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Abstract

While is it widely accepted that adults with poor reading skills have inferior labour market outcomes, little is known about whether low reading proficiency in school is a precursor to inferior labour market outcomes in adulthood. We fill this gap in the literature using education and labour market information to age 25 years for participants in the 2003 Program of International Student Assessment (PISA) who were tracked from age 15 in the 2003 Longitudinal Survey of Australian Youth. We find no difference in full-time employment rates or earning capacity of jobs attained at age 25 between those who had low and medium reading proficiency at age 15. Supporting analysis suggests that high rates of participation and positive outcomes from vocational education and training (VET) among those with low reading proficiency helps them avoid any negative effects from poor achievement in school. These results highlight the role of accessible VET pathways in facilitating the labour market participation of youth who may become disengaged from learning in school.

JEL classification: I20, I26, J01
Keywords: Academic achievement, PISA, labour market

1. Introduction

There is a considerable body of international literature showing that those with low reading proficiency in adulthood experience lower earnings (Dougherty 2001; McIntosh and Vignoles 2001; Shomos 2010; Vignoles et al. 2010; Antoni and Heineck 2012) and lower employment rates (Shomos 2010). Low proficiency measured in adulthood reflects the outcome of an individual's entire developmental process, while low proficiency when at school reflects only a partial snapshot. It is not clear whether low reading proficiency in school is necessarily a precursor to poor reading skills and bad labour market outcomes in adulthood.[1]

Low reading proficiency in school may not diminish young peoples' future labour market prospects if it prompts school interventions and/or more focussed exploration of post-secondary study and career options by them. The importance of post-secondary education in improving literacy levels is supported by an OECD study (2012a) that re-tested 15 year-old Canadian participants in the Program for International Student Assessment (PISA) at age 24. The study found large improvements in the reading levels of participants who had low reading proficiency in PISA, particularly among those who acquired post-school qualifications (OECD 2012a).[2]

In this study, we shed light on this issue by estimating the labour market outcomes at age 25 years of individuals whose reading proficiency was below level 3 in the Program for International Student Assessment (PISA) when school students in Australia at age 15. PISA is an intentional assessment of how well 15-year-old students from different education systems are prepared for the challenges of life across three domains — reading, mathematics and scientific literacy. Students who perform at below level 3 are viewed as unable to perform the kind of moderately difficult reading tasks needed to meet real-life challenges (OECD 2005a). Across OECD countries, achievement of level 3 in PISA is a commonly used

[1] The recent study by Lin, Lutter and Ruhm (2016) estimated lifetime differences in earnings associated with numeracy and literacy levels in the United States measured at 16-23, at an age somewhere between school and adulthood when post-secondary education and initial employment may still influence proficiency. As such, those results do not give a clear picture of post-school trajectories by reading proficiency in school.

[2] Measurement error will also mean that some of those considered to be low achievers will have been misclassified (OECD 2012a).

benchmark for appraising performance. For example, France has a target of 83% reading proficiency at level 3 or above, while Japan, Poland, Australia and Israel have goals for reducing the percentage of students reading below level 3 (Breakspear 2012). In this study, we examine employment and job quality outcomes in Australia, partly because Australia is one of only a handful of countries for which PISA participants are tracked over time and partly because Australia has highly accessible post-secondary vocational education and training (VET) sector. If participation in post-secondary education is important for offsetting the negative impacts of low school achievement, then this should be apparent in the Australian data.

We use multivariate regression techniques to examine the outcomes of low achieving students in PISA relative to outcomes of those with medium (level 3 and 4) and high reading proficiency (level 5) at age 15 years. The data used is from the 2003 PISA survey, linked, at the individual level, to panel data from the 2003 Longitudinal Survey of Australian Youth (LSAY 2003). Linking PISA to LSAY allows us to track 15 year-olds in PISA through to age 25 years. In estimation, we control for potential confounders related to socio-economic and demographic status and estimate models both with and without controls for the highest education qualification attained by age 25. We interpret the former as the total relationship between reading proficiency and labour market outcomes and the latter as reflecting the direct effect. Any direct effect can be interpreted as representing lower labour productivity that is unrelated to completed education level.

Our main findings is that those with low reading proficiency at 15 have the same rates of full-time employment at 25 as those with medium reading proficiency and were employed in jobs with similar earning capacity. The results hold irrespective of controls for highest completed education. We find that those with low reading proficiency, including those who do not finish school, engage heavily in VET and tend to choose initial courses that have good outcomes. A possible interpretation is that low reading proficiency at school can be the impetus for better career preparation.

2. The Australian education system

Like other English speaking countries, Australia's upper-secondary school system is not tracked into vocational and general education streams, with a curriculum that is focussed on preparation for higher-level academic study. In PISA, Australian students perform above the

OECD average in reading and mathematical literacy. However, between PISA 2000 and 2009, Australia has been only one of a few countries with a high-performing education sector that has experienced a decline in the proportion of students attaining a high level of proficiency in reading and mathematical proficiency (level 5), but with little change in the proportion who attained low levels (level 2 and below) (Thomson et al. 2004). Research by Ryan (2013) suggests that this decline in scores is more apparent in private schools, especially in those further down the performance distribution.

Although there is no tracking of students, almost all schools offer vocational education and training (VET) subjects, known as 'VET-in-schools subjects', in upper-secondary school.[3] These courses fill the dual purpose of counting towards a secondary school qualification (ISCED 3A) and a national VET qualification (usually at the 2C or 3C level). Around 29% of upper-secondary students in Australia take at least one of these courses (Polidano and Tabasso 2013). VET-in-schools courses were introduced into the upper-secondary school curriculum in the mid-1990s to help retain less academically oriented students in school and to prepare students for work and further training (Ministerial Council on Employment Education and Training and Youth Affairs (MCEETYA) 1999).

Secondary school completion rates (equivalent to ISCED 3A) in Australia are approximately 68% (Homel et al. 2012), which is below the OECD average (OECD 2010).[4] For the 2003 PISA cohort, the minimum school leaving age in Australia was 15 or 16, depending on the state. A possible reason for the relatively low school completion rates in Australia is the highly accessible pathways back into education. While there are options for early school leavers to re-commence their secondary school studies, around 90% of those who return to formal education do so by enrolling in a VET course (Polidano, Tabasso and Tseng 2013).

VET courses available to students outside of secondary school are much the same as those delivered inside of school, except that the variety of courses to choose from is far greater

[3] A possible exception is the state of Victoria that offers an alternative upper-secondary school certificate, the Victorian Certificate of Applied Learning (VCAL). VCAL uses work-related experience to build literacy, numeracy, technical and personal skills that are important for life and work. While this alternative pathway is typically taken by students who do not intend to enter higher education straight after school, students are not compelled to take this pathway.

[4] The estimate of school completion rates is based on data from the Youth In Focus (YIF) survey. Estimates from LSAY are higher those from YIF, but are likely to over-estimate the true completion rates because some students have left school prior to the LSAY survey (Homel et al. 2012).

(around 1,500 courses).[5] Post-school VET courses in Australia are highly accessible because they are available at a range of different levels to suit students with different learning needs, including basic courses at the ISCED 2C level and that have no academic prerequisites. For young people, the vast majority of courses are heavily subsidised by government, with students paying only a fraction of the total cost.[6] Historically, subsidised places in VET were restricted by government funding allocations, with access to students rationed on a first-come first-served basis, but with priority given to early school leavers. Students who missed-out on a publicly funded place had the option of enrolling in a fee-for-service course, with either public or private colleges.

University study in Australia is mainly bachelor-level education in wide-ranging fields for direct preparation for employment and higher, research-oriented, degrees. University entry rates in Australia are high by OECD standards (OECD 2012b), due in part to the long established and universally available deferred loans scheme for tuition and government subsidies of tuition charges.[7] The deferred loans scheme enables students to take a low-interest loan that is repaid through the tax system once their income exceeds a certain level. All Australian residents who gain entry to university have their undergraduate tuition subsidised. In 2012, Australia removed the cap on the number of subsidised university places and tied university funding to student choice. Evidence suggests that university enrolment numbers increased by around 13 percent as a result and minimum academic requirements for course entry, as measured by the Australian Tertiary Admission Rank (ATAR) scores, declined (Norton 2013).[8]

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[5] VET-in-school courses are a select group of training packages that are approved by the state boards of curriculum.

