FACULTY OF
BUSINESS &
ECONOMICS

THE UNIVERSITY OF
MELBOURNE

Melbourne Institute Working Paper Series

Working Paper No. 14/12

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A Second Chance at Education for
Early School Leavers*

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Abstract

Despite efforts to engage youth in education, there have been only modest improvements in the rates of school completion across OECD countries since the mid-1990s. These modest improvements underline the importance of programs that encourage early school leavers to return to post-school education. The objective of this paper is to better understand the factors that affect the chances of re-engaging early school leavers in education, with a particular focus on the importance of time out from school (duration dependence) and school-related factors. Using data from three cohorts of the Longitudinal Survey of Australian Youth and duration models that control for unobserved heterogeneity, our results suggest that programs that encourage an early return to study and programs that develop post-school career plans may be more effective than programs that concentrate on improving numeracy and literacy scores.

1. Introduction

Dropping out of school can substantially diminish the life prospects of youth. On average, early school leavers have much greater difficulty in finding and retaining employment and are more likely to be in low-paid jobs (Heckman and Rubinstein 2001, Rumberger and Lamb 2003). High rates of youth unemployment in the OECD since the global financial crisis, in excess of 20% in some countries (OECD 2010), has renewed interest in programs to engage youth in education. For example, as part of its '2020 Agenda', the European Commission set out targets to reduce early school leavers to less than 10% of youth between 18 and 24 by 2020 (European Commission 2011). In Australia, the government has set a similar target of at least 90% of 20-24 year olds to attain a secondary school certificate or equivalent by 2015 (Council of Australian Governments (COAG) 2009).

Since the mid-1990s, there has been little improvement in school completion rates in the OECD. On average, school completion rates have risen from 74% in 1995 to 80% in 2008 (OECD 2010), with rates in the European Union and the United States increasing by only around 3 percentage points in the last decade (European Commission 2011 and Chapman et al. 2011 respectively).[1] These trends call into question the effectiveness of education reforms that were aimed at engaging students in study during this period. These reforms included increased school autonomy and accountability, more years of compulsory education, a greater focus on early intervention in numeracy and literacy and expanded upper-secondary curriculum.

While retaining youth in school should be the first priority, the modest improvement in school completion rates since the mid-1990s underlines the importance of also having programs to encourage early school leavers to return to study. The aim of this paper is to contribute to the debate on how to encourage early school leavers to re-engage in education. The key research questions addressed in this paper are: independent of individual heterogeneity, how does time out from school affect the chances of re-engaging early school leavers in education? How can schools prepare youth who leave school early for further study after school? In particular, what is the likely effectiveness

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[1] Completion rates in the U.S. are measured as the percentage of 18 through to 24-year-olds who are not enrolled in high school and who have earned a high school diploma or an alternative credential, including a GED certificate. Completion rates in Europe are the percentage who attain a secondary school qualification.

of improving numeracy and literacy levels, delaying school dropout, incorporating vocational courses in the upper-secondary curriculum and improving career counselling?

Whether time out from school has a negative or a positive effect on the chances of re-engagement is uncertain. On the one hand, it may have a negative effect (negative duration dependence) if time out from school depreciates knowledge and skills needed to participate in further study. It may also have a negative effect if the expectation to become financially independent from parents increases with time out from school. On the other hand, time out from school may have a positive effect if it gives early school leavers the chance to mature and develop a plan for their future, which may help them better weigh-up the benefits and costs from returning to study. Understanding the direction of any effect of time out from school and its importance relative to in-school factors will help shed light on which programs are most cost-effective in re-engaging early school leavers in study. School factors are a focus because career preparation, including preparation for further study, is a key role of schools.

We address the research questions by using data from the Longitudinal Survey of Australian Youth (LSAY) to estimate duration models of re-engagement in education that control for unobserved heterogeneity. LSAY is a panel dataset that tracks youth from age 15 (around the end of compulsory education in Australia) for 12 annual survey waves and contains rich school and post-school information. Examining re-engagement of early school leavers in Australia provides an interesting context because Australia has highly accessible and flexible second chance educational options, including both options to recommence secondary study (in and outside of a school setting) and options to enter vocational education. Possibly because of its accessible second-chance options, the rate of re-engagement in education among early school leavers in Australia is relatively high. According to data from the LSAY 2003 cohort, of the 23% who leave school early, 82% return to education within the first 5 years. This contrasts to rates of re-engagement in education of around 30% in the European Union within the same time frame (GHK 2005).[2]

There are two main contributions of this paper to the literature. First, we more precisely estimate the effect of duration dependence in the re-engagement of early school leavers.

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[2] Re-engagement is enrolment in a ISCED level 3, which is equivalent to an upper-secondary qualification (UNESCO 1997).

