 2). In the second instance, we test for correlation between VET and unobserved factors, both constant and time-varying, by estimating a bivariate dynamic probit model (see appendix A for more information and results).

Modelling participation and completion of VET

VET participation and completion is modelled using a sample selection bivariate probit model (Maddala 1983). This model works by first estimating a probit model of participation and then estimating a probit model of completion using only those who were observed to participate. The key motivation for using this model (as opposed to just estimating two independent probit models) is that it allows for correlation in unobserved factors, which if left uncontrolled will bias the results. This is known as the 'sample selection' problem, where the allocation of individuals into the sample, in our case into VET participation, is non-random, but instead depends on observed and unobserved (such as ability) personal characteristics. A key issue with estimating these models is the so-called identification restrictions.

[11] A point to note is that we do not observe the date of a VET completion prior to the commencement of the HILDA survey. Therefore, some of the values for the lagged VET variables will be missing, for instance, there is no two to three year lagged value in the first two periods of the analysis. Instead of omitting these observations, which would reduce the robustness of the results, we included a set of indicator variables as explanatory variables (1 if lagged variable is observed, 0 otherwise) to capture the effect of the observation criteria on employment outcomes. In simple terms, the estimated effects of these variables represent the effect of missing information on VET completions on employment. They are not part of the estimated effect of VET completion on employment, and they serve no other purpose than correcting for missing-data bias.

Box 2 Mundlak correction terms and VET

Any relationship between a time-varying variable and employment may be divided into 'fixed effects', that is, correlation in employment and time-varying variables that is unchanged through time; and 'time-varying effects', correlation that does vary through time. In the case of VET, 'fixed effects' may occur because of the presence of unobserved personality traits, such as motivation, that affect both the decision to undertake VET and also employment outcomes. 'Time-varying effects' may occur because undertaking a VET course changes an individual's job search behaviour, which leads to employment. Because time-varying effects measure how individual changes affect employment, and fixed effects measure the effect of differences between individuals, they are often called 'within individual effects' and 'between individual effects'. In this study, 'time-varying effects' of VET on employment are most important because they represent the average employment benefits from policies that encourage greater participation in VET, irrespective of differences in individual traits.

Including Mundlak corrections is analogous to including a 'fixed effect' for each time-varying variable. Therefore, with Mundlak corrections, the model results for variables that vary through time, including VET completion, represent the 'time-varying effect', or the change in individual or employer behaviour that occurs from a change in the variable.

Identification restrictions

The prevailing view in today's econometric literature is that to obtain unbiased estimates in models where two simultaneous processes are taking place (a two-equation system), a number of identification restrictions must be imposed. Typically, these restrictions come in the form of variables that are included or excluded from the first equation (in our case the participation equation), but not from the second (the completion equation), because it can be argued that they affect only the process represented by the equation that includes them. The idea is that there must be some variables in one of the two equations that only influence that equation and not the other equation in the system, so that the effects of the remaining variables that are common to both equations are allowed to be different. The choice of specific variables to identify equation systems is never perfectly clear cut in the context of using survey data, hence experimentation is always desirable. We have experimented with a number of variables, including the place of residence, the SEIFA (Socio-Economic Indexes for Area) index of relative advantage (both could be thought of as proxies for regional labour market and study opportunities), and the occupation of the parents (separately father's and mother's). The variable that appears to be the strongest candidate for identification is the SEIFA index, but we chose to include all potential variables in the participation estimation, as the inclusion of more valid identification restrictions is known to improve the precision of the whole estimation.

Results

We start our analysis by examining the employment benefits of VET for those with and without a disability; following that, the factors that affect rates of employment within the disability sub-sample. Although models to examine whether the benefits of VET varied across disability groups were estimated, due to the small number of observations for some of the disability groups, robust results were not produced and hence are not presented in this report. Finally we discuss the results of our participation and completion analysis.

Estimated employment benefits of VET

All of the results in this section are generated using the dynamic random-effects panel probit employment model discussed in the previous section, initially using the combined disability and no disability groups and later using only the disability sample. Only key results from the main equation excluding the Mundlak corrections are reported in table 8. A complete set of results for the employment model is presented in appendix B.

The marginal effects presented in table 8 represent the estimated percentage point change in the probability of employment for a one-unit change in each of the explanatory variables, independent of the effects of all other explanatory variables in the model. For categorical variables, the marginal effects represent the percentage-point change in the probability of employment for a given outcome, relative to the reference category that is omitted.[12] As an example, take the education variables in the initial period. Being in possession of a higher education qualification is associated with a probability of being employed eight percentage points higher when compared with the reference category, in this case people with no qualifications at all. A VET or Year 12 qualification is estimated to result in a probability of employment of four percentage points higher, relative to the reference case. Past educational qualifications clearly improve the chances of employment. The size of the marginal effects would appear to be very low, but it should be borne in mind that in multivariate regression other effects are also being controlled. For example, younger people have a higher probability of employment and, also, younger people are better educated. Hence part of the 'education' effect that we observe in raw data can be apportioned to age and part to education itself. All three education categories are statistically significant at the 5% level (all t-ratios are above 1.96).[13]

[12] Crucially, the statistical significance also depends on the choice of reference case.

[13] We report t-statistics next to each marginal effect. A t-statistic indicates the precision of the estimate and can be interpreted as a test of the confidence with which we can state that a marginal effect is different from zero. Although it is customary to check if a t-statistic is higher than 1.96, which is the value representing a 5% level of significance, it is good to remember that the higher the t-statistic, the more precise is our estimate.

Table 8 Key marginal effects of employment, with and without disability

	Marginal effect	t-statistic
Highest education in initial period of HILDA		
Higher education	0.08**	8.27
VET	0.04**	6.61
Completed secondary school	0.04**	5.60
Did not complete secondary school (reference category)	ref.	ref.
Completed VET after initial period		
Did not complete VET (reference category)	ref.	ref.
Completed VET (since last interview)	0.05**	2.60
Completed VET, t-1	0.09**	3.62
Completed VET, t-2	0.04	1.24
Has a disability in current year	-0.06**	-3.96
Extent of work limitation (0–10)	-0.01**	-5.47
Employed, t-1	0.24**	9.88
Interaction effects		
Has a disability x employed t-1	0.11**	4.48
VET x with a disability	0.20**	3.35
VET t-1 x with a disability	-0.03	-0.39
VET t-2 x with a disability	0.00	0.04
VET x employed t-1	-0.12**	-3.81
VET t-1 x employed t-1	-0.18**	-5.19
VET t-2 x employed t-1	-0.08	-1.46
VET x employed t-1 x with a disability	-0.19**	-3.28
VET t-1 x employed t-1 x with a disability	0.12	1.31
VET t-2 x employed t-1 x with a disability	0.18	1.47

Notes: Statistical significance denoted by **, significant at 5%; and *, significant at 10% level. The mean marginal effects of the lagged VET completion variables (Completed VET, t-1 and Completed VET, t-2) are corrected for missing observations in the first two and first three waves respectively. A number of control variables are included in the estimation and can be found in table B1, appendix B.

Source: Mavromaras and Polidano (2009).

While we can use the marginal effects to interpret employment benefits of past education, it is not so easy to interpret the effects of completing a VET course because of the significant interaction terms (table 8), which suggests that the benefits vary by disability and previous year's employment status, or the employment status immediately before course completion.[14] To estimate the effects of completing a VET course, we use the model results to derive predicted probabilities of employment for an average group member, with and without the completion of a VET course. These effects are estimated for the average member of the following four key groups.

- ✧ with a disability and out of work
- ✧ with a disability and in employment
- ✧ without a disability and out of work
- ✧ without a disability and in employment.

Whether the predicted probabilities of employment between those with and without VET completion are statistically different from zero is tested by generating standard errors using the delta method. It is important to note that for those who were in employment just prior to completing a VET course, there are no statistically significant differences estimated. On the other hand, all the estimated differences in predicted probabilities for those who were out of work just

[14] We calculate marginal effects for the interaction terms using the approach outlined in Ai and Norton (2003).

prior to completion are significant at the 5% level. Therefore, we present only predictions for those individuals who were out of work just prior to completing a VET qualification.