[6] For example, in Victoria in 2011, publicly-funded student tuition fees varied between $1.08 and $1.84 per contact hour, depending on the course level, with maximum annual fees capped between $500 and $2000 (Skills Victoria 2011). In 2011, fee concessions were also available for Health Care Card holders (low income earners), pensioners, veterans, dependents of those eligible, and indigenous. For TAFE providers, the base subsidies in 2011 were between $7 and $9.75 per hour, depending on the course level (Skills Victoria 2011).

[7] Before 2012 the number of publicly subsidised places in universities (for domestic students only) was capped at the course level. Since 2012, the number of publicly subsidised places in universities has been uncapped and supply limited only by university capacity.

[8] ATAR is a standardised measure of academic performance in upper secondary school and is widely, but not exclusively, used as the academic price of entry to university. The use of information from other sources, such as interviews, work portfolios and past community service in determining course entry, has increased since the cohort studied here applied to attend university.

Besides direct entry to university from school, indirect entry is also possible through the completion of higher-level VET courses (such as Diploma level (ISCED 5B) courses). However, this is a relatively uncommon path.

3. Data

A feature of this study is the link of individual information on numeracy and literacy proficiency from the 2003 PISA study to post-school outcomes from LSAY 2003. The 2003 PISA cohort was the first to be linked to LSAY and, currently, is the only one for which we observe post-school outcomes to age 25. We do not examine labour market outcomes at earlier ages because these would not include the initial labour market outcomes of some students who enrolled in university after school.

PISA is an international study that aims to measure, every three years from 2000, how well 15 year-old students from different education systems are prepared for the challenges of life after school. The assessment is not of young people's skills and knowledge in a certain field, but instead their ability to apply skills and knowledge from three domains to solve real world problems. These domains are reading literacy, mathematical literacy and scientific literacy. In this study, we focus on examining the outcomes of 15 year-old students with low reading literacy in PISA because literacy skills are seen as important in determining the ability of students to continue learning throughout their lives (OECD 2003). Besides literacy scores, a feature of PISA is principal and student surveys that contain detailed information on school and individual characteristics.

The Australian PISA sample in 2003 consists of 12,551 fifteen-year-old students chosen at random from 320 schools. The Australian sample is more than double the size of other participating countries because small states are over-sampled and because extra observations are needed to make the sample consistent with previous LSAY cohorts. Because the PISA sample is age-based, variation in the school starting age in Australia means that the data contains students from different year levels (mostly Years 9, 10 and 11).[9]

The PISA concept of reading literacy is broader than an ability to read fluently. It reflects the ability to understand and use text in a range of contexts, including in education and employment:

[9] For more information on the sampling design, see Thomson et al. (2004).

The capacity to understand, use and reflect on written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society (OECD 2003, p. 19).

The assessment of reading literacy in PISA is undertaken by asking students to complete a number of reading tasks. The text used in the reading tasks is either continuous (for example, narrative, descriptive or persuasive) or discrete (for example, graphs and tables, advertisements or maps) and applies to various situations (for example, educational, personal or occupational). Responses to the text are assessed and the scores are combined to form a continuous overall score. To express the scores as a level of reading competency, the OECD split the continuous score into 5 reading proficiency categories — level 1 (335 to 407), level 2 (408 to 480), level 3 (481 to 552), level 4 (553 to 625) and level 5 (more than 625). At successively higher levels, students are expected to be able to perform more complex reading tasks, so that students performing at level 3 are expected to be capable of performing reading tasks at level 2. In this study, we categorise reading proficiency (using the first plausible value) as high (level 5), medium (level 3 to 4) or low (level 2 and below). These groupings correspond to the ability of students to complete tasks with low difficulty, moderate difficulty and high difficulty (OECD 2005a).[10] A description of the minimum reading tasks required for high and medium proficiency are provided in Appendix Table A1. Dividing the distribution into three groups is necessary to derive a medium group as a reference category against which to compare outcomes for 15 year-olds with low reading proficiency.

LSAY is a longitudinal survey of youth, similar to the National Longitudinal Survey of Youth (NLSY) in the United States and the Youth in Transition Survey (YITS) in Canada and is one of only a handful of longitudinal datasets that can be linked to PISA. Canada, the Czech Republic, Denmark, Switzerland and Uruguay have similar longitudinal datasets with a capacity to be linked to PISA. The LSAY 2003 sample contains around 10,000 of the 12,551 PISA 2003 students whose schools agreed to take part in LSAY. LSAY 2003 contains rich information on education and employment outcomes and living arrangements up until age 25, including information on types of course enrolments (VET and university courses), qualifications attained and employment status. The sample of analysis used in this study is

[10] Estimates using one plausible value give unbiased estimates of the underlying population reading proficiency (OECD 2005b). Averaging all five plausible values at the individual level reduces the variance in the estimates and induced biased estimates of relationships between reading and other phenomena (OECD 2005).

those from the 2003 PISA cohort who are observed in LSAY 2003 until they are 25, either in 2011 or 2012. In all, the sample comprises 2,564 individuals: 414 had low reading literacy proficiency at 15, 1,495 had medium reading proficiency and 655 had high reading proficiency. The difference between the original LSAY 2003 sample and the sample of analysis at age 25 reflects sample attrition, which is around 75% by age 25. The possible effect of sample attrition on the results is examined in the sensitivity analysis.

In all of the analysis presented in this study at age 25, including results from the regression analysis, we use PISA weights to account for the initial LSAY 2003 sample and survey attrition (see Lim 2011 for discussion of the derivation and use of final weights in LSAY).

3.1. Education pathways

As described in the introduction, the expected labour market outcomes at age 25 for students with low reading literacy at age 15 is likely to depend on their educational pathways, which we classify as either being VET or university study or a combination of both. In this study, VET study is equal to International Standard Classification of Education (ISCED) level 2C, 3C, 4B or 5B and university enrolment is level 5A or 6 (United Nations Educational Scientific and Cultural Organisation (UNESCO) 2006).

From Table 1, which summarises how common different pathways are, what is clear is that low reading proficiency at age 15 does not appear to be a considerable barrier to participation in further education and training in Australia by age 25. Among those with low reading proficiency at age 15, the participation rate in post-secondary education is 87% by age 25, which is only slightly lower than the rate for students with medium level reading proficiency (93%). Not only is the participation rate in education high, but the rate of qualification acquisition among low proficiency readers is high as well.

Table 1: Average post-school education pathways taken by 25 across reading proficiency level at 15

	Low (1-2)		Medium (3-4)		High (5)	
	mean	s.e.	mean	s.e.	mean	s.e.
Never enrolled in post-school study	0.13	0.02	0.07	0.01	0.03	0.01
Started a VET course, incomplete or dropped out	0.12	0.02	0.09	0.01	0.03	0.01
Completed a VET qualification	0.31	0.03	0.21	0.01	0.06	0.01
Completed at least a second VET qualification at a level higher than the first	0.05	0.01	0.04	0.01	0.01	0.01
Completed at least a second VET qualification at a level no higher than the first	0.09	0.02	0.02	0.00	0.02	0.01
Completed a VET qualification, dropped out of a university course	0.08	0.01	0.08	0.01	0.04	0.01
Completed a VET qualification and completed a university course	0.05	0.01	0.05	0.01	0.04	0.01
Started a university course, incomplete or dropped out without previously completing a VET course	0.04	0.01	0.06	0.01	0.08	0.01
Completed a university course without previously completing a VET course	0.11	0.02	0.35	0.02	0.63	0.02
Completed a university course then dropped out of a VET course	0.01	0.01	0.03	0.01	0.03	0.01
Completed a university course and then a VET course	0.00	0.00	0.01	0.00	0.01	0.01
Number of observations	414		1495		655	

Note: estimates are generated using population weights from PISA, adjusted by the LSAY sample weights and attrition weights, to give estimates of the population in Australia. A VET qualification is at International Standard Classification of Education (ISCED) levels 2C, 3C, 4B or 5B. A university course is defined by ISCED 5A or 6.

Overall, 71% of those with low reading proficiency attained some form of post-secondary qualification by the age of 25, compared to 74% of those with medium reading proficiency.

