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# **What happens to students with low reading proficiency at 15? Evidence from Australia\***

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## **Abstract**

While illiterate adults are disadvantaged in the labour market, it is unclear whether low reading proficiency in school diminishes employment prospects in adulthood. We fill this gap using data on participants in the 2003 Program of International Student Assessment who were tracked to age 25 in the Longitudinal Survey of Australian Youth. We find no difference in full-time employment rates or earning capacity of jobs attained at age 25 associated with low reading proficiency at 15. Those with low reading proficiency are found to avoid negative effects through high rates of participation and positive outcomes from vocational education and training.

JEL classifications: I20, I26, J01.

Keywords: Academic achievement, PISA, labour market.

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## I. 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.<sup>1</sup>

Low reading proficiency in school may not diminish students' 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 of young people with low reading proficiency 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 at age 15 in PISA, particularly among those who acquired post-school qualifications (OECD 2012a).<sup>2</sup>

In this study, we shed further light on the extent to which governments should be concerned about students with low reading proficiency in middle school (below level 3 performance at 15 in PISA), by comparing their labour market outcomes at 25 to those obtained by middling

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<sup>1</sup> 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.

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

performers at 15 (levels 3-4 in PISA). Students performing below level 3 can be viewed as unable to perform the kind of moderately difficult reading tasks needed to meet real-life challenges (OECD 2005a). Across OECD countries, including in Australia, achievement of level 3 in PISA is a commonly used benchmark for appraising performance.<sup>3</sup> The use of Australian data is important. First, Australia is one of only a handful of countries in which PISA participants are tracked over time (through the Longitudinal Survey of Australian Youth (LSAY)). Second, Australia has a highly accessible post-secondary vocational education and training (VET) sector, which is ideal for examining potentially compensatory impacts of investments in post-secondary VET for low-achievers. Therefore, this study provides important evidence on the role that an accessible post-secondary VET system can play in promoting a socially and economically inclusive society.

We use multivariate regression techniques to examine the relative labour market outcomes of low achieving students in PISA. The data used is from the 2003 PISA survey, linked, at the individual level, to panel data from the 2003LSAY. 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 without and with 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.

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<sup>3</sup> 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).

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.

## **II. The Australian education system**

Like other English speaking countries, Australia's upper-secondary school system is untracked, with a focus 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 was 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. 2013). 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.<sup>4</sup> These courses fill the dual purpose of counting towards a secondary school qualification

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<sup>4</sup> 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.

(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).<sup>5</sup> 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 recommence 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 (around 1,500 courses).<sup>6</sup> 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. During the period of analysis, a centralised state-based VET funding model operated, where subject to state budgetary allocations and supply constraints, all Australian citizens under 25 could access

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<sup>5</sup> The estimate of school completion rates is based on data from the Youth In Focus (YIF) survey. Estimates from LSAY are higher than 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).

<sup>6</sup> VET-in-school courses are a select group of training packages that are approved by the state boards of curriculum.

a subsidised place, with students paying only a fraction of the total cost.<sup>7</sup> 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.<sup>8</sup> 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).<sup>9</sup>

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<sup>7</sup> For example, in Victoria in 2011, as a share of base-rate total hourly costs of training, student fees were around 13% to 16%, depending on the course (Skills Victoria 2011). These rates were lower for concession card holders — pensioners, veterans, dependents of those eligible and indigenous. Colleges at this time allocated subsidised places on a first-come, first-served basis, with preference given to early school leavers. Those who missed out could enrol in a full-fee-paying course. We cannot identify what percent of VET students received a subsidised place, but it is likely to be very high. Estimates using administrative data in 2008 show that 98% of 15-19 year-old VET enrolments were publicly subsidised (McVicar and Polidano 2015).

<sup>8</sup> 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.

<sup>9</sup> 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

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.

### **III. 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. Unlike many other low-stakes standardized tests, PISA is not an assessment of a young person's skills and knowledge of 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 2003a). Besides literacy scores, a feature of PISA is principal and student surveys that contain detailed information on school and individual characteristics.

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as interviews, work portfolios and past community service in determining course entry, has increased since the cohort studied here applied to attend university.

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 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).<sup>10</sup>

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:

“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 2003b, p. 19).

Reading literacy in PISA is assessed 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 five 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

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<sup>10</sup> For more information on the sampling design, see Thomson et al. (2004).

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).<sup>11</sup> 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 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

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<sup>11</sup> 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 2005b).

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 below.

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).

### *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 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. 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.

### **INSERT TABLE 1**

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).