A previous study by Black, Polidano and Tseng (2012) estimated duration dependence over a working life using a population-wide sample of all early school leavers. However, the authors did not have sufficient numbers of early school leavers, observed from the time of dropout, to precisely estimate duration dependence in the early years out from school, a time when duration dependence is likely to matter most. In this paper, by pooling data from three cohorts of the LSAY dataset (1995, 1998 and 2003 cohorts), we build a large sample of early school leavers whose patterns of re-engagement can be traced on a monthly basis up until 6 years out from the time of dropout. An advantage of having such a large sample is that it allows us to estimate duration dependence while controlling for unobserved heterogeneity. Second, the examination of school related factors is new. Previous studies into the re-engagement of early school leavers have either ignored school-level factors (Black et al. 2012 and Rumberger and Lamb 2003) or have only given them cursory attention (Hill and Jepsen 2007).

Overall, we find negative duration dependence is the most important factor explaining the patterns of re-engagement, which suggests that policies to coerce youth back to education early may be highly effective. Results also point to the importance of developing post-school career paths in encouraging a return to study. We find that those who report leaving school for employment or study reasons are much more likely to re-engage in education compared to those who leave for other reasons, for example, because they did not like school. Similarly, those who find post-school employment in jobs that they would like as a career are more likely than those in other types of jobs to return to study. The importance of finding a suitable career path may have important implications for other countries, such as the United Kingdom, Netherlands and New Zealand, who like Australia, have accessible second-chance vocational pathways. Because vocational education is job-specific, those who are unsure of their preferred career path face highly uncertain returns from re-engaging, and as a result, may delay or refrain from further study. Importantly, we find no evidence that numeracy and literacy levels or extra years in school make a difference to the chances of re-engaging.

The paper is organised into 6 main sections. In section 2, we provide an overview of the Australian secondary schooling system and second-chance education options; in section 3 we define key terms and describe the dataset and in section 4 we explain the duration models used and the choice of explanatory variables. Section 5 contains a discussion of the key model results and section 6 concludes the paper.

2. Australian school completion and pathways back to education

There are three tiers of education in Australia — primary school, secondary school and tertiary education (which includes university and vocational education and training). Depending on the state or territory, the minimum school leaving age is 15 or 16 over the period of analysis.[3] At the end of compulsory education, there is no test to determine suitability for upper-secondary education, like there is in the UK (General Certificate of Secondary Education). Rather the choice to enter post-compulsory secondary school education, which is typically up until age 18, is left to the student and their parents.

In this study, we define school completion as attaining an upper-secondary school certificate, equivalent to an International Standard Classification of Education (ISCED 1997) 3A. The upper-secondary school certificate in Australia is recognised as an entry point into university and higher level post-school vocational education and training (VET) courses and some entry level jobs. Like in other English speaking countries, such as the United States, Canada, New Zealand and the United Kingdom, Australia's upper-secondary school system (last two years of secondary school) is general, with no separate vocational track. That said, students have the flexibility to combine general education subjects with VET subjects, including apprenticeships or traineeships, that contribute to both a secondary school certificate and a nationally accredited VET qualification.[4] VET subjects are either provided by the schools themselves, or are provided by a local VET provider. In-school VET qualifications a subset of those that can be attained outside of school and are set by state government school authorities. Overall in 2010, 78% of youth attained an upper-secondary certificate in 2010 (Australian Bureau of Statistics (ABS) 2011), which is around the OECD average (OECD 2010).

For Australians who leave school for the first time without attaining an upper-secondary school certificate, referred to in this study as early school leavers, there are several pathways back into education, the cost of which are all heavily subsidised by government. Students can decide to continue their secondary school education through an Adult and

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[3] For most of the time period spanning the data collection period, the minimum legal age for leaving school was 15 or 16, depending on the state or territory. In 2009, the Australian Government introduced a mandatory requirement for all students to complete Year 10 (around 16 years of age) and must be in either full-time education, training or employment or a combination until age 17. This reform occurred after the period of analysis in this study.

[4] The main motivations for incorporating VET courses into the upper-secondary school curriculum was to improve school retention by giving less academically inclined students alternative education pathways in school (Ministerial Council on Employment Education and Training and Youth Affairs 1999).

Community Education (ACE) centre, that specialises in providing education for people who have difficulty participating in more formal education settings, through a VET provider, or through a secondary school. Alternatively, early school leavers can re-engage in education by commencing a VET course with a VET provider. VET courses in Australia are highly accessible for early school leavers because they are available in a range of different modes to suit individual circumstances and unlike entry into higher education, there is no requirement to have attained a secondary school certificate to enrol. VET courses are available at a range of levels from basic courses at the certificate levels I and II (equivalent to International Standard Classification of Education 1997 (ISCED97) level 2C), to Diploma courses (equivalent to ISCED97 level 5B) that often count towards part completion of a university course (ABS 2001). From the LSAY data, most early school leavers are observed to enrol in certificate levels II and III, which is considered by the Australian Government as being at least equivalent to an upper-secondary school certificate (COAG 2009).