Table 9 Predicted probabilities of continuous post-study employment for an average person without a disability who is out of work and for an average person with a disability who is out of work

	Without disability			With disability		
Length of continuous employment after VET completion	Completed a VET course	Didn't complete a VET course	Difference	Completed a VET course	Didn't complete a VET course	Difference
	%	%	%	%	%	%
Up to one year later	62	52	10**	29	9	20**
1–2 years later	55	47	8**	20	5	15**
2–3 years later	50	43	7**	13	2	10**

Notes: Statistical significance denoted by **, significant at 5%; and *, significant at 10% level using the delta method.
Source: Mavromaras and Polidano (2009).

Predicted probabilities for those who were out of work just prior to VET completion are presented in tables 9 to 11. Table 9 concentrates on those who were in employment at the previous interview and follows their probability of continuing to be employed for the next three years (the three categories of 'Up to 1 year later'; '1–2 years later' and '2–3 years later'). It then goes on to distinguish between those with and without a disability. Then, within each disability status group, the table presents three columns that distinguish between those who completed a VET course between the previous and current interview and those who did not, with the difference between the two in the third column. Table 10 represents the opposite case of people who start without employment and remain without employment continuously for up to three years after completion. Table 11 represents a less clear-cut case of those who were out of work in the previous period and who are predicted to be in employment at least once in the following periods.

Starting with the contents of table 9 we explain what each predicted probability suggests. Looking at the 'Without disability' column and the 'Completed VET course' sub-column, the 'Up to one year later' category suggests that someone who was not in employment in the previous interview, has reported no disability in the previous and the current interview, and who has completed a VET course in the time between these two interviews has a 62% probability of being in employment in their current interview (which, given that we do not know exactly when they completed their VET course, can be 'Up to one year later' after the course completion). The probability of also being in employment one to two years later is 55% and that of also being in employment two to three years later is 50%.[15] To obtain an idea of the effect of VET completion on employment chances, the next sub-column indicates the same type of probabilities for those without a disability who did not complete a VET qualification. For the 'Up to one year later' category, the estimate is 52%. Hence, VET completion is associated with a 10% higher probability of being in employment (for those without a disability and were not in employment in the previous interview) in the first year after completion. This difference is statistically significant.

In a similar fashion to the example described in the last paragraph, we have calculated the predicted probabilities (in table 9) of all those who were not in employment in the previous interview and have reported a disability in both of their previous and current interviews. It is very clear that the probability of retaining employment is considerably lower for people with disabilities: the probability of continuous employment for three years after completion of a VET qualification is 50% and 13% respectively for people without and with a disability. Without a VET completion the probability of continuous employment is 43% for those without a disability and a mere 2% for those with a disability. It clearly looks as if the few chances that people with disabilities have of

[15] Note that we do not investigate whether there were any unreported interruptions to employment between interviews.

retaining their continuous employment are only present for those who engage in VET successfully. Therefore the most important result in table 9 arises from the comparison of the difference columns between people with and without a disability, which can be used as a measure of the beneficial continuous employment effect of VET completion by disability status. People without a disability and a VET completion have a 16% higher probability of being in continuous three-year employment (50 percentage points is 16% higher than 43 percentage points). By contrast, people with a disability and a VET completion have a 550% higher probability of being in continuous three-year employment (13 percentage points is 550% higher than two percentage points). These differences are a clear indication of the potential additional benefits of VET education for people with disabilities.

Table 10 Predicted probabilities of no post-study employment for an average person without a disability who is out of work and for an average person with a disability who is out of work

	Without disability			With disability		
Time continuously out of work after VET completion	Completed a VET course	Didn't complete a VET course	Difference	Completed a VET course	Didn't complete a VET course	Difference
	%	%	%	%	%	%
Up to 1 year later	38	48	-10**	71	91	-20**
1–2 years later	11	23	-12**	60	83	-23**
2–3 years later	4	11	-7**	53	76	-24**

Notes: Statistical significance denoted by **, significant at 5%; and *, significant at 10% level using the delta method.
Source: Mavromaras and Polidano (2009).

Table 10 begins from the same point as table 9 (that is, all individuals were out of work in their previous interview) and presents the probabilities that they remain continuously out of work afterwards. Clearly, people without a disability gain employment much more frequently than their counterparts with a disability. Indeed, the chances of being continuously out of work for the three years in question is only four percentage points for a person without a disability who completed a VET qualification between their previous and current interviews, and 53 percentage points for their counterpart with a disability. VET completion reduces the chances of remaining continuously out of work by seven to 12 percentage points for those without a disability and by 20 to 24 percentage points for those with a disability.

Table 11 Predicted probabilities of some post-study employment for an average individual without a disability who is out of work and for an average person with a disability who is out of work

	Without disability			With disability		
Some employment after VET completion	Completed a VET course	Didn't complete a VET course	Difference	Completed a VET course	Didn't complete a VET course	Difference
	%	%	%	%	%	%
Up to one year later	62	52	10**	29	9	20**
1–2 years later	89	77	12**	40	17	23**
2–3 years later	96	89	7**	47	24	24**

Notes: Statistical significance denoted by **, significant at 5%; and *, significant at 10% level using the delta method.
Source: Mavromaras and Polidano (2009).

Table 11 concludes our comparisons by indicating the beneficial employment outcomes associated with VET completion (note that the first row of table 11 is identical to the first row of table 9). The patterns presented in table 11 are the same as in table 9, only the probabilities are higher, as a result of the fact that the employment benefit they measure is a lesser benefit. (Instead of measuring the probability that someone is continuously employed in all three interviews, this table measures the

probability of being employed in at least one of the three interviews.) The benefit from VET completion is once again much stronger for people with disabilities than for people without disabilities.

Results in tables 9 to 11 portray a limited but informative set of contingencies. The message is very clear. First, people with disabilities find it considerably harder to retain employment. Second, VET completion improves the chances of employment for all people of working age, independent of their disability status. Third, the beneficial effect of VET completion is considerably stronger for people with a disability, not only in proportional terms but also in absolute terms. These results are all statistically significant, follow very clearly the same pattern, and provide strong empirical evidence in support of using VET as a means of combating the labour market disadvantage faced by people with disabilities.

Employment outcomes for those with a disability

Thus far, we have found that VET closes the employment gap associated with disability. The following analysis uses only the disability sub-group to examine the differences in employment outcomes among disability groups (type and onset) and the employment benefits of VET for the disability group as a whole. An issue with examining the effect of disability type and onset on employment is that the control that we have for the severity of disability (extent to which limitation affects ability to work) is likely to depend also on the type of disability. Therefore, we estimated an employment model that includes disability type and onset variables, with and without the measure for severity (models 1 and 2 respectively in table 12).

Table 12 Marginal effects of employment for people with a disability

	Model 1		Model 2	
	Marginal effect	t-statistic	Marginal effect	t-statistic
Constant	-0.39**	-3.45	-0.57**	-5.27
Highest education in initial period				
Higher education	0.12**	3.28	0.15**	4.11
VET	0.08**	2.83	0.09**	3.05
Completed secondary school	0.06	1.60	0.07*	1.80
Did not complete secondary school (reference category)	ref.	ref.	ref.	ref.
Completed VET after initial period				
Completed VET (since last interview)	0.29**	3.96	0.29**	3.96
Completed VET t-1	0.12	1.62	0.11	1.54
Completed VET t-2	0.17**	2.02	0.16**	2.00
Female	0.04	1.07	0.01	0.37
Married	0.10	0.86	0.06	0.55
Married x female	0.16	0.98	0.18	1.11
Dependent children less than 15	0.03	0.27	0.02	0.14
Female x dependent children	-0.22	-1.29	-0.18	-1.01
Age				
15–24 (reference category)	ref.	ref.	ref.	ref.
25–34	0.08	1.64	0.04	0.69
35–44	0.08*	1.69	0.04	0.81
45–54	0.02	0.37	-0.04	-0.73
55–64	-0.16**	-3.21	-0.21**	-4.20
State of residence				
NSW (reference category)	ref.	ref.	ref.	ref.
Victoria	-0.00	-0.11	-0.01	-0.19
Queensland	-0.01	-0.17	-0.00	-0.08