Importantly, post-secondary VET appears to be an important safety net for low performing students who dropout of school. Although a quarter of students who have low reading proficiency at 15 fail to complete school (compared to 8% for the medium group), more than half go on to complete further qualifications. In particular, 7% go onto finish some basic-level VET (ISCED 2C) and a further 7% attain a qualification level at or above the vocationally equivalent of an upper-secondary qualification (ISCED 3B, 3C). Despite this, 19% of those with low reading proficiency have not attained at least an upper-secondary certificate or vocational equivalent (at least ISCED level 3), compared to 5% for the medium proficiency group (Table 2).

At the other end of the qualification spectrum, those who have low reading proficiency are much less likely to study at university and attain a bachelor level qualification. We estimate that around 29% of those with low reading proficiency at age 15 enrol in university and 17% attain a university degree. The comparable rates for those with medium reading proficiency are 58% and 43% respectively (Table 2).

3.2. Labour market outcomes

The focus of this study is examining employment and job quality outcomes at age 25 of those with low reading proficiency at age 15, relative to those with medium reading proficiency. Employment outcomes include full-time employment and not studying; part-time work and not studying; studying and neither employed or studying. These outcomes are important in measuring the extent to which low-achievers are excluded from work.

Two measures of job quality are used, weekly wage and job status. It is difficult to properly compare wage outcomes at age 25 because university graduates are only just starting out in their careers, whereas those who took other paths had up to 9 years of experience in the labour market. Given that attaining a university degree is highly correlated with reading proficiency at 15, this would tend to skew any comparison of wages and job status in favour of those with low reading proficiency. The very different employment history by proficiency status makes it difficult to adjust for this using standard regression techniques.

Table 2: Mean sample characteristics by reading proficiency at 15

	Low reading proficiency (1-2)		Medium reading proficiency (3-4)		High reading proficiency (5)	
	Mean	s.e.	Mean	s.e.	Mean	s.e.
Employment outcome at 25						
Full-time employed, not in study	0.58	0.03	0.58	0.02	0.60	0.02
Part-time employed, not in study	0.14	0.02	0.13	0.01	0.09	0.01
In study	0.20	0.02	0.22	0.01	0.26	0.02
Not in employment or study	0.08	0.02	0.07	0.01	0.04	0.01
Quality of jobs at age 25[a]						
Average weekly wage ($)	1121	36	1140	21	1270	28
Occupation status (index, 0-100)	42	1.63	55	0.88	66	1.32
Demographic and socio-economic variables						
Male	0.62	0.03	0.45	0.02	0.41	0.02
Live in an urban area	0.79	0.02	0.73	0.01	0.77	0.02
Indigenous	0.03	0.01	0.01	0.00	0.01	0.00
Mother's 1 digit ANZSCO occupation category						
Elementary occupations	0.25	0.03	0.14	0.01	0.08	0.01
Plant and machine operators and assemblers	0.01	0.01	0.02	0.00	0.02	0.01
Craft and related workers	0.02	0.01	0.02	0.01	0.02	0.01
Skilled agricultural and fisheries workers	0.01	0.00	0.01	0.00	0.01	0.00
Service workers and shop and sales people	0.21	0.03	0.11	0.01	0.08	0.01
Clerks	0.12	0.02	0.15	0.01	0.16	0.02
Technicians and associated professionals	0.08	0.02	0.13	0.01	0.15	0.02
Professionals	0.12	0.02	0.26	0.01	0.37	0.02
Legislators, senior officials and managers	0.09	0.02	0.09	0.01	0.09	0.01
Missing: No occupation	0.06	0.02	0.04	0.01	0.01	0.00
Missing: Non-response	0.02	0.01	0.03	0.01	0.01	0.00
Mother's highest education qualification	3.04	0.10	3.33	0.05	3.65	0.07
ISCED 2 & below	0.29	0.03	0.22	0.01	0.16	0.02
ISCED 3B, 3C	0.05	0.02	0.03	0.01	0.02	0.01
ISCED 3A, ISCED 4	0.30	0.03	0.31	0.02	0.28	0.02
ISCED 5B	0.12	0.02	0.12	0.01	0.13	0.01
ISCED 5A, 6	0.15	0.02	0.28	0.01	0.42	0.02
Missing	0.08	0.02	0.04	0.01	0.00	0.00
Father's 1 digit ANZSCO occupation category						
Elementary occupations	0.08	0.02	0.08	0.01	0.03	0.01
Plant and machine operators and assemblers	0.12	0.02	0.10	0.01	0.06	0.01
Craft and related workers	0.19	0.02	0.19	0.01	0.12	0.02
Skilled agricultural and fisheries workers	0.05	0.01	0.04	0.01	0.04	0.01

Service workers and shop and sales people	0.04	0.01	0.05	0.01	0.06	0.01
Clerks	0.03	0.01	0.04	0.01	0.03	0.01
Technicians and associated professionals	0.09	0.02	0.11	0.01	0.12	0.01
Professionals	0.09	0.02	0.16	0.01	0.34	0.02
Legislators, senior officials and managers	0.15	0.02	0.15	0.01	0.17	0.02
Missing: No occupation	0.06	0.02	0.03	0.01	0.00	0.00
Missing: Non-response	0.10	0.02	0.05	0.01	0.02	0.01
Father's highest education qualification						
ISCED 2 & below	0.26	0.03	0.22	0.01	0.15	0.02
ISCED 3B, 3C	0.03	0.01	0.03	0.01	0.01	0.01
ISCED 3A, ISCED 4	0.28	0.03	0.31	0.02	0.23	0.02
ISCED 5B	0.10	0.02	0.10	0.01	0.09	0.01
ISCED 5A, 6	0.20	0.03	0.27	0.01	0.50	0.02
Missing	0.13	0.02	0.06	0.01	0.02	0.01
Living Arrangements at 25						
Living at home	0.44	0.03	0.39	0.02	0.34	0.02
Living independently	0.24	0.03	0.27	0.01	0.29	0.02
Married/defacto	0.32	0.03	0.35	0.02	0.37	0.02
Cultural background						
Australian born with Australian parents	0.65	0.03	0.74	0.02	0.75	0.02
Australian born with one parent from a non-English speaking country	0.04	0.01	0.04	0.01	0.05	0.01
Australian born with two parents from non-English speaking country	0.11	0.02	0.08	0.01	0.06	0.01
Born in an English speaking country	0.09	0.02	0.07	0.01	0.05	0.01
Born in a non-English speaking country	0.12	0.02	0.07	0.01	0.09	0.01
Education variables						
Highest qualification attained by 25						
ISCED 2 & below	0.19	0.03	0.05	0.01	0.01	0.00
ISCED 3B, 3C	0.07	0.01	0.02	0.01	0.00	0.00
ISCED 3A	0.35	0.03	0.31	0.02	0.18	0.02
ISCED 4	0.09	0.02	0.08	0.01	0.03	0.01
ISCED 5B	0.13	0.02	0.10	0.01	0.06	0.01
ISCED 5A or 6	0.17	0.02	0.43	0.02	0.71	0.02
Year level at 15						
Year 9	0.050	0.012	0.013	0.004	0.002	0.002
Year 10	0.747	0.028	0.677	0.015	0.576	0.022
Year 11	0.198	0.026	0.302	0.015	0.411	0.022
Year 12	0.006	0.004	0.009	0.003	0.011	0.004
N	384		1427		642	

Note: estimates are generated using population weights from PISA, adjusted by the LSAY sample weights and attrition weights, to give estimates of the population in Australia. [a]These estimates are based on a sub-sample of people who are employed full-time or part-time and not in study.

To get around this problem, we use a measure of earnings potential — average population weekly wage associated with the 4-digit ANZSCO occupation attained at age 25. This

information is from the Australian Bureau of Statistics (2013). We use separate measures of average wage for males and females across all people employed in the specific 4-digit ANZSCO occupation in 2013. For some occupation categories no average wage is reported for females, mainly because of the small number employed. In these cases, we use the average estimate across males and females.

For job status, we link the student's 4-digit occupation at age 25 with a job status measure known as 'AUSIE06' produced by the Australian Council for Education Research (McMillan et al. 2009). AUSIE06 is a continuous measure that ranges from 0 (lowest status occupation) to 100 (highest status occupation) (see McMillan et al. 2009 for more information).