#### *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, job status and weekly wage. In this context, 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. Thus, if we were to estimate wage rate models at age 25, we could not

adequately adjust for differences in labour market experience because of a lack of common support between those who attained a bachelor degree and those who did not. Given that wages tend to increase with labour market experience, results from such models would put the low proficiency group in a more favourable light compared to long-run comparisons.

## **INSERT TABLE 2**

To get around this problem, we use a measure of earnings potential — the average weekly wage associated with the 4-digit ANZSCO occupation attained at age 25 from the Australian Bureau of Statistics (2013). We use separate measures for males and females across all people employed in each 4-digit ANZSCO occupation in 2013. For some occupations, no average wage is available for females because of the small number employed. In these cases, we use the average estimates generated across males and females.

Job status is a construct from sociology that measures the prestige or social desirability of an occupation, accounting for the social standing of people employed in different occupations in addition to their earning capacity. In this study, we use the ‘AUSIE06’ measure of job status produced by the Australian Council for Education Research (McMillan et al. 2009) and link it to the student’s 4-digit occupation at age 25. AUSIE06 is a continuous measure that ranges from 0 (Labourers not elsewhere classified) to 100 (Medical practitioners) (see McMillan et al. 2009 for more information).

An interesting observation from Table 2 is that, except for occupational status, there are only minor differences in labour market outcomes observed between those with low and medium proficiency levels.

#### IV. 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) do not suggest that the IIA is violated.<sup>12</sup> 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.

##### *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

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<sup>12</sup> 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.

living arrangements at age 25.<sup>13</sup> 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 a direct effect that is unrelated to educational attainment and the latter is the entire association.

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<sup>13</sup> We also estimated models with extra controls, including controls for state and regional location of residence, which made little difference to the results. These were not included here because they contained a considerable number of missing observations. Results are available upon request from the corresponding author.

## V. Results

Table 3 contains key results from the multivariate regression models (see Tables A2 and A3 in the appendix for full results). 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. For wage outcomes, because the dependent variable is 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 presented 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.

### **INSERT TABLE 3**

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.<sup>14</sup>

#### **INSERT TABLE 4**

##### *Interaction effects*

The tenor of the results presented to date is particularly puzzling given the substantial body of evidence that 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

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<sup>14</sup> The coefficients are 0.04.z-score reading proficiency and 0.015z-score reading proficiency<sup>2</sup>. The coefficients are jointly significant at 1% (F-statistic=15.83, p-value=0.0001).

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.

### *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 as those with higher qualifications gain labour market experience. 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. Projections presented in Table 5 suggest that we may not expect to 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.

### **INSERT TABLE 5**

### *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 A6-A10.

#### 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. Aggregation bias may occur if there is a high concentration of students on the margin between low and middle reading proficiency (around the cut-off between level 2 and 3), 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 (top pane of Table A6 in the appendix).

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. Reclassifying the reading proficiency distribution of Year 9 and Year 10 students in this way makes little difference to the standard results (bottom panel of Table A6 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). Non-random attrition can bias results when it changes the characteristics of the treatment and control groups in a way that affects the outcomes (Hausman and Wise 1979), which may occur if those who leave the sample have poorer outcomes than those who remain. In our setting, the relative outcomes of the low proficiency group could be upward-biased if

those with poor labour market outcomes attrite at a greater rate than those from the medium level, especially because of the embarrassment of reporting poor outcomes.<sup>15</sup>

We first assess the robustness of our results to attrition bias by examining whether non-random attrition in LSAY makes the outcomes of the poor reading group look relatively more favourable relative to the medium group. We do this by examining whether the relative labour market outcomes at age 25 in LSAY are consistent with those that might be expected if 25-year-olds in HILDA had the same qualification attainment as the reading level groups in LSAY. Data from HILDA provides an important point of comparison because its original sample is nationally representative and, unlike LSAY, has relatively low rates of attrition.<sup>16</sup> If those with low reading proficiency select-out of LSAY because of their poorer labour market outcomes (possibly because they are ashamed to report them), then for this group we should expect to see more positive labour market outcomes at 25 in LSAY than in HILDA where attrition is much lower. To derive expected labour market outcomes at 25 by reading proficiency using HILDA, for each reading category, we multiple the highest qualification attainment shares at 25 from LSAY (see Table 2) by the average labour market outcomes by highest qualification attained at 25 from HILDA. We find only small estimated differences in labour market outcomes at 25 between low and medium proficiency reading levels in HILDA, which are generally consistent with those from LSAY (see Table A7 in the Appendix) and provide some surety that our results are robust to attrition bias from this source. We also find consistent

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<sup>15</sup> 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.