	Model 1		Model 2	
	Marginal effect	t-statistic	Marginal effect	t-statistic
Western Australia	0.00	0.04	-0.01	-0.31
Tasmania	-0.02	-0.30	-0.01	-0.24
South Australia	-0.03	-0.72	-0.04	-0.92
ACT/Northern Territory	0.03	0.36	0.02	0.30
Live in rural area	0.04	1.21	0.02	0.77
Living arrangements				
Live rent free (reference category)	ref.	ref.	ref.	ref.
Own their home	0.02	0.20	0.04	0.36
Rent	0.05	0.44	0.05	0.40
SEIFA index (1–10)	0.01**	2.63	0.01**	3.10
Extent of work limitation (1–10)	-0.02**	-2.84	-	-
Type of disability				
Sensory (reference category)	ref.	ref.	ref.	ref.
Physical	0.07	1.29	-0.05	-0.89
Mental	-0.04	-0.61	-0.14**	-2.31
Other	0.07	1.12	0.01	0.24
Multiple	-0.06	-1.09	-0.17**	-3.41
Disability onset				
Child (0–14) (reference category)	ref.	ref.	ref.	ref.
Youth (15–24)	-0.01	-0.26	-0.01	-0.24
Prime age (25–44)	0.03	0.65	0.04	0.86
Older adult (45–64)	0.23**	2.60	0.28**	2.76
Onset unknown	0.07	1.61	0.04	1.12
Employed t-1	0.74**	34.04	0.79**	37.14

Notes: **significant at 5%, *significant at 10%. The marginal effects of the lagged VET completion variables (Completed VET, t-1 and Completed VET, t-2) are corrected for missing observations in the first two and first three waves respectively.

Source: Mavromaras and Polidano (2009).

Consistent with the findings of previous cross-sectional studies (Mavromaras, Lee & Black 2006; Wilkins 2004), table 12 shows that without controls for work limitations associated with disability (Model 2), having a mental impairment is estimated to reduce a person's chances of being employed. All else equal, it is estimated that having either type of mental disability (intellectual or psychological) reduces the chances of being in employment by 14 percentage points, relative to having a sensory disorder. Also consistent with Mavromaras, Lee and Black (2006), we find that having multiple disorders is estimated to reduce a person's chances of being in employment by 17 percentage points, relative to having a sensory disorder. These impacts are independent of other personal characteristics that may be linked to each of the disabilities, including highest educational qualification. When severity of disability is controlled, these effects disappear.

However, in contrast to the findings of Mavromaras, Lee and Black (2006) and Wilkins (2004), we find that (with and without controls for the extent to which disability affects work) those who experience disability onset as an older adult are more, and not less, likely to be employed than those who experience the onset as a child. A possible explanation is that reverse causation leads to an overestimate of the detrimental effects of older-age onset on employment in cross-sectional studies. The examination of the effect of reverse causation is somewhat negated in this study by omitting from the sample those with a disability who had reported no disability in the previous period. Assuming that the estimated relationship in this study is correct, the implication is that people who suffer an early disability onset are at a particular disadvantage. This may be because their accumulation of human and social capital was disrupted at an early age, which would be consistent with the Heckman and Lochner (2000) hypothesis that 'skills beget skills'.

Benefits of VET

Consistent with the analysis above, completing a VET course is estimated to have immediate and ongoing employment benefits for people with a disability, with and without controls for the extent of the limitations on employment. From the marginal effects of the two lagged variables, it appears that this employment benefit persists up to two to three years after completion. The estimated short- and longer-term employment benefits of VET means that VET not only helps people with a disability to overcome some of the initial barriers to employment, such as a lack of confidence and statistical discrimination by employers, but it addresses longer-term barriers, such as skill deficiencies.[16]

Neighbourhood effects

The socioeconomic status of a person's neighbourhood is estimated to affect their employment prospects if they have a disability. At the extreme, for people with a disability, living in the most privileged areas (index=10) is estimated to improve the chances of being employed by around ten percentage points, compared with living in the most disadvantaged areas (index=1). A number of other studies, especially on the relationship between youth unemployment and neighbourhood status, claim that employment information and social norms embedded in networks are important factors in determining employment outcomes (O'Regan 1998; Buck 2001; Andrews, Green & Mangan 2004). To the extent that people with a disability are socially and (or) physically less mobile than people without a disability, we would expect them to be more susceptible to negative neighbourhood effects.

Other important factors

As expected, older adults aged 45–64 years are less likely than youths aged 15–24 years to be in employment, regardless of whether they have a disability or not. However, the negative effect of age for people with a disability, particularly those aged 55–64 years, is much greater, which implies that the combined effect of age and disability may affect an individual's motivation to work and (or), that employers are more likely to discriminate against older workers if they have a disability.

Participation in, and completion of, VET

Barriers to participation and completion of a VET course for those with and without a disability are examined by estimating a model that treats participation and completion as two separate but interdependent processes. The first part of this exercise involves estimating a model of VET course participation and uses the complete sample; that is, both VET course participants and non-participants. The second part involves estimating a model of VET course completion and uses only those who were observed to participate in a VET course. Estimating participation and completion as interdependent processes is both sensible and necessary. This is because of the sample selection that happens during the first process, whereby the choice to be a participant or a non-participant is non-random and the outcome of the participation choice will influence the composition of the sample that will be available for, as well as the outcome of, the second process (that is, to complete or not the VET course). Sample selection is both a common and potentially serious empirical problem that in this context will occur when the allocation of individuals into the sample, in our case into VET participation, is non-random, and depends on observed and unobserved (such as ability) personal characteristics. Estimating these two models jointly is different from estimating them independently,

[16] The estimated employment benefits from completing a VET course are robust, even when we take into account the possible presence of unobserved time-varying factors that may simultaneously affect both VET completion and employment outcomes. The results presented in table 12 do control for the presence of unobserved time-invariant factors (via Chamberlain/Mundlak corrections), but not time-varying factors, such as financial demands, that may affect VET completion and employment. We control for the presence of time-varying factors by estimating a bivariate random effects dynamic panel probit model with selection into VET. Results from this model are available on request from the authors.

as it allows us to control for sample selection bias by incorporating in the estimation the impact of correlation in unobserved factors that affect both processes and their outcomes.

Table 13 Marginal effects of participation in, and completion of, VET: Bivariate probit model with sample selection, people with and without a disability

	Participated in VET		Completed VET	
	Marginal effect	t-statistic	Marginal effect	t-statistic
Highest prior qualification				
Higher education	-0.001	-0.371	-0.017	-0.537
VET	0.032	8.933**	0.101	2.457**
Completed Year 12	0.011	2.882**	0.036	1.195
Did not complete Year 12 (reference category)	ref.	ref.	ref.	ref.
VET course participated in				
Certificate I & II (reference category)	ref.	ref.	ref.	ref.
Certificate III & IV	-	-	-0.03	-1.363
Certificate not defined	-	-	-0.069	-2.530**
Diploma/advanced diploma	-	-	-0.212	-7.627**
Male and single (reference group)	ref.	ref.	ref.	ref.
Female	0.021	5.824**	0.069	2.416**
Married/de facto	-0.009	-2.174**	-0.044	-1.447
Dependent children less than 15	-0.004	-1.471	0.046	1.401
Married/de facto x female[1]	-0.013	-2.940**	-	-
Dependent children x female[1]	-	-	-0.068	-1.72
Age				
15–24 (reference category)	ref.	ref.	ref.	ref.
25–34	-0.027	-8.868**	-0.126	-2.714**
35–44	-0.037	-12.145**	-0.136	-2.392**
45–54	-0.052	-19.751**	-0.175	-2.061**
55–64	-0.063	-28.320**	-0.269	-2.271**
State of residence				
New South Wales (reference category)	ref.	ref.	ref.	ref.
Victoria	-0.007	-2.336**	-0.087	-3.240**
Queensland	-0.008	-2.542**	-0.102	-3.731**
Western Australia	-0.012	-3.278**	-0.13	-3.261**
Tasmania	-0.011	-1.858*	-0.098	-1.758*
South Australia	-0.007	-1.788*	-0.111	-3.228**
ACT/NT	-0.001	-0.159	-0.083	-1.430
Reside in rural area[1]	0.004	1.196	-	-
SEIFA index (1–10)[1]	-0.002	-4.532**	-	-
Need help, but can't get it (1–7)[1]	-	-	0.002	0.371
Disability, t-1	0.012	0.972	-0.039	-0.433
Type of disability reported in t-1				
Sensory (reference category)	ref.	ref.	ref.	ref.
Physical	0.008	0.657	0.03	0.271
Mental	0.003	0.223	0.218	1.323
Other	-0.003	-0.27	-0.054	-0.389
Multiple	0.005	0.393	-0.004	-0.037
Disability onset, t-1				
Child (0–14) (reference category)	ref.	ref.	ref.	ref.
Youth (15–24)	-0.019	-2.084**	0.004	0.036
Prime age (25–44)	-0.001	-0.095	-	-
Older adult (45–64)	-0.041	-1.902*	-	-