VET courses are typically endorsed by industry and government as part of a nationally accredited industry training package. Similar to VET in the Netherlands, United Kingdom and New Zealand, VET training in Australia is competency based, which means that to attain a qualification, students must demonstrate competency in the performance of job-specific and more generic tasks. While the focus on competency-based training makes VET relevant to employers, its jobs-specific nature makes articulation between VET and university study difficult because competency standards do not easily translate into academic performance (Wheelahan and Moodie 2011). Therefore, for early school leavers who re-engage in VET, the pathway to university study is not as straight forward as for those who re-engage by continuing their secondary school education.

3. Data

The primary data source for this paper is the Longitudinal Survey of Australian Youth (LSAY). LSAY is a panel survey that tracks students from Year 9 (or around age 15) for 12 annual waves. There are 5 different LSAY cohorts (1995, 1998, 2003, 2006 and 2009) each starting with a sample of around 10,000 students. There are differences in the sampling methodology between cohorts. The 1995 and 1998 cohorts are nationally stratified samples of around 300 schools, with the survey participants from two Year 9 classes chosen at random from each school. Instead of being a survey of Year 9 students,

from 2003 LSAY is nationally representative sample of 15 year-old students from 300 schools participating in the OECD PISA data collection. Around 50 sample participants are drawn randomly from each school; for schools with fewer than 50 students, all 15 year-olds are selected.[5]

To maximise the sample size, we use data from the three cohorts for which there is at least 5 years of post-school data — 1995, 1998 and 2003 cohorts. Because at the time of writing only 7 waves of the 2003 cohort were available, we restrict the sample for the 1995 and 1998 cohorts to the first 7 waves as well, which allows us to examine re-engagement patterns up to 6 years after leaving school, or when most youth in the sample are 21.

In the context of this study, LSAY's rich data on involvement in school programs, school achievement and post-school outcomes makes it ideal for examining issues related to transition from school.

3.1 Early school leavers

Using LSAY, we identify early school leavers as being those who report leaving school for the first time after the legal minimum age, but without attaining an upper-secondary school certificate. In essence, this means that those who remained in school to the end (around age 18), but did not receive an upper-secondary certificate are treated as early school leavers.[6] We note that there are a handful of early school leavers who complete a vocational education and training (VET) qualification before leaving school early. Consistent with the Australian Government classification of these qualifications (COAG 2009), those who report leaving school early, but complete a VET certificate level II (equivalent to ISCED 1997 Level 2) and above before doing so, are treated as school completers.

Over the three cohorts, we observe 6,593 early school leavers in our data and a school completion rate ranging from 72% in 1995 to 77% in 2003 (Table 1), which is consistent with ABS (2011) figures. The earliest youth are observed leaving school is Year 9 when most, but not all students, turn 15; however, the majority (60-70%) leave in upper-secondary school (Year 11 and Year 12).

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[5] For more information on the LSAY survey methodology, visit the LSAY website (http://www.lsay.edu.au/publications/index.html).

[6] They will not receive an upper-secondary school certificate because they did not fulfill the academic requirements.

Table 1: Sample of early school leavers in LSAY

	1995 cohort		1998 cohort		2003 cohort	
	Count	%	Count	%	Count	%
Early school leavers	2 648	28	2 043	25	1,902	23
Year 12 completers	6 763	72	6 295	75	6,337	77
Total	9 411	100	8 338	100	8 239	100
School year of dropout						
Year 9	65	3	31	2	16	1
Year 10	917	35	617	30	422	22
Year 11	1070	40	946	46	878	46
Year 12	596	23	449	22	586	31
Total	2 648	28	2 043	25	1,902	23

Source: LSAY, 1995, 1998 and 2003 cohorts.

3.2 Re-engaging in education

In this study, re-engagement is defined as the first enrolment in education that leads to a nationally recognised qualification (certificate I and above) or an upper-secondary school certificate since leaving school for the first time. This definition rules out enrolment in short-courses and recreational courses. In LSAY, an enrolment is identified by whether an individual reports commencing study since the last interview, regardless of whether or not they are currently in study.

Overwhelmingly, data from Table 2 shows that the most popular routes back into education for early school leavers in Australia involves enrolling in a VET course (91%), with a continuation of secondary school relatively uncommon (9%). Around half of those who choose a VET course are undertaking an apprenticeship or traineeship and the other half are not. The most popular VET courses unrelated to apprenticeship or traineeships are in business, tourism, information technology, hospitality and community services (National Centre for Vocational Education and Research (NCVER) 2010).