An interesting observation from Table 2 is that there are only minor differences in labour market outcomes observed across the reading proficiency levels, especially between outcomes for those with low and medium proficiency levels. An exception is occupational status, which shows clear increases with proficiency level.

4. Method

We use multivariate regression techniques to estimate the relationship between reading proficiency and labour market outcomes, exploiting the rich data in LSAY to control for potential confounders. To estimate the relationship with employment outcomes, we use a multinomial logit (MNL) model. Using a MNL model allows us the flexibility to estimate the relationship between reading proficiency and the chances of being in each of the employment states, including studying, rather than just one. A required condition of the MNL model is Independence from Irrelevant Alternatives (IIA), which states that the probability of choosing one of the outcomes is independent of the probability of choosing other outcomes. If the IIA is violated, the implication is that the MNL parameters are biased (Greene 2003). In this study, results from a specification test (Hausman and McFadden 1984) suggest that the IIA is not rejected.[11] For outcomes related to job quality, we estimate OLS regression models using the sub-sample of employed individuals who are not in study at age 25.

[11] We omit each of the alternative outcomes in turn, one at a time, and estimate the difference in the model coefficients relative to those from the specification when all alternatives are included. In each case, the null hypothesis that the coefficients are the same cannot be rejected at the 1% level.

4.1. Control variables

In estimation, we control for a range of socio-economic, demographic and schooling factors related to both reading proficiency at age 15 and labour market outcomes at age 25. These include parents' occupation and highest education when the child was 15; whether living in an urban area at 15; cultural background; school grade level at age 15 years; indigenous status and living arrangements at age 25. Estimates in Table 2 suggest that on average, those with low reading proficiency at age 15 are from lower socio-economic status. Specifically, their parents are more likely to be without basic levels of education (ISCED 2 and below), work in low skill occupations and be from non-English speaking backgrounds. Consistent with the literature (Marks 2008), those with low reading proficiency are also more likely to be male.

Besides socio-economic and demographic factors, a key control variable in the analysis is the school year level at age 15. Data presented in Table 2 shows that those with low reading proficiency at 15 are also more likely to be in lower year levels (years 9 and 10). This reflects differences in state-level school system features (the existence or not of a pre-year 1 kindergarten grade) and possibly students with low reading skills being held back. Controlling for differences in year level is important because as well as being correlated with proficiency in reading it is also likely to be associated with outcomes by age 25, since individuals will have one less year to establish themselves in the labour market by that age. Failure to control for such confounding effects may bias our analysis.

In exploring the relationship between reading proficiency at 15 and labour market outcomes at 25, we estimate models with and without controls for highest education completed. In the former case, any estimated relationship with reading proficiency represents the direct effect that is unrelated to educational attainment and the latter is the entire association.

5. Results

Table 3 contains key results from the multivariate regression models (full results are in Tables A2 and A3 in the appendix). The employment results are the average marginal effects generated at the individual level from the MNL model when reading proficiency is low or high, relative to when it is medium.[12] For wage outcomes, because the dependent variable is

[12] Using the command margin, dydx(*) predict(outcome(#)) in STATA.

in log form, the interpretation of the marginal effects is the percentage difference in weekly wage associated with low relative to medium reading proficiency. For job status, the interpretation is the point difference out of 100 in job status associated with low relative to medium reading proficiency. All standard errors are cluster-robust, with clustering at the school level.

Employment and wage results in Table 3 suggest that compared to having a medium reading proficiency, having low reading proficiency at age 15 makes no difference to the chances of being in any of the labour market states at age 25. This result holds regardless of whether we control for highest level of education attained by age 25. For job status, we estimate that having low reading proficiency is associated with having a job with a 9-point lower social status scale. These results suggest that being in the low proficiency group does not confer any disadvantage in employment or pay, irrespective of the level of qualifications attained.

We also find null results when we use mathematical literacy instead (Table A4 in the appendix). However, without controls for highest education, low mathematical literacy is associated with higher chances of full-time employment and higher weekly wage at age 25. This suggests that mathematical proficiency at age 15, unlike reading proficiency, is associated with better labour market outcomes at age 25, but only through higher levels of education attained. There is no estimated direct payoff to mathematical proficiency.

We stress that these results do not mean that reading proficiency is irrelevant to employment and wages at age 25. Instead, they suggest that they matter more at the upper-end of the proficiency distribution. Those with high reading proficiency, compared to low proficiency, are less likely to be working part-time and not studying and work in jobs that have 9% higher earning capacity, although the magnitude of the estimated relationships are smaller or insignificant when controls for highest education are added. When instead we use a continuous measure of reading proficiency, we find a significant quadratic relationship between reading proficiency and job earning capacity without controls for qualification levels. Specifically, we estimate that the effects of reading proficiency increases at an increasing rate.[13]

[13] The coefficients are 0.04.z-score reading proficiency and 0.015z-score reading proficiency^2. The coefficients are jointly significant at 1% (F-statistic=15.83, p-value=0.0001).

Table 3: Key multivariate model results by reading proficiency at 15[a]

Outcome at 25	Low reading proficiency (1-2)				High reading proficiency (5)			
	Without controls for highest education		With controls for highest education		Without controls for highest education		With controls for highest education	
Employment[b]								
Employed full-time and not studying	-0.030	(0.034)	-0.01	(0.037)	0.04	(0.029)	0.012	(0.029)
Employed part-time and not studying	0.027	(0.028)	-0.03	(0.030)	-0.036*	(0.017)	-0.044**	(0.016)
Studying	-0.007	(0.026)	-0.01	(0.027)	0.013	(0.022)	0.034	(0.023)
Neither employed or studying	0.011	(0.018)	-0.01	(0.015)	-0.017	(0.016)	-0.002	(0.019)
Job quality[c]								
Log average weekly wage	-0.044	(0.037)	-0.004	(0.037)	0.087**	(0.028)	0.039	(0.027)
Occupation status (0-100)	-9.00***	(1.522)	-3.72***	(1.331)	5.704***	(1.259)	1.1	(1.176)

***Significant at 1%, **Significant at 5%, *Significant at 10%. Standard errors are cluster robust.

[a] The reference category is medium level reading proficiency (3-4) at age 15. [b]Results are marginal effects from a MNL model and represent the change in the probability of being in a given employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level. [c]Results are from an OLS regression model for those in employment at age 25.

Table 4: Marginal effects of low reading proficiency relative to medium reading proficiency from a MNL model of outcomes at age 25[a]

Highest qualification	Employment outcome[b]				Job quality[c]	
	Employed full-time and not studying	Employed part-time and not studying	Studying	Neither employed or studying	Log wage	Job status
ISCED 2C and below (Cert II and below)	0.179**	0.025	-0.079	-0.125*	0.043	-2.99
	(0.090)	(0.062)	(0.078)	(0.070)	(0.107)	(3.949)
ISCED 3C (Cert III)	0.300**	0.074	-0.190**	-0.184	0.024	1.14
	(0.122)	(0.102)	(0.082)	(0.118)	(0.174)	(6.509)
ISCED 3A (Secondary school)	-0.010	0.009	-0.011	0.012	-0.057	-4.046
	(0.095)	(0.070)	(0.089)	(0.054)	(0.116)	(4.726)
ISCED 4 (Cert IV)	0.021	0.013	0.038	-0.073**	0.035	4.458
	(0.102)	(0.086)	(0.103)	(0.034)	(0.146)	(5.246)
ISCED 5B (Diploma)	0.023	-0.020	-0.012	0.009	-0.116	0.665
	(0.100)	(0.067)	(0.100)	(0.015)	(0.148)	(5.277)
ISCED 5A, 6 (University degree)	-0.188	0.114	0.047	0.026	-0.064	0.695
	(0.240)	(0.248)	(0.204)	(0.065)	(0.129)	(4.863)

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

a The reference category is medium level reading proficiency (3-4) at age 15. [b]Results are marginal effects from a MNL model and represent the change in the probability of being in a given employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level. [c]Results are from an OLS regression model for those in employment at age 25.