	Participated in VET		Completed VET	
	Marginal effect	t-statistic	Marginal effect	t-statistic
Prime age and older (25–64)[2]	-	-	0.064	0.609
Onset unknown	-0.008	-1.494	0.020	0.404
Extent of work limitation (0–10)	-0.002	-1.924*	-0.020	-2.193**
I often need help but can't get it (1 strongly disagree – 7 strongly disagree)[1]	-	-	0.002	0.371
Sensory x I often need help but can't get it (reference category)	ref.	ref.	ref.	ref.
Physical x I often need help but can't get it[1]	-	-	0.018	0.761
Mental x I often need help but can't get it[1]	-	-	-0.097	-2.055**
Other x I often need help but can't get it[1]	-	-	0.042	1.116
Multiple x I often need help but can't get it[1]	-	-	0.014	0.647
Annual gross income[1]	0.006	2.641**	-0.002	-0.23
Annual gross income squared	0.000	-2.524**	-	-
Employment status, t-1				
Not in labour force (reference category)	ref.	ref.	ref.	ref.
Employed full-time	0.02	4.812**	-0.022	-0.575
Employed part-time	0.021	4.895**	0.019	0.507
Unemployed	0.057	6.510**	0.208	3.014**
Time trend				
2001–02 (reference category)	ref.	ref.	ref.	ref.
2003–04	0.004	1.280	-	-
2005–06	0.008	2.479**	-	-
rho	0.840	7.629**	-	-

Notes: *Significant at 10%, **Significant at 5%.

1 These variables were not significant in their respective equations and were removed for the sake of parsimony.

2 There are insufficient observations to allow estimation of the effects of each age group on completion. Therefore, age groups for completion are limited to youth and prime age and older.

Source: Mavromaras and Polidano (2009).

From the significant and positive *rho* parameter presented in table 13, we can conclude that there are unobserved factors that affect both participation and completion, and that failure to control for these factors will lead to somewhat biased results. The interpretation of the marginal effects for the bivariate probit model with sample selection (table 13) is the same as for the dynamic random-effects probit model (table 12). They represent the change in the probability of participation, or the change in the probability of completion (given participation), for a one-unit change in the explanatory variable.

Disability

Despite the greater employment benefits for people with a disability from completing a VET course, we find no evidence that people with a disability participate or complete VET at a different rate from those without a disability. This finding is consistent with the results from the descriptive statistics presented above. Table 13 also shows that for disability type there are no significant differences in participation and completion rates. However, we estimate that there are differences in participation and completion rates among people with different timing of disability onset, disability severity, and support conditions.

Not surprisingly, we find that people with more severe limitations, measured as the extent to which a disability affects their ability to work (0–10), are less likely to participate and complete VET. For a one-point increase in the index, there is a 0.2 percentage point and a two-percentage-point reduction in the probability of participation and completion respectively.

The age of disability onset is estimated to affect participation, but not completion. In particular, we find that compared with people who experience onset as a child (0–14 years), people who experience onset as an older adult (45–64 years) are less likely to participate in VET, and so are, to a lesser extent, people who experience onset in their youth (15–24 years). The low rates of participation for people who experience onset as an older adult may be due to a reluctance to retrain, given the limited time to recoup their investment in the labour market.

A key finding in table 13 is that, independent of the severity of disability, the likelihood of completion for a person with a mental disability depends on whether or not they report having adequate help from others (significant interaction effect). Those with a mental disability who agree that they often need help from others, but can't get it (an index of 5 or more out of 7, where 7 is strongly agree) are estimated to be less likely to complete a VET course compared with those with a sensory disability in a similar situation. At the extreme, those who strongly agree that they often need help from others, but can't get it (index = 7), are estimated to be 46 percentage points less likely to complete VET than a person who has a sensory disorder, irrespective of whether or not they need help, but can't get it. This is consistent with the findings of the NCVER study by Miller and Nguyen (2008), which found that the academic progress of VET students with a mental disorder was often hampered by a reluctance to use student support services. In some cases, they found that students couldn't use student support services because they declined to declare their disability.

Type of course

Rates of completion are estimated to vary with the qualification level. Compared with people who study for a certificate I or a certificate II course, people who study for an undefined certificate or a diploma or advanced diploma are estimated to be seven percentage points and 21 percentage points less likely to complete, respectively. People may drop out of diploma or advanced diploma courses at a higher rate because these are generally more challenging courses that take longer to complete.

Age

Age is estimated to be a strong predictor of participation and completion of VET. For both participation and completion, rates are predicted to decline with age. For the oldest cohort (55–64 years), rates of participation and completion are estimated to be six percentage points and 27 percentage points lower respectively than for youths aged 15–24 years. The negative effect of age in both cases is likely to be related to declining returns in the labour market from completion. As people age, the returns decline because there are fewer years in which they can recoup their investment.

Gender, marital status and caring responsibilities

From the significant interaction terms in table 13, we can conclude that gender differences in VET participation and completion depend on marital status and caring responsibilities. With respect to participating in VET, compared with single males, a single female is estimated to be around two percentage points more likely to participate on average; a female in a relationship is estimated to be 0.1 percentage points less likely (2.1.-0.9-1.3); and a male in a relationship 0.9% less likely to participate.

Completion rates on the other hand, are linked more with caring responsibilities than with marital status. It is estimated that compared with males with no dependent children under 15 years, females with no such dependents are estimated to be 6.9 percentage points more likely to complete a course on average; females with dependents are 4.7 percentage points more likely (6.9+4.6-6.8); and males with dependents are 4.6% more likely to complete a VET course.

Previous employment status

As expected, participation in VET since the last interview was contingent on the reported employment status at the last interview. In particular, people who are employed (part- or full-time)

or unemployed (not employed but currently looking for work) are estimated to be around two and six percentage points, respectively, more likely to participate than people not in the labour force (not employed and not currently looking for work). In terms of completion, we find no difference in completion rates between the employed and those not in the labour force. However, it is estimated that the unemployed are around 20 percentage points more likely than those not in the labour force to complete their courses.

Regional differences

Although there are small differences in participation rates across the states, differences in completion rates are substantial. In particular, compared with completion rates in New South Wales, the completion rates in Western Australia and Queensland are estimated to be 13 percentage points and ten percentage points lower, possibly a result of the relatively tighter labour market conditions in these states brought about by the mining boom. Under tight conditions, it is possible that employers in the mining sector may have supplemented the lack of trained workers with semi-skilled recruits.

Conclusions

The disadvantaged labour market position of people with disabilities has been well documented in most Western developed economies, including Australia. This study aims to provide evidence on the influence of VET in the Australian labour market regarding the relative position of people with and without a disability. The underlying motivation for this study is the desire to increase our understanding of the factors that distinguish VET from other post-school education, and to highlight the possible relevance of VET in the continuous effort to alleviate the labour market disadvantage of people with disabilities. This study has used up-to-date longitudinal data (the Household, Income and Labour Dynamics in Australia survey, 2001–07) and advanced econometric methodology to address a number of questions.