<sup>16</sup> 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.

results when we estimate a pooled model of early career attrition (ages 21 and 25), with previous year's labour market outcomes on the right-hand-side (see Table A8 in appendix).<sup>17</sup>

Another potential source of attrition bias is the presence of unobserved personal traits, such as motivation, that may correlate with reading proficiency levels, attrition and outcomes at age 25. 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 A9 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

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<sup>17</sup> We also transform the data into long format and estimate a pooled binary probit model of attrition from ages 21 to 25, conditional on observed labour market outcomes from the previous year and using the same control variables from the main models, except for reading proficiency, highest education and living arrangements. An additional control was month of interview, which may capture unobserved time-varying factors that may affect attrition and lagged employment outcomes (Ryan 2011). We find that part-time employment, relative to full-time employment, reduces the chance of attrition in the following wave of the survey by 2 percentage points (see results in Table A8 in appendix). No significant difference in the rates of attrition is found between full-time employment and not in study or employment. This evidence, that potentially inferior outcomes to full-time work (part-time employment and not in study or employment) are not associated with elevated risk of attrition in the following year, does not support the proposition that poor labour outcomes drive attrition.

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 A10 in the appendix), which provides some comfort that our main findings are not an artefact of differential impacts from an economic shock.

## **VI. 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 disadvantage 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. However, we stress that that the extent to which good course choices compensates for low achievement may depend on economic conditions. In particular, the labour market penalties for being low reading proficiency may have been greater if conditions in Australia during the period of analysis (2003-13) were less favourable.<sup>18</sup>

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<sup>18</sup> Since 1991 Australia has experienced 25 consecutive years of economic growth and was relatively unaffected by the global financial crisis in 2008-09.

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**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.

**Table 2: Mean sample characteristics at age 25 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.
<i>Employment outcome at 25</i>						
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
<i>Quality of jobs at age 25<sup>a</sup></i>						
Average weekly wage (\$)	1121	36	1140	21	1270	28
Occupation status (index, 0-100)	42	1.63	55	0.88	66	1.32
<i>Demographic and socio-economic variables</i>						
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						
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
<i>Education variables</i>						
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. Sample sizes are smaller than reported in Table 1 because of control variable non-response. \*These estimates are based on a sub-sample of people who are employed full-time or part-time and not in study.

**Table 3: Marginal effects of reading proficiency at 15 for labour market outcomes at 25<sup>a</sup>**

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	
<i>Employment<sup>b</sup></i>								
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)
<i>Job quality<sup>c</sup></i>								
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.

<sup>a</sup> The reference category is medium level reading proficiency (3-4) at age 15. <sup>b</sup>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. N=2509. <sup>c</sup>Results are from an OLS regression model for those in employment at age 25. N=2085 (weekly wage), N=2256 (employment status).

**Table 4: Marginal effects of low reading proficiency at 15 by qualification attainment for labour market outcomes at age 25<sup>a</sup>**

Highest qualification	Employment outcome <sup>b</sup>				Job quality <sup>c</sup>	
	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** (0.090)	0.025 (0.062)	-0.079 (0.078)	-0.125* (0.070)	0.043 (0.107)	-2.99 (3.949)
ISCED 3C (Cert III)	0.300** (0.122)	0.074 (0.102)	-0.190** (0.082)	-0.184 (0.118)	0.024 (0.174)	1.14 (6.509)
ISCED 3A (Secondary school)	-0.010 (0.095)	0.009 (0.070)	-0.011 (0.089)	0.012 (0.054)	-0.057 (0.116)	-4.046 (4.726)
ISCED 4 (Cert IV)	0.021 (0.102)	0.013 (0.086)	0.038 (0.103)	-0.073** (0.034)	0.035 (0.146)	4.458 (5.246)
ISCED 5B (Diploma)	0.023 (0.100)	-0.020 (0.067)	-0.012 (0.100)	0.009 (0.015)	-0.116 (0.148)	0.665 (5.277)
ISCED 5A, 6 (University degree)	-0.188 (0.240)	0.114 (0.248)	0.047 (0.204)	0.026 (0.065)	-0.064 (0.129)	0.695 (4.863)

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

<sup>a</sup> The reference category is medium level reading proficiency (3-4) at age 15. <sup>b</sup>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. N=2509. <sup>c</sup>Results are from an OLS regression model for those in employment at age 25. N=2085 (weekly wage), N=2256 (employment status).

**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: outcomes at 45 are estimated using annual transition matrices between three employment states derived from HILDA data. These states are: full-time employment, part-time employment and not employed. These matrices 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 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. The number of individuals used to derive the transition probabilities varies, depending on the transition, but in all cases, there are at least 100 individuals used. 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.