5.1. Interaction effects

The tenor of the results presented to date is particularly puzzling given the substantial body of evidence that higher qualification levels, especially university qualifications, have employment and wage benefits (Kane and Rouse 1995; Arcidiacono 2004; Leigh 2008). One possibility is that higher payoffs to VET for the low reading proficiency group may offset any disadvantage from lower university qualification attainment compared to the medium group. To test this, we re-estimate the employment and job quality models with interactions between reading proficiency and highest level of education attained at age 25.

Key results in Table 4 support the hypothesis that the effects of qualification attainment vary by reading proficiency. In particular, we find that among young people who leave school early and attain no more than ISCED2C or 3C level qualifications, those with low reading proficiency group are 18 and 30 percentage points respectively more likely to be full-time employed at age 25. Among those who left school early and attained no qualification higher

than an ISCED2C, the low reading proficiency group are less likely than the medium group to be neither employed nor in study, whereas for those who left school early and attained an ISCED3C qualification (year 12 equivalent), the low proficiency group is less likely to be studying. There is no statistical difference in full-time employment rates by reading proficiency for school completers (ISCED3A) and those who attain higher qualifications. Average wage results associated with occupations held at age 25 show similar patterns, but are not statistically significant possibly because of a lack of statistical power.

Among those with low levels of education at age 25 (ISCED level 3 (ASCED certificate III) and below), the higher full-time employment rates of the low proficiency group may be associated with better VET course choice. In particular, we estimate that among those who do not attain a university qualification, on average, the first postsecondary VET course chosen by those with low reading proficiency has a 6 percentage point higher expected graduate wage (see Table A5 of the Appendix). To the extent that higher graduate wages is associated with more highly valued skills, then the implication is that the initial VET course chosen by the low proficiency group is better aligned with the needs of the labour market. This initial discrepancy in expected returns to course choice also exists for the last course VET enrolment by age 25, but is smaller (4 percentage points). Doing poorly at school at age 15 may give young people the impetus to prepare early for a working life; for example, by choosing vocational subjects in school and by researching employment prospects from different VET courses.

5.2. Possible long-run effects

Although we find that low reading proficiency at age 15 does not appear to be a marker for labour market disadvantage at age 25, it is still possible that outcomes will become disparate over time. We cannot directly estimate longer-term effects in LSAY, but we instead project possible long-run outcomes using outcomes in HILDA. More specifically, we project employment outcomes to age 45 for the three reading proficiency groups, assuming that they follow the same employment transitions between 25 and age 45 as similarly educated individuals in HILDA.[14] Projections presented in Table 5 suggest that we may not expect to

[14] Specifically, we estimate annual transition matrixes between three employment states using the HILDA data. These states are: full-time employment, part-time employment and not employed. These matrixes are estimated separately for males and females for the six ISCED education categories used in this paper. One matrix is estimated for each individual year of age transition – from age 25 to 26 years, 26 to 27, and so on up

see any considerable differential change in employment patterns between the groups to age 45. The estimated outcomes at 45 show higher rates of full-time employment, but with only small differences in rates of full-time employment.

Table 5: Estimated outcomes at age 45 by reading proficiency at 15

	Males			Females		
	Low	Middle	High	Low	Middle	High
	%	%	%	%	%	%
Full-time employed	83	85	88	42	47	50
Part-time employed	7	6	5	38	37	37
Not employed	10	9	7	20	15	13

Note: Estimates are derived using the HILDA data, based on observed outcome transitions between 25 and 45 by education and employment states at 25. For this exercise, people are defined only by their employment status, ignoring their study status.

5.3. Sensitivity analysis

There are a number of alternative explanations for these results, including aggregation bias, model misspecification, bias from non-random attrition and differences in exposure to the global financial crisis. In this section, we present sensitivity analysis around these issues. To save space, we present all of the results in the appendix – Tables A5-A9.

Aggregation bias and model misspecification

Other possible explanations for the lack of differences in employment and wage outcomes by reading proficiency include aggregation bias and model misspecification due to interaction effects between year level and age. In the case of the former, it is possible that there is a high proportion of 15 year-olds categorised as having level 2 or level 3 reading proficiency and that grouping students into either low (level 1 and 2) or medium proficiency (level 3 or 4). This would lead to only minor differences in the group average proficiency, which may not amount to any meaningful differences in outcomes by age 25. However, this is not borne out in the sensitivity analysis. When we reclassify the low reading proficiency as level 1 and below, we find similarly insignificant results (Table A5 in the Appendix).

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to 44 to 45 years. The transition probabilities are averaged across time by pooling the data for the first twelve waves of the HILDA data. We then take the age 25 distributions of low, middle and high achievers for each education level for each gender across the three states and age the individuals using the HILDA annual transition probabilities until they reach age 45. The approach does not distinguish those who study separately, since there are many cells without observations across education categories for individuals by single year of age.

In the case of interaction effects, the concern is that having low reading proficiency at age 15 in itself may not matter for outcomes at age 25, but having low reading proficiency relative to the rest of your year group may. If this is true, then controlling for year level alone may not be sufficient. To test for possible bias related to misspecification of the model, we estimate each student's reading proficiency as their rank in their year level and group them into three categories: bottom (lowest ranked 17%), middle (17.01% to 78%) and top (highest ranked 22%). These are the proportion in the low, medium and high proficiency reading categories in the entire sample in year 11. Restricting the reading proficiency distribution of Year 9 and Year 10 students in this way makes little difference to the standard results (Table A5 in the Appendix).

Bias from non-random attrition

Attrition in longitudinal surveys is typically concentrated among disadvantaged groups, such as those from low socio-economic background, and LSAY 2003 is no exception (Rothman 2007). In our case, attrition may bias results if those who leave the sample have poorer outcomes than those who remain. It is possible that those with poor outcomes may be more likely to leave the survey by age 25 to avoid the embarrassment of reporting their situation. To the extent that those with low reading proficiency at age 15 have poor labour market prospects, they may be particularly likely to leave the sample by age 25. If this is the case, then our results may under-estimate the true effect of having a low reading proficiency at age 15.[15]

We use three ways to assess potential impacts from non-random attrition. First, we examine whether the outcomes at age 25 are consistent with those in the HILDA survey. Data from HILDA provide an important point of comparison because its original sample is nationally representative and, unlike LSAY, has relatively low rates of attrition.[16] We use HILDA to estimate outcomes among 25 year-olds who have the same education distributions as those in the LSAY low, medium and high reading proficiency groups. The estimated outcomes in HILDA are highly consistent with those in LSAY (see Table A6 in the Appendix). Apart

[15] This may be the case, even though our results use derived using sample weights adjusted for attrition, if the weights do not fully adjust for differences in attrition by employment status. In the estimation, we control for the initial sample selection of LSAY using sample weights.

[16] Around 70% of wave 1 respondents in HILDA were interviewed in wave 10 (after 10 years), compared to 38% in wave 10 of LSAY 2003.

from the over-representation in education and under-representation in 'not working and not studying' category (findings consistent with Homel et al. 2012), the LSAY distribution of outcomes may not face large problems from the impact of attrition.

Second, a concern with attrition in this setting is that there are unobserved poor outcomes, such as long-term unemployment, that correlate with both attrition and labour market outcomes at age 25. To test this, we transform the data into long format and estimate a pooled binary probit model of attrition from ages 21 to 25, conditional on the employment status in the year prior. We also use the same control variables from the main models, except for reading proficiency, highest education and living arrangements. In the case of the latter two, we instead use values from the year prior. To further control for observed and unobserved differences between those who do and do not attrite, we condition on the month of interview in the year prior. Those who complete the survey in later months are more likely to attrite in the following year (Ryan 2011). Results from this probit attrition model are inconsistent with the hypothesis that students in possibly negative employment states (part-time work and not in study and neither in employment or study) drop out at a higher rate than those in full-time employment. Instead, we find that being full-time employed and not in study is associated with a 2 percentage higher rate of attrition compared to part-time employment, which is significant at the 1% level. We also find no significant difference in the rate of attrition between those full-time employed and those not in employment or study in the prior year.