The first question this study asked was whether disability generates an employment disadvantage for those who wish to participate in the labour market. We measured disability in terms of the presence of a long-term condition, excluding spells that were clearly transient, to concentrate on the long-run effects of disabilities. We also used a measure of the severity of work limitations caused by each reported disability. We find that, jointly, the presence and the severity of disabilities are negatively associated with employment participation, in terms of both being in employment and regaining employment, and positively associated with losing employment and being out of work. These are not novel results in the literature but they are the most up-to-date results on the Australian labour market, confirming and quantifying a serious facet of the labour market disadvantage suffered by people with disabilities.

The second question asked was whether the completion of a VET qualification can influence the position of those who wish to participate in the labour market. We concentrated on VET qualifications at the level of certificate III and above, as there is little information on certificates I and II in our data. We examined the short-run effect of VET completion (employment up to one year after completion) and the long-run effect of VET completion (employment outcomes up to three years after completion). The use of longitudinal (panel) data allows us to estimate causal relationships and not just empirical associations that may be present in the data. We also estimated the degree of state persistence of employment and how this relates to VET completion. We find that completing a VET qualification improves significantly the employment position of all labour market participants. We find considerable state persistence at a level that accords with international estimates from both the United Kingdom and the United States.

The third question was the degree to which the employment disadvantage suffered by people with disabilities is ameliorated by the completion of a VET qualification. To this purpose the study compares the improvement that VET makes for people with disabilities against that for people without disabilities. A complex estimation is used to construct a set of indicative scenarios. We distinguish between people who were either employed or out of work at the start of the period during which they completed their VET qualification. We find that for those who were in employment (either with or without a disability) VET completion had no effect on their subsequent employment throughout the three years covered by the estimation. By contrast, we find that for those who were not working at the start of the period during which they completed their VET qualification, VET completion improves subsequent employment, much more so for people with a disability. This is a result that is novel in the international literature and is of considerable policy significance. We speculate that there are many reasons for the much larger improvement in

employment prospects enjoyed by people with disabilities who complete a VET qualification (against their comparators without a disability), making VET a more accessible means of up-skilling, especially for people whose ability to access conventional higher education may be reduced. These include geographical dispersion, flexible course design and delivery, the modular structure of VET qualifications and other distinguishing VET characteristics.

The fourth question this study poses is whether people with disabilities participate and complete VET at the same rate as those without a disability. We estimate that, despite the greater employment benefits from completing a VET course for people with a disability, no significant differences in the participation and completion rates of VET between people with and without a disability (between 2002 and 2006). However, we find evidence that people with a mental condition, who suffer the greatest employment disadvantage of any disability group (independent of education), also drop out of VET courses at a greater rate if they report that they often are unable to find help from others. There is no estimated difference in completion rates for people with a mental health condition who report that they are usually able to find help. Because we control for the severity of disability, this result points to the importance of ensuring adequate support for people with a mental health condition. This finding supports those from a previous NCVER study by Miller and Nguyen (2008), who found that the academic progress of VET students with a mental disability was often hampered by a reluctance to use student support services. In some cases, they found that students did not access student support services because they declined to declare their disability. As raised in the Miller and Nguyen study, possible policy responses include improving resources for mental health support services, staff training, and the promotion of available mental health services among staff and students.

The fifth question is whether the timing of disability onset affects employment outcomes. Consistent with the findings of Mavromaras, Lee and Black (2006) and Wilkins (2004), we find that having a mental impairment or having multiple disabilities are particularly detrimental to a person's chances of being employed. All else equal, it is estimated that having either a mental disability (intellectual or psychological) or having multiple disabilities reduces the chances of employment by 14 and 17 percentage points respectively, relative to having a sensory disorder (table 12). However, in contrast to findings from these previous studies, results presented here show that childhood onset is more disruptive than onset in later life, which is in line with the Heckman and Lochner (2000) hypothesis that disruption of skill acquisition at an early age has cumulative effects. One possible explanation for the difference is that by using the longitudinal data we have, to some extent, eliminated the possible effect of reverse causation that tends to over-estimate the effect of later life disability onset on employment in cross-sectional analysis. These results underline the importance of measures that are targeted at specific disability groups.

Finally, there are many issues that this report has not addressed. For example, we must acknowledge that the results of this study are derived using population-based data and methodologies that have their limitations. We need further research on more specific issues of accessibility, delivery, and other aspects of VET. It should also be recognised that the data at hand do not allow for a pure experimental design, in that VET participation and completion are not random events and people self-select into them. Notwithstanding these issues, we consider that our results shed some favourable light on VET as an educational pathway which promotes the Australian agenda of an inclusive labour market and society.

References

Ai, C & Norton, E 2003, 'Interaction terms in logit and probit models', *Economic Letters*, vol.80, pp.123–29.

Anderson, H & Vahid, F 2002, 'Choosing lag lengths in nonlinear models', Department of Econometrics and Business Statistics, Working paper 21/02, Monash University, Melbourne.

Andrews, D, Green, C & Mangan, J 2004, 'Spatial inequality in the Australian youth labour market: The role of neighbourhood composition', *Regional Studies*, vol.38, no.1, pp.15–25.

Arulampalam, W & Stewart, M 2008, 'Simplified implementation of the Heckman estimator of the dynamic probit model and a comparison with alternative estimators', Warwick University Economic Research Papers, no.884.

Baldwin, M & Johnson, W 1994, 'Labor market discrimination against men with disabilities', *Journal of Human Resources*, vol.29, no.1, pp.1–19.

Blanchard, O & Diamond, P 1994, 'Ranking employment duration and wages', *Review of Economic and Studies*, vol.6, pp.417–34.

Buck, N 2001, 'Identifying neighbourhood effects on social exclusion', *Urban Studies*, vol.38, no.12, pp.251–75.

Butler, JS & Moffitt, R 1982, 'A computationally efficient quadrature procedure for the one-factor multinomial probit model', *Econometrica*, vol.50, pp.761–4.

Cai, L, Mavromaras, K & Oguzoglu, U 2008, 'The effect of health and health shocks on hours worked', Institute for the Study of Labor, Discussion paper, no.3496, Institute for the Study of Labor, Bonn.

Cavallaro, T, Foley, P, Saunders, J & Bowman, K 2005, *People with a disability in vocational education and training*, NCVER, Adelaide.

Chamberlain, G 1984, 'Panel data', in Z Griliches and M Intriligator (eds), *Handbook of Econometrics*, vol.II, North-Holland, Amsterdam.

Clark, K & Summers, L 1982, 'The dynamics of youth unemployment', in *The youth labor market problem: Its nature, causes, and consequences*, eds R Freeman and D Wise, University of Chicago Press, Chicago, pp.199–234.

Clark, A, Georgellis, Y & Sanfey, P 2001, 'Scarring: The psychological impact of past unemployment', *Economica*, vol.68, no.270, pp.221–41.

Commonwealth of Australia 2002, *Intergenerational report, 2002–03,* Budget paper 5, Treasury, Canberra.

——2005, *Welfare to Work: Budget overviews*, Treasury, Canberra.

——2008, 'National Mental Health and Disability Employment Strategy update: Setting the direction', Australian Government, Canberra.

Department of Family, Housing, Community Services and Indigenous Affairs (FaHCSIA) 2006, 'Characteristics of disability support pension recipients, June 2006', FaHCSIA, Canberra.

Elbers, C& Ridder, G 1982, 'True and spurious duration dependence', *Review of Economic Studies*, vol.49, no.3, pp.403–9.

Flaig, G, Licht, G & Steinr, V 1993, 'Testing for state dependence effects in a dynamic model of male unemployment behaviour', in *Panel data and labour market dynamics*, eds H Bunzel, P Jensen and N Westergard-Neilsen, pp.189–213, North Holland, Amsterdam.

Flinn, C & Heckman, J 1983, 'Are unemployment and out of the labor force behaviourally distinct labor force states?' *Journal of Labor Economics*, vol.1, no.1, pp.28–42.

Greene, W 2007, 'LIMDEP Version 9.0, Econometric Modelling Guide', Econometric Software Inc., New York.

Guilkey, D & Murphy, J 1993, 'Estimation and testing in the random effects probit model', *Journal of Econometrics*, vol.59, no.3, pp.301–17.

Harris, M 1996, 'Modelling the probability of youth unemployment in Australia', *The Economic Record*, vol.72, no.217, pp.118–29.

Heckman, JJ 1981, 'Heterogeneity and state dependence', in *Studies in Labor Markets*, ed. S Rosen, University of Chicago Press, Chicago.

——1991, 'Identifying the hand of the past: Distinguishing state dependence from heterogeneity', *The American Economic Review*, vol.81, no.2, Papers and Proceedings of the Hundred and Third Annual Meeting of the American Economic Association, May 1991, pp.75–9.

Heckman, JJ & Lochner, LJ (eds) 2000, *Rethinking myths about education and training: Understanding the sources of skill formation in a modern economy securing the future: Investing in children from birth to college*, Russell Sage Foundation, New York.
Johnston, J 1984, *Econometric methods*, 3rd edn, McGraw-Hill, New York.
Jones, M, Latreille, P & Sloane, P 2006, 'Disability, gender and the British labour market', *Oxford Economic Papers*, vol.58, no.3, pp.407–49.
Karmel, T & Nguyen, N 2008, *Disability and learning: How much does the disability really matter?*, NCVER, Adelaide.
Knights, S, Harris, M & Loundes, J 2002, 'Dynamic relationships in the Australian labour market: Heterogeneity and state dependence', *Economic Record*, vol.78, no.242, pp.284–98.
Lancaster, T 1979, *Duration analysis*, Cambridge University Press, Cambridge.
Maddala, G 1983, *Limited dependent and qualitative variables in econometrics*, Cambridge University Press, Cambridge.
Mavromaras, K, Wang-Sheng Lee & Black, D 2006, *An examination of welfare transitions using the first three waves of the HILDA survey*, report prepared for the Commonwealth Department of Employment and Workplace Relations, Canberra.
Mavromaras, K, Oguzoglu, U, Black, D & Wilkins, R 2006, *Disability and employment in the Australian labour market*, report prepared for the Commonwealth Department of Employment and Workplace Relations, Canberra.
Mavromaras, K & Polidano, C 2009, 'Disabilities, vocational education and employment', Working paper no.23, Melbourne Institute of Applied Economic and Social Research.
McCall, J 1970, 'Economics of information and job search', *Quarterly Journal of Economics*, vol.84, no.1, pp.113–26.
McManus, D 1992, 'How common is identification in parametric models?, *Journal of Econometrics*, vol.53, pp.5–23.
Miller, C & Nguyen, N 2008, *Who's supporting us? TAFE staff perspectives on supporting students with mental illness*, NCVER, Adelaide.
Mundlak, Y 1978, 'On the pooling of time series and cross section data', *Econometrica*, vol.46, pp.69–85.
O'Regan, K 1998, 'Spatial effects upon employment outcomes', *Urban Studies*, vol.35, no.7, pp.1187–205.
Orme, C 1997, 'The initial conditions problem and two-step estimation in discrete panel data models', Mimeo, University of Manchester.
Pissarides, C 1992, 'Loss of skill during unemployment and the persistence of employment shocks', *Quarterly Journal of Economics*, vol.107, pp.1371–91.
Productivity Commission 2004, *Review of the* Disability Discrimination Act 1992, Productivity Commission Inquiry report, Melbourne.
Wilde, J 2000, 'Identification of multiple equation probit models with endogenous dummy regressors', *Economic Letters*, vol.69, no.3, pp.309–12.
Wilkins, R 2004, 'The effects of disability on labour force status in Australia', *The Australian Economic Review*, vol.37, no.4, pp.359–83.
Wynand, P & van Praag, B 1981, 'The demand for deductibles in private health insurance', *Journal of Econometrics*, vol.17, pp.229–52.

Appendix A: Technical discussion of modelling approach

Modelling employment benefits of VET: theory and econometrics

To model employment as a binary outcome, the standard job search model is deployed (McCall 1970). Under this model, individuals choose to be in employment if they receive a wage offer that is at least as high as the minimum wage that they would require to accept an offer (referred to as their reservation wage). In this setting an individual is not required to accept a wage offer and can choose to remain out of work while waiting for further offers. On the demand side, employers are assumed to make wage offers that are not greater than the additional income to the firm resulting from the contribution of the employee (referred to as the marginal value product of the individual employee). Because of differences in productivity and expectations between individuals, each worker looking for a job will have their own unique equilibrium reservation wage. The interaction between demand and supply for an individual's labour is not explicitly modelled, only how demand and supply-side factors affect an individual's observed employment status. Modelling the demand and supply for an individual's labour is intractable without considerably more informative data because of identification problems.[17]

The approach used in this study is based on the latent variable method that has been used in previous studies (see, for example, Flaig, Licht & Steinr 1993; Harris 1996; Knights, Harris & Loundes 2002). Under this approach, an individual's employment status is a result of an underlying latent index y^*, which measures the difference between an individual's wage offer w and the reservation wage w^*:

$$y_i^* = w_i - w_i^* \tag{1}$$

which is assumed to be represented by observed $(x'\beta)$ and unobserved (v) individual characteristics:

$$y_i^* = x_i'\beta + v_i. \tag{2}$$

However, the latent index is not observed; what is observed is an individual's employment status y. If an individual is employed, their wage offer is assumed to be at least equal to their reservation wage and their latent index is positive, while individuals who are not in work are assumed to have an index in deficit:

$$y_i = \begin{cases} 1 \text{ if } y_i^* \geq 0 \\ 0 \text{ if } y_i^* < 0 \end{cases}. \tag{3}$$

[17] In practical terms, there are a number of factors, such as age, gender, part-time employment and academic ability that may simultaneously affect both the reservation wage and the wage offer. For example, a part-time job may increase the marginal value product and wage offer, but this may be factored into the reservation wage. A general discussion of these identification issues is given by Johnston (1984).

Assuming that v is normally distributed with zero mean and variance equal to 1, this model can be estimated using a univariate binary probit model.

Allowing for unobserved heterogeneity

A problem with the model described above is that if the data across all waves are pooled, there is a risk that an individual's error terms in consecutive periods will be correlated. This may occur if there are unobserved personal characteristics (unobserved heterogeneity) that affect employment outcomes in consecutive periods. If autocorrelation in the error terms is present, the standard errors in the above model will be biased, which may lead to incorrect inference about the significance of model coefficients (Guilkey & Murphy 1993). For this reason, we estimate a random-effects probit model, which takes into account autocorrelation of the error term. Under the random-effects model, the error term of the unobserved latent index in equation (2) is divided into an individual heterogeneity term that is constant through time (α_i) and a random term that varies through time (ε_{it}):

$$y_{it}^{*} = x_{it}'\beta + \alpha_i + \varepsilon_{it}. \quad (4)$$

Under the random-effects specification, it is assumed that the distribution of α_i and ε_{it} are random drawings and that they are independent and normally distributed with mean zero and respective variances σ_α^2 and σ_ε^2. It follows that the composite error term $v_{it} = \alpha_i + \varepsilon_{it}$, is normally distributed, with mean zero and variance $\text{var}(v_{it}) = \sigma_\alpha^2 + \sigma_\varepsilon^2$. A consequence of the distributional assumptions, which sets it apart from the related fixed-effects specification, is that there is no correlation assumed between the individual heterogeneity term and the explanatory variables. This may be a somewhat limiting assumption, but the use of a fixed-effects model is not suitable in this study because time invariant variables, such as past education and disability, cannot be included in a fixed-effects specification. Nonetheless, we can allow for correlation between time-varying variables and the heterogeneity term by including individual averages (over the five waves) for such variables on the right-hand side (Mundlak 1978; Chamberlain 1984).

In this study, it is assumed that the correlation in the error terms for all individuals is constant between periods. This specification is commonly known as the 'equicorrelated' random-effects model (Butler & Moffitt 1982) and is the standard approach used by econometric software, including in LIMDEP, which is used in this study.