While previous year's employment outcomes do not appear to drive attrition in the following year, bias may still arise from the presence of other unobserved factors that correlate with reading proficiency, attrition and outcomes at age 25. One possibility is that students with low reading proficiency at age 15 lack motivation, making them more likely to drop out of the sample and lead to poor labour market outcomes. To test this, we re-estimate the outcome models, except we adopt a two-step procedure. In the first step, we estimate a model of career aspirations on the full sample at age 15. Specifically, we regress the AUSIE06 index of occupational status associated with student's intended job at age 30 (expressed at age 15) against demographic and socio-economic variables and year level at age 15. In the second step, the residuals from the first step are included as independent variables in all outcome models. The intuition is that the residuals from the first step control for unobserved factors associated with career aspirations that may also correlate with reading proficiency, attrition and labour market outcomes.

Results from the second step are much the same as the main results (Table A8 from Appendix), which suggests that our results are robust to the presence of unobserved factors, such as motivation, that are associated with career aspirations at age 15, attrition and labour market outcomes at age 25. Importantly, the coefficients on the predicted residuals in the second step are positive and significant for studying in the MNL employment model (at 5%) and in the job quality models. In the case of the former, this is likely to represent the higher career aspirations of those still in study.

Differences in exposure to the global financial crisis

Another possible explanation is that because those with low reading proficiency were less likely to participate in university study, they were more likely to have entered the labour market before the negative impacts of the global financial crisis. To test this, we re-estimate the standard models on a sample of 814 individuals who had not enrolled in any university course by age 25. Results are very close to those estimated on the entire sample (Table A9 in the appendix), which provides some comfort that our main findings are not an artefact of differential impacts from an economic shock.

Conclusions

Despite international evidence that adult numeracy and literacy levels have a positive effect on labour market outcomes, results presented in this study suggest that having low reading proficiency at age 15 does not translate, on average, to labour market disadvantaged at age 25 in Australia. We find that rates of full-time/part-time employment, studying and being in a productive activity (either employment or study) at age 25 are the same for those with low and medium reading proficiency at age 15. While low reading proficiency is associated with jobs that have a lower status, they are not associated with jobs that have lower earning potential. These results are robust to bias from model misspecification, aggregation of proficiency categories and non-random attrition. Importantly, we find no evidence to suggest that the outcomes at 45 are likely to be markedly different to those observed at age 25.

Results presented in this paper suggest that those with low reading proficiency avoid labour market disadvantage by achieving good outcomes from VET. Not only are those with low reading proficiency more likely to invest in VET, they are also more likely to enrol in VET courses that are associated with positive graduate outcomes. An interpretation is that having a

low reading proficiency at age 15 may provide the impetus for exploring VET options from an early age. Given the large number of VET courses available, each designed to prepare students for specific occupations; early career preparation for those taking the VET pathway may be important.

These results do not mean that reading proficiency does not matter to employment or job earning potential at age 25, but rather, that they matter more in explaining differences in outcomes between those with medium and high reading proficiency levels. Results that compare outcomes for those with high and medium reading proficiency do show more significant positive outcomes associated with reading proficiency. It is also important to keep in mind that we have only estimated differences in job earning capacity at age 25 and not differences in individual earning capacity. It is possible that having medium, rather than low reading proficiency, reduces the cost of subsequent investments in human capital, which leads to greater improvements in productivity and individual earnings, irrespective of the job attained.

An implication of these findings is that low academic performance at age 15 does not determine automatically subsequent labour market disadvantage. Moreover, our findings suggest that young people who are not doing well academically may compensate for their poor academic performance by seeking out VET courses that are associated with positive employment outcomes. This underlines the importance of ensuring access to VET for young people who find learning difficult in academic settings and measures, such as career counselling, that that help young people develop vocational plans while in school.

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Appendix A: Other results

Table A1: Expected minimum reading tasks for high and medium reading proficiency levels

High proficiency (level 5)
The reader must sequence or combine several pieces of deeply embedded information, possibly drawing on information from outside the main body of the text; construe the meaning of linguistic nuances in a section of text; or make evaluative judgements or hypotheses, drawing on specialised knowledge. The reader is generally required to demonstrate a full, detailed understanding of a dense, complex or unfamiliar text, in content or form, or one that involves concepts that are contrary to expectations. The reader will often have to make inferences to determine which information in the text is relevant, and to deal with prominent or extensive competing information.

Medium proficiency (level 3-4)
At this level, students cannot recognise the links between pieces of information that have to meet multiple criteria; integrate several parts of a text to identify a main idea, understand a relationship or construe the meaning of a word or phrase; make connections and comparisons; or explain or evaluate a textual feature. The reader must take into account many features when comparing, contrasting or categorising. Often the required information is not prominent but implicit in the text or obscured by similar information.

Source: OECD 2002, p. 207.

Table A2: Marginal effects from a MNL model of outcomes at age 25[a]

	Employed full-time and not studying	Employed part-time and not studying	Studying	Neither employed or studying
Male	0.146***	-0.036*	-0.059**	-0.051***
	(0.026)	(0.017)	(0.023)	(0.013)
Live in an urban area	0.04	-0.023	0.002	-0.019
	(0.031)	(0.021)	(0.027)	(0.018)
Indigenous	-0.031	0.038	0.046	-0.053***
	(0.089)	(0.062)	(0.075)	(0.016)
Mother's Occupation (ref. case: Elementary occupation)				
Plant and machine operators and assemblers	-0.062	-0.028	0.113	-0.023
	(0.100)	(0.062)	(0.086)	(0.038)
Craft and related workers	0.04	0.038	-0.027	-0.052*
	(0.099)	(0.068)	(0.082)	(0.026)
Skilled agricultural and fisheries workers	-0.023	-0.067	0.044	0.047
	(0.103)	(0.039)	(0.093)	(0.067)
Service workers and shop and sales people	0.002	0.004	0.004	-0.01
	(0.054)	(0.030)	(0.045)	(0.022)
Clerks	0.021	0.053	-0.029	-0.045*
	(0.050)	(0.033)	(0.045)	(0.018)
Technicians and associated professionals	0.054	-0.005	-0.065	0.015
	(0.048)	(0.028)	(0.042)	(0.027)
Professionals	-0.007	0.025	-0.017	-0.001
	(0.046)	(0.032)	(0.042)	(0.025)
Managers	0.05	-0.019	0	-0.03
	(0.049)	(0.029)	(0.046)	(0.023)
Missing: Mother is not employed	0.023	0.01	-0.076	0.043
	(0.077)	(0.043)	(0.077)	(0.045)
Missing: Non-response	-0.139	0.035	0.006	0.098
	(0.110)	(0.052)	(0.092)	(0.087)
Mother's Education (ref. case: ISCED 2 & below)				
ISCED 3B, C	0.034	-0.005	0.021	-0.050**
	(0.077)	(0.066)	(0.066)	(0.018)
ISCED 3A, ISCED 4	-0.013	-0.014	0.005	0.022
	(0.041)	(0.030)	(0.029)	(0.018)
ISCED 5B	-0.006	-0.036	0.066	-0.025
	(0.051)	(0.033)	(0.045)	(0.022)
ISCED 5A, 6	-0.032	-0.048	0.092**	-0.013
	(0.043)	(0.032)	(0.035)	(0.019)
Missing	0.108	-0.067	-0.028	-0.012
	(0.090)	(0.044)	(0.075)	(0.026)