Modelling state dependence

Modelling state dependency in employment outcomes involves including a lagged dependent variable (dynamic panel probit model) as a regressor in the latent index equation of the random-effects model discussed above (equation 4):

$$y_{it}^{*} = x_{it}'\beta + y_{i,t-1}\gamma + \alpha_i + \varepsilon_{it}. \quad (5)$$

However, including a lagged dependent variable is problematic because, unless the employment outcomes in the initial period are exogenous, they will be correlated with the random effect of the same equation, in which case the lagged dependent variable will be endogenous. To get around this 'initial conditions' problem, Heckman (1981) suggests explicitly modelling the labour market outcome in the initial period:

$$y_{i0}^{*} = x_{i0}'\beta + \alpha_i + \varepsilon_{i0}, \quad (6)$$

and to allow correlation between the individual effects between the two equations (5 and 6). In this paper, we adopt a shortcut to estimating the 'equicorrelated' Heckman model, as suggested by Arulampalam and Stewart (2008). This shortcut involves a series of data transformations, so that parameters for both equations (5 and 6) can be estimated in the one equation. 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). Following Greene (2007), the equation can be written as:

$$y_{it}^{*} = x_{i0}'\beta + x_{it}'\beta + y_{i,t-1}\gamma + \phi d_{it} + \varsigma f_{it} + d_{it}\tau\alpha_i + f_{it}\sigma\alpha_i + \varepsilon_{it} \quad (7)$$

where,

d_{it} = 1 in the initial period, 0 in subsequent periods;

f_{it} = 0 in the initial period, 1 in subsequent periods;

x_{i0} = the set of regressors in the initial period, 0 in subsequent periods; and

x_{it} = 0 in the initial period, regressors in subsequent periods.

Estimation of this model is performed in LIMDEP using the random parameters command, where only the two constants (d_{it}) and (f_{it}) are random parameters, which is equivalent to the random effects estimator (Greene 2007).

Test for the endogeneity of VET completion

As discussed above, including (Mundlak and Chamberlain) correction terms in the random-effects dynamic panel probit model only controls for correlation between time-invariant unobserved factors and time-varying explanatory variables. There is still the possibility that the results are biased by time-varying unobserved factors that are correlated with explanatory variables. To test the robustness of the estimated outcomes from VET completion, the main focus of this study, we estimated a random-effects bivariate panel probit model, which explicitly estimates any correlation in unobservable (time-varying and time-invariant) factors that determine VET course completion and employment outcomes in the same period. For example, it is possible that an increase in (unobserved) financial demands may increase the likelihood of participating in and completing VET and also necessitate work.

To incorporate state dependence in this model, we extended the Orme (1997) two-step procedure to solving the initial conditions problem. Under the Orme (1997) approach, the initial conditions equation is estimated first and an Inverse Mills Ratio is then calculated and inserted into the 'within sample' random-effects panel probit employment equation. We extend this approach here by estimating the 'within sample' employment equation as part of a bivariate random-effects panel probit model, where the two simultaneously estimated outcomes are 'employed' in a given year and 'completed VET' in a given year. In both cases, these outcomes are treated coded 1 for yes and 0 for no. Estimating a random-effects bivariate panel probit model is a standard approach for dealing with potentially endogenous binary variables (Maddalla 1983).

An important issue when estimating multivariate models is identification restrictions. Maddala (1983) points out that, for the purposes of identification, at least one exogenous variable in the reduced-form equation (completed VET) should be excluded from the structural equation (employment equation).[18] In our case, for the restriction to be valid, it must be significantly related to completion of VET, but not employment. We choose a variable of VET participation, but non-completion in the previous period as an instrument. It is assumed that non-completion significantly

[18] There is some uncertainty in the literature as to whether identification restrictions are needed in non-linear models, like the ones estimated in this report. Wilde (2000) claims that this restriction is only applicable for the special case of constant-only exogenous regressors and that parameters of the structural equation are identified if there exists at least one varying exogenous regressor. He concludes that for the standard case with varying exogenous regressors, the full rank of the matrix is sufficient for identification. McManus (1992) claims that non-linearity of the multivariate probit is sufficient for parameter identification.

reduces participation and completion in the following period, but makes no difference to subsequent period employment outcomes, relative to non-participation.

This model is estimated for the disability and without disability groups and the results are comparable with those reported in appendix B (available on request from the authors). Thus we can conclude that the results presented in the main report are not seriously affected by the presence of time-varying unobserved factors.

Lagged treatment of VET completion

The number of periods for which the benefits of a VET completion persist is an empirical one. At the time of writing this paper, there were six waves available in HILDA, which means that we can examine employment outcomes up to four years after they were completed. We can observe outcomes for only four years and not five because VET completion is only observed between waves, that is, the question posed in the survey is, 'since last survey, have you completed a VET course?'. Therefore, we cannot observe a VET completion in the first wave (or the first period for new respondents).

As a starting point, we tested whether benefits persisted for four years after completion by including three lag terms as well as a dummy for completing a VET course since the previous survey. Because we do not observe the period of VET completion prior to the start of the sample, there will be missing values for some of the lagged variable observations. For example, for a VET completion variable that is lagged four periods, there will be no observation until period 6. Instead of omitting these observations and suffering a loss of efficiency in estimation, we replace the missing observations with a zero. To indicate whether the lag variable is actually observed in a given period, as opposed to being a missing observation, we include a dummy variable for each lag, which is coded 1 for observed and 0 for not observed.

The estimated coefficients with all lags included showed that employment benefits trended upward over time, but the uncertainty surrounding the parameters increased with the lag length as well, so much so that the benefits estimated in the third and fourth periods after VET completion were not significant. The increasing uncertainty of the estimated parameters is because we used an 'unbalanced panel', which means that we included individuals who were not surveyed in every wave of HILDA, either because they dropped out or were added during the seven years of the survey. As a consequence, we have fewer observations for higher order lags.

To choose the optimum number of lags, we adopted the approach suggested by Anderson and Vahid (2002), which is to estimate models with none to four lags and to choose the one that gives the lowest Akaike Information Criterion (AIC). This process avoids using a stepwise procedure that is often path dependent (Anderson & Vahid 2002). Using this procedure, the optimal number of lags was found to be two.

Modelling participation and completion of VET

There are two variables of interest: participation in VET and completion of VET, given participation. In modelling these outcomes, it is assumed that there are two latent variables y_2^* and y_1^*, which represent the net benefit of participating and completing VET programs respectively, which depend upon individual characteristics and their environment x_1 and x_2:

$$\begin{aligned} y_1^* &= x_1'\beta + e_1 \\ y_2^* &= x_2'\beta + e_2 \end{aligned} \tag{8}$$

In this form, the $x_1'\beta$ and $x_2'\beta$ are called the index functions. However, we do not observe the latent net benefit variables; instead, we observe the outcomes of whether an individual participated

in VET (y_2) and whether a VET participant completed VET (y_1). In both cases, the dependent variables are binary, 1 if yes and 0 if no. Therefore, our observation criteria are:

$$y_j = \begin{cases} 1 \text{ if } y_j^* \geq 0 \\ 0 \text{ if } y_j^* < 0 \end{cases}, j=1 \text{ or } 2. \quad (9)$$

Under the unrealistic assumption that the two error terms[19] are independent—no unobserved factors that affect both outcomes—and are normally distributed with a zero mean and variance of 1, then both equations can be estimated using a binary univariate model. In the case of VET completion, the model is estimated only on the sample of individuals who are enrolled in VET.

In reality, the two error terms are likely to be highly correlated because unobserved personal traits that affect participation, such as motivation and ability, are also likely to affect completion. If the error terms are correlated, results for the completion equation will be biased and inconsistent (commonly termed sample selection bias). To test for independence of the error terms, we extend the above univariate approach to bivariate approach with sample selection (Wynand & van Praag 1981).[20] This involves assuming that the equation error terms take on a bivariate normal distribution, with a correlation equal to ρ. Added to the observability criteria, equation (2), is the condition that y_1, x_1 are observed when $y_2 = 1$.