Father's Occupation (ref. case: Elementary occupation)				
Plant and machine operators and assemblers	0.01	-0.053	0.041	0.002
	(0.058)	(0.044)	(0.051)	(0.028)
Craft and related workers	-0.022	0.023	0	-0.001
	(0.054)	(0.045)	(0.045)	(0.023)
Skilled agricultural and fisheries work	0.083	-0.016	-0.03	-0.037
	(0.076)	(0.054)	(0.066)	(0.024)
Service workers and shop and sales people	0.037	0.027	-0.025	-0.04
	(0.073)	(0.063)	(0.059)	(0.023)
Clerks	0.09	-0.067	-0.001	-0.022
	(0.088)	(0.061)	(0.067)	(0.037)
Technicians and associated professionals	-0.034	-0.018	0.007	0.045
	(0.062)	(0.045)	(0.051)	(0.032)
Professionals	0.001	-0.039	0.025	0.013
	(0.059)	(0.045)	(0.048)	(0.028)
Managers	0.072	-0.057	-0.024	0.008
	(0.060)	(0.040)	(0.049)	(0.029)
Missing: Father is not employed	-0.017	-0.014	-0.069	0.101
	(0.119)	(0.066)	(0.098)	(0.065)
Missing: Non-response	0.086	-0.02	-0.059	-0.008
	(0.086)	(0.051)	(0.074)	(0.034)
Father's Education (ref. case: ISCED 2 & below)				
ISCED 3B, C	-0.154*	0.079	0.117	-0.042
	(0.078)	(0.066)	(0.071)	(0.044)
ISCED 3A, ISCED 4	0.031	-0.017	0.015	-0.03
	(0.034)	(0.021)	(0.030)	(0.024)
ISCED 5B	0.019	0.025	-0.002	-0.041
	(0.047)	(0.030)	(0.035)	(0.030)
ISCED 5A, 6	-0.069	0.070*	0.054	-0.056*
	(0.046)	(0.035)	(0.038)	(0.026)
Missing	-0.121	0.049	0.005	0.067
	(0.072)	(0.043)	(0.057)	(0.053)
Living Arrangements (ref. case: Living at home)				
Living independently	0.053	-0.060*	0.018	-0.011
	(0.033)	(0.025)	(0.029)	(0.017)
Married/defacto	0.087**	-0.069***	-0.037	0.019
	(0.031)	(0.020)	(0.024)	(0.016)
Cultural background (ref. case: Aust. born with Aust. parents)				
Aust. born with one parent from a non-English speaking country	-0.008	-0.021	0.014	0.015
	(0.056)	(0.035)	(0.040)	(0.036)
Aust. born with two parents from non-English speaking country	0.042	-0.048	0.032	-0.026
	(0.055)	(0.027)	(0.045)	(0.020)
Born in an English speaking country	-0.049	0.006	0.086	-0.043*

	(0.050)	(0.039)	(0.057)	(0.017)
Born in a non-English speaking country	-0.022	-0.002	0.028	-0.004
	(0.047)	(0.029)	(0.038)	(0.028)
Grade at age 15 (ref. case: Year 9 or below)				
Year 10	0.091	-0.039	-0.057	0.004
	(0.098)	(0.061)	(0.093)	(0.031)
Year 11	0.066	-0.017	-0.078	0.029
	(0.101)	(0.068)	(0.094)	(0.034)
Year 12	0.299*	-0.081	-0.195	-0.023
	(0.129)	(0.088)	(0.105)	(0.042)
Reading proficiency at 15 (ref. case: Medium (level 3-4)				
Low (level 1-2)	-0.03	0.027	-0.007	0.011
	(0.034)	(0.028)	(0.026)	(0.018)
High (level 5)	0.04	-0.036*	0.013	-0.017
	(0.029)	(0.017)	(0.022)	(0.016)
N	2509	2509	2509	2509

***Significant at 1%, **Significant at 5%, *Significant at 10%. [a]The marginal effects are the change in the probability of being in an employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level.

Table A3: OLS regression results for job quality measures at age 25[a]

	Log wage	Job status
Male	0.329***	-5.870***
	(0.024)	(1.182)
Live in an urban area	0.008	2.312
	(0.030)	(1.345)
Indigenous	0.056	1.952
	(0.101)	(4.423)
Mother's Occupation (ref. case: Elementary occupation)		
Plant and machine operators and assemblers	-0.04	-3.532
	(0.100)	(4.098)
Craft and related workers	0.049	5.874
	(0.072)	(4.335)
Skilled agricultural and fisheries workers	0.035	-2.638
	(0.085)	(3.835)
Service workers and shop and sales people	-0.026	0.874
	(0.059)	(2.368)
Clerks	0.064	2.697
	(0.046)	(2.322)
Technicians and associated professionals	0.047	3.117
	(0.048)	(2.278)
Professionals	0.037	0.701
	(0.048)	(2.097)
Managers	0.049	0.627
	(0.049)	(2.558)
Missing: Mother is not employed	0.171*	7.767*
	(0.068)	(3.425)
Missing: Non-response	-0.184	-9.235
	(0.152)	(7.000)
Mother's Education (ref. case: ISCED 2 & below)		
ISCED 3B, C	-0.019	-3.214
	(0.071)	(2.878)
ISCED 3A, ISCED 4	0.042	1.327
	(0.042)	(1.698)
ISCED 5B	0.04	-1.876
	(0.047)	(1.975)
ISCED 5A, 6	-0.001	-0.039
	(0.047)	(1.909)
Missing	-0.016	-6.21
	(0.082)	(4.367)
Father's Occupation (ref. case: Elementary occupation)		
Plant and machine operators and assemblers	-0.018	-3.208

	(0.070)	(2.851)
Craft and related workers	-0.056	-2.651
	(0.068)	(2.291)
Skilled agricultural and fisheries work	0.021	-0.405
	(0.084)	(3.272)
Service workers and shop and sales people	0.073	2.726
	(0.079)	(3.114)
Clerks	-0.082	-3.226
	(0.088)	(4.308)
Technicians and associated professionals	-0.006	-0.88
	(0.078)	(2.669)
Professionals	0.023	1.697
	(0.070)	(2.633)
Managers	0.096	1.228
	(0.070)	(2.695)
Missing: Father is not employed	-0.044	-7.372
	(0.127)	(5.396)
Missing: Non-response	0.043	2.4
	(0.087)	(3.753)
Father's Education (ref. case: ISCED 2 & below)		
ISCED 3B, C	-0.019	2.053
	(0.090)	(3.241)
ISCED 3A, ISCED 4	-0.016	1.079
	(0.044)	(1.640)
ISCED 5B	0.004	3.608
	(0.057)	(2.352)
ISCED 5A, 6	0.019	6.522***
	(0.045)	(1.708)
Missing	-0.136	-4.693
	(0.077)	(3.398)
Living Arrangements (ref. case: Living at home)		
Living independently	0.078*	3.836**
	(0.030)	(1.355)
Married/defacto	0.129***	2.664
	(0.030)	(1.388)
Cultural background (ref. case: Aust. born with Aust. parents)		
Aust. born with one parent from a non-English speaking country	-0.031	1.691
	(0.068)	(2.241)
Aust. born with two parents from non-English speaking country	0.06	4.762
	(0.066)	(2.433)
Born in an English speaking country	0.052	2.177
	(0.053)	(1.951)
Born in a non-English speaking country	0.137**	9.421***
	(0.045)	(2.280)
Grade at age 15 (ref. case: Year 9 or below)		

Year 10	0.05	7.873*
	(0.090)	(3.580)
Year 11	0.124	9.796**
	(0.090)	(3.698)
Year 12	0.021	2.638
	(0.155)	(5.464)
Reading proficiency at 15 (ref. case: Medium (level 3-4)		
Low (level 1-2)	-0.044	-9.006***
	(0.037)	(1.522)
High (level 5)	0.087**	5.705***
	(0.028)	(1.259)
N	2084	2256

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

Table A4: Key multivariate model results by numeracy proficiency at 15[a]

Outcome a 25	Low numeracy proficiency (less than level 3)				High numeracy proficiency (level 5)			
	Without controls for highest education		With controls for highest education		Without controls for highest education		With controls for highest education	
Employment[b]								
Employed full-time and not studying	-0.083*	(0.034)	0.03	(0.056)	-0.025	(0.026)	0.028	(0.042)
Employed part-time and not studying	0.037	(0.025)	-0.013	(0.041)	-0.025	(0.019)	-0.037	(0.024)
Studying	0.027	(0.026)	-0.014	(0.049)	0.073**	(0.023)	0.01	(0.034)
Neither employed or studying	0.019	(0.019)	-0.003	(0.022)	-0.022	(0.014)	-0.001	(0.026)
Job quality[c]								
Average weekly wage	-0.082**	(0.032)	-0.048	(0.034)	0.077**	(0.028)	0.042	(0.030)
Occupation status	-8.131***	(1.441)	-3.884***	(1.343)	8.180***	(1.167)	4.348***	(1.130)

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

[a] The reference category is medium level reading proficiency (3-4) at age 15. [b]Results are marginal effects from a MNL model and represent the change in the probability of being in a given employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level. [c]Results are from an OLS regression model for those in employment at age 25.