Evidence of sample selection bias in the univariate approach, and the need for the bivariate probit model, is based on the estimated correlation between the error terms (ρ). If ρ is not different from zero, then there is insufficient evidence to reject the null hypothesis that there is no sample selection bias.

[19] All the factors that affect the net benefit of participating and completing that are not controlled for.

[20] Another approach would be to use a two-step procedure where an Inverse Mills Ratio (IMR) is derived from estimates of the univariate participation equation and inserted into the univariate completion equation. However, because of the non-linearity of the IMR, the results of the completion equation will be inconsistent (Maddala 1983).

Appendix B: Full results of employment model

Table B1 Marginal effects for the 'within sample' equation

	Marginal effect	t-statistic
Constant	0.06**	4.35
Highest education in initial period		
Higher education	0.08**	8.27
VET	0.04**	6.61
Completed secondary school	0.04**	5.60
Did not complete secondary school (reference category)	ref.	ref.
Completed VET after initial period		
Did not complete VET (reference category)	ref.	ref.
Completed VET (since last interview)	0.05**	2.60
Completed VET, t-1	0.09**	3.62
Completed VET, t-2	0.04	1.24
Female	0.00	0.63
Married	0.03	1.59
Married x female	-0.03	-1.56
Dependent children less than 15	-0.03	-1.35
Female x dependent children	-0.12**	-4.91
Age		
15–24 (reference category)	ref.	ref.
25–34	0.00	0.61
35–44	0.03**	3.53
45–54	-0.03**	-3.97
55–64	-0.18**	-10.57
State of residence		
NSW (reference category)	ref.	ref.
Victoria	0.00	0.73
Queensland	0.01	0.96
Western Australia	0.00	-0.34
Tasmania	0.01	0.51
South Australia	0.00	-0.22
ACT/Northern Territory	0.02	1.43
Live in rural area	0.00	0.64
Living arrangements		
Live rent free (reference category)	ref.	ref.
Live in own home	0.03**	1.97
Rent	0.04**	2.60
SEIFA index (1–10)	0.01**	6.21
Employed, t-1	0.24**	9.88

	Marginal effect	t-statistic
Has a disability in current year	-0.06**	-3.96
Extent of work limitation (0–10)	-0.01**	-5.47
Has a disability x employed t-1	0.11**	4.48
VET x with a disability	0.20**	3.35
VET t-1 x with a disability	-0.03	-0.39
VET t-2 x with a disability	0.00	0.04
VET x employed t-1	-0.12**	-3.82
VET t-1 x employed t-1	-0.18**	-5.19
VET t-2 x employed t-1	-0.08	-1.46
VET x employed t-1 x with a disability	-0.19**	-3.28
VET t-1 x employed t-1 x with a disability	0.12	1.31
VET t-2 x employed t-1 x with a disability	0.18	1.47
Random parameter, initial period	0.78**	44.18
Random parameter, within sample	0.71**	54.42
Mundlak correction terms		
Married	0.04**	2.37
Married x female	-0.08**	-3.35
Dependent children less than 15	0.03	1.53
Female x dependent children	0.01	0.56
Living arrangements		
Live rent free (reference category)	ref.	ref.
Live in own home	0.01	0.63
Rent	-0.04**	-2.02
Has a disability in current year	0.01	0.81
Completed VET after initial period		
Did not complete VET (reference category)	ref.	ref.
Completed VET (since last interview)	0.04	1.60
Completed VET, t-1	0.05	1.44
Completed VET, t-2	-0.05**	-5.14
Extent of work limitation (0–10)	-0.03**	-7.68
VET x with a disability	-0.02	-0.45
VET t-1 x with a disability	-0.08	-1.23
VET t-2 x with a disability	-0.12**	-7.14

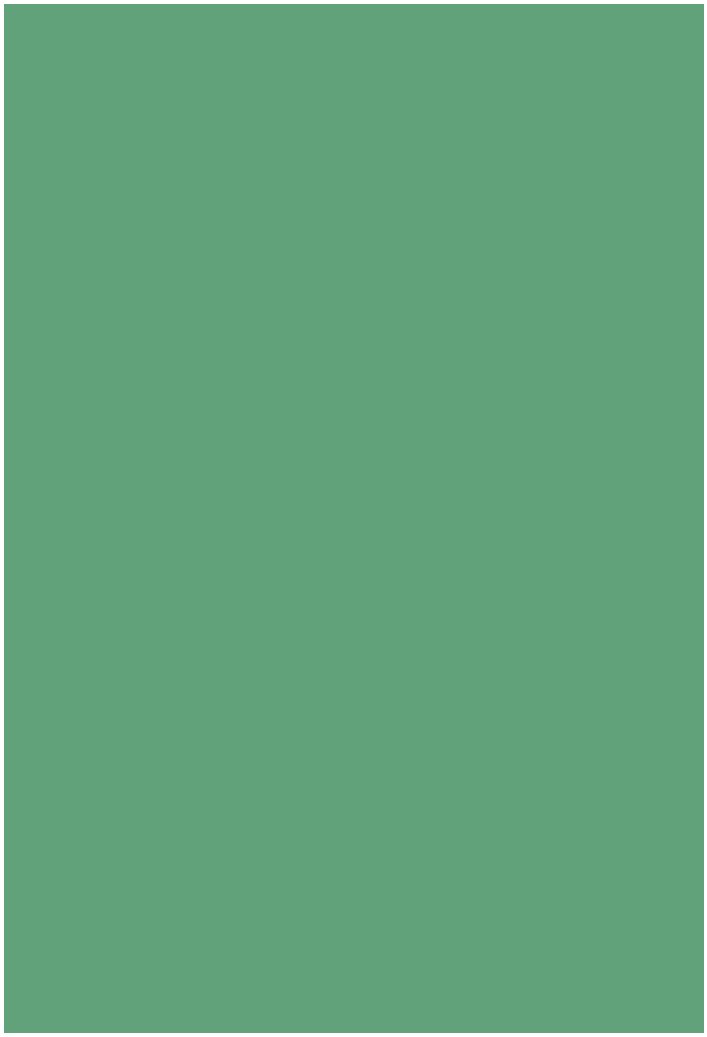
Notes: **significant at 5%, *significant at 10%. The marginal effects of the lagged VET completion variables (Completed VET, t-1 and Completed VET, t-2) are corrected for missing observations in the first two and first three waves respectively.

Source: Mavromaras and Polidano (2009).

Table B2 Marginal effects for the 'initial conditions' equation

	Marginal effect	t-statistic
Constant	-0.15**	-7.25
Highest education in initial period		
Higher education	0.14**	8.94
VET	0.06**	7.16
Completed secondary school	0.08**	7.34
Did not complete secondary school (reference category)	ref.	ref.
Female	0.02**	2.45
Married	0.06**	5.33
Married x female	-0.07**	-5.09
Dependent children less than 15	0.00	0.32
Female x dependent children	-0.15**	-7.69
Age		
15–24 (reference category)	ref.	ref.
25–34	-0.15**	-8.81
35–44	-0.20**	-9.19
45–54	-0.31**	-9.79
55–64	-0.52**	-10.29
State of residence		
NSW (reference category)	ref.	ref.
Victoria	0.01	1.20
Queensland	0.00	-0.33
Western Australia	0.00	0.15
Tasmania	-0.01	-0.73
South Australia	-0.01	-0.85
ACT/Northern Territory	0.03**	1.78
Live in rural area	0.03**	3.31
SEIFA index (1–10)	0.01**	6.93
Born in English-speaking country	0.06**	6.51
Log of years in employment	0.15**	10.20
Has a disability in current year	-0.03**	-3.37
Extent of work limitation (0–10)	-0.04**	-9.43

Notes: **significant at 5%, *significant at 10%
Source: Mavromaras and Polidano (2009).



NCVER

National Centre for Vocational Education Research Ltd

Level 11, 33 King William Street, Adelaide, South Australia

PO Box 8288, Station Arcade, SA 5000 Australia

Telephone +61 8 8230 8400 Facsimile +61 8 8212 3436

Website www.ncver.edu.au Email ncver@ncver.edu.au