Table A5: Key multivariate model results for expected VET course graduate wage by reading proficiency at 15[a]

	Low reading proficiency (less than level 3)		High reading proficiency (level 5)	
Post-secondary VET course				
First	0.063**	(0.254)	0.020	(0.045)
Last	0.037*	(0.019)	0.020	(0.037)

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

[a] The reference category is medium level reading proficiency (3-4) at age 15. Results are from an OLS regression model of expected log graduate wage, with controls for socio-economic status. The expected log graduate wage (real terms) is that associated with 4-digit ASCED field of study and certificate level combinations for under 25 course graduates in the Student Outcome Survey (SOS). In each year from 2005 to 2012, we estimate the average log wage for graduates from the year prior who appear in SOS using a Mincer wage style equation. In estimating the wage equation, we adjust for age, gender, state and region of residence, full-time employment status, disability, highest prior education, indigenous status, whether from English-speaking background, English speaking proficiency, employment status prior to study, whether training is part of an apprenticeship/traineeship and whether it is the first job after completing training. The reference case is Building Certificate level III, which was chosen because of the large number of observations and because it is a qualification that is easily recognisable (the typical qualification attained to become a builder in Australia). The size of the sample doubles every two years.

Table A6: Sensitivity test results for aggregation bias and model misspecification

Outcome at 25	Low reading proficiency (less than level 3)				High reading proficiency (level 5)			
	Without controls for highest education		With controls for highest education		Without controls for highest education		With controls for highest education	
Results using alternative measure of low reading proficiency[b]								
Employment[c]								
Employed full-time and not studying	-0.01	(0.062)	0.033	(0.064)	0.039	(0.029)	0.01	(0.029)
Employed part-time and not studying	0.047	(0.046)	0.058	(0.050)	-0.037*	(0.017)	-0.045**	(0.016)
Studying	-0.054	(0.042)	-0.069	(0.042)	0.015	(0.022)	0.037	(0.023)
Neither employed or studying	0.018	(0.030)	-0.021	(0.021)	-0.017	(0.016)	-0.002	(0.019)
Job quality[d]								
Average weekly wage	-0.055	(0.059)	0.006	(0.063)	0.087***	(0.028)	0.039	(0.028)
Occupation status	-14.823***	(2.389)	-6.51**	(2.644)	5.873***	(1.258)	1.209	(1.176)
Results using year level rank in reading[e]								
Employment[c]								
Employed full-time and not studying	-0.061	(0.042)	-0.049	(0.044)	0.022	(0.025)	0.004	(0.025)
Employed part-time and not studying	0.069*	(0.035)	0.091*	(0.038)	-0.018	(0.015)	-0.026	(0.015)
Studying	-0.015	(0.030)	-0.024	(0.030)	0.03	(0.022)	0.048*	(0.022)
Neither employed or studying	0.007	(0.019)	-0.018	(0.015)	-0.035**	(0.013)	-0.026	(0.015)
Job quality[d]								
Average weekly wage	-0.075	(0.043)	-0.047	(0.044)	0.068**	(0.023)	0.024	(0.023)
Occupation status	-9.102***	(1.768)	-3.111*	(1.723)	6.033***	(1.088)	2.019*	(1.038)

***Significant at 1%, **Significant at 5%, *Significant at 10%. Standard errors are cluster robust.

[a] The reference category is medium level reading proficiency (3-4) at age 15. [b]Low reading proficiency is level 1 and below. [c]Results are marginal effects from a MNL model and represent the change in the probability of being in a given employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level. [d]Results are from an OLS regression model for those in employment at age 25. [e] The reference category is middle group, which is reading proficiency rank of 17.01% to 78% within the student's year level. These proportions correspond to the proportions who are in the low, medium and high reading proficiency groups in year 11.

Table A7: Estimated 25-year-old outcomes in HILDA by reading proficiency at 15

	All persons			Males			Females		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
HILDA[a]									
Employed full-time and not studying	0.55	0.59	0.62	0.67	0.66	0.66	0.45	0.53	0.57
Employed part-time and not studying	0.12	0.11	0.09	0.07	0.07	0.06	0.17	0.14	0.13
Studying	0.16	0.19	0.20	0.16	0.18	0.20	0.18	0.19	0.19
Not employed, not studying	0.15	0.11	0.09	0.10	0.09	0.07	0.20	0.14	0.11
LSAY 2003									
Employed full-time and not studying	0.59	0.58	0.60	0.64	0.66	0.63	0.49	0.51	0.58
Employed part-time and not studying	0.14	0.13	0.09	0.15	0.10	0.07	0.14	0.15	0.11
Studying	0.20	0.22	0.26	0.17	0.19	0.27	0.25	0.25	0.26
Not employed, not studying	0.07	0.07	0.04	0.04	0.05	0.03	0.13	0.09	0.09

[a] Distributions for HILDA are derived by applying the reading proficiency at 15 and qualification attainment distributions from LSAY to 25 year-olds in HILDA. Estimates are generated using population weights to correct for attrition.

Table A8: Sensitivity test results for attrition bias from unobserved motivation[a]

Outcome at 25	Low reading proficiency (less than level 3)				High reading proficiency (level 5)			
	Without controls for highest education		With controls for highest education		Without controls for highest education		With controls for highest education	
Results using predicted residuals from a model of career aspiration[b]								
Employment[c]								
Employed full-time and not studying	-0.033	(0.034)	-0.011	(0.037)	0.042	(0.028)	0.015	(0.029)
Employed part-time and not studying	0.027	(0.028)	0.032	(0.029)	-0.036*	(0.017)	-0.044**	(0.016)
Studying	-0.002	(0.026)	-0.005	(0.026)	0.01	(0.022)	0.029	(0.023)
Neither employed or studying	0.008	(0.017)	-0.016	(0.015)	-0.016	(0.016)	-0.001	(0.019)
Job quality[d]								
Average weekly wage	-0.04	(0.037)	-0.003	(0.037)	0.084***	(0.027)	0.038	(0.027)
Occupation status (0-100)	-8.419***	(1.540)	-3.562***	(1.340)	5.480***	(1.241)	1.012	(1.170)

***Significant at 1%, **Significant at 5%, *Significant at 10%. Standard errors are cluster robust.

[a] The reference category is medium level reading proficiency (3-4) at age 15. [b] Career aspirations is measured as the AUSIE06 job status of student's intended occupation at age 30, reported at age 15. This outcome is regressed on all demographic and socio-economic variables (except living arrangements) and education variables at 15. In the employment model, residuals for studying are positive and statistically significant (at the 5% level), as are the residuals for wage and occupation status (significant at 1% level). [c]Results are marginal effects from a MNL model and represent the change in the probability of being in a given employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level. [d]Results are from an OLS regression model for those in employment at age 25.

Table A9: Key multivariate model results for those who did not attend university by reading proficiency at 15[a]

Outcome at 25	Low reading proficiency (less than level 3)				High reading proficiency (level 5)			
	Without controls for highest education		With controls for highest education		Without controls for highest education		With controls for highest education	
Employment[b]								
Employed full-time and not studying	-0.043	(0.044)	-0.019	(0.044)	0.019	(0.061)	0.005	(0.066)
Employed part-time and not studying	0.038	(0.036)	0.019	(0.036)	-0.054	(0.031)	-0.065	(0.034)
Studying	0.018	(0.027)	0.032	(0.030)	0.013	(0.042)	0.014	(0.044)
Neither employed or studying	-0.013	(0.026)	-0.032	(0.025)	0.022	(0.043)	0.046	(0.052)
Job quality[c]								
Log average weekly wage	-0.021	(0.044)	-0.028	(0.046)	-0.095	(0.074)	-0.114	(0.076)
Occupation status (0-100)	-4.136**	(1.656)	-3.561**	(1.818)	-2.132	(2.323)	-3.383	(2.216)

***Significant at 1%, **Significant at 5%, *Significant at 10%. Standard errors are cluster robust.

[a]The reference category is medium level reading proficiency (3-4) at age 15. Results are estimated on a sub-sample of 842 participants who had not enrolled in a university course by age 25. [b]Results are marginal effects from a MNL model and represent the change in the probability of being in a given employment state (relative to all other states) when the explanatory variable is at a given level, relative to when it is at the reference case level. [c]Results are from an OLS regression model for those in employment at age 25.