Table 2: Re-engagement pathway for early school leavers in the first 6 years after leaving school

	Count	%
Continue secondary school education	396	9
Return to school	38	1
Outside of school	358	8
Commence a VET course	4000	91
VET as part of an apprenticeship/traineeship	2041	46
VET *unrelated* to an apprenticeship/traineeship	1959	45
Count	4396[a]	100

[a] There are 4683 early school leavers observed to re-engage, but only 4396 have information regarding the timing of re-engagement. Source: LSAY 1995, 1998 and 2003 cohorts, waves 1-7.

To gauge how the probability of re-engaging early school leavers changes over time, we present the Kaplan-Meier non-parametric hazard functions fitted to the raw data for males and females (Figure 1). Initially, we observe positive duration dependence, with the peak in the chances of re-engaging for the first time observed at 3 months, which represents time out between leaving school and commencing further study. The initial time out from study may be because students are waiting for the start of the next academic year or because they deliberately delay study to work and save money or to travel. After the peak at 3 months, Figure 1 provides evidence of negative duration dependence. Between 3 and 7 months there is a dramatic fall in the chances of re-engaging, after which there is a more steady decline in the chances of re-engaging up until month 20. After 20 months the decline in the hazard asymptotically tends toward zero. Overall, the pattern of duration dependence is non-monotonic, which underlines the importance of using a model with a flexible baseline hazard when modelling time to re-engagement. As well as non-monotonic duration dependence, there is also some evidence of a cyclical trend, with bumps corresponding to the timing of the beginning and mid-year student intakes, especially in the first 12 months (around 9 and 15 months respectively). Another important observation from Figure 1 is that there appears to be little difference in the shape of the plotted male and female hazards.

Figure 1: Kaplan-Meier hazard function of re-engagement in education up to 6 years after leaving school early
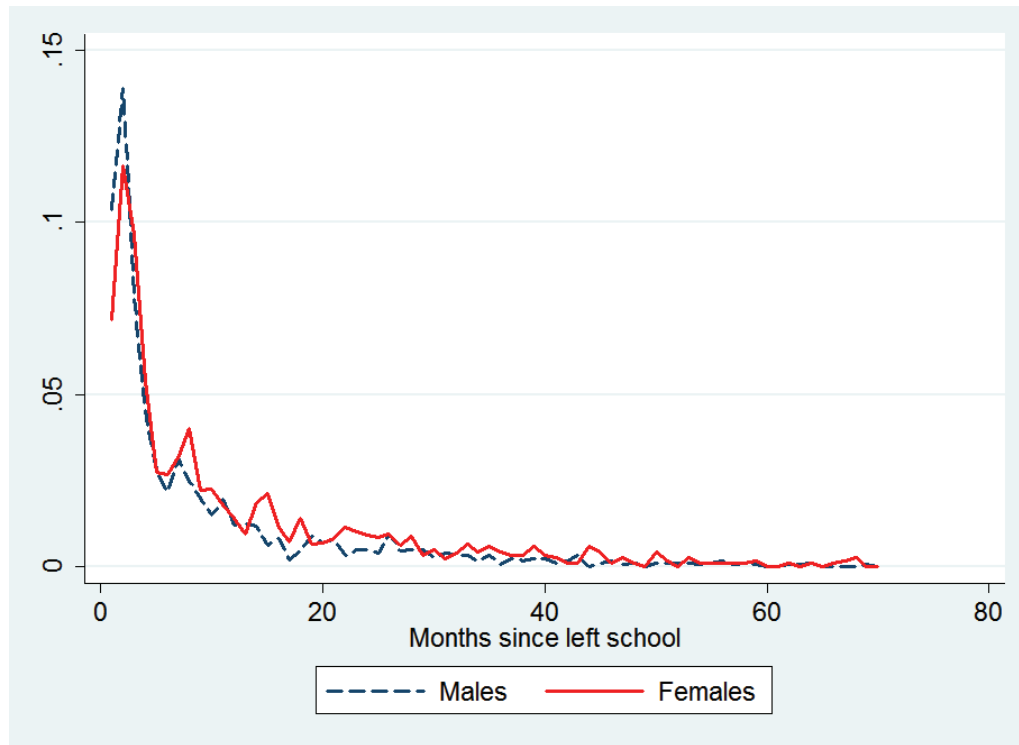
Source: LSAY 1995, 1998 and 2003 cohorts, waves 1-7.

4. Modeling re-engagement

In this paper, we model the patterns of re-engagement using duration models rather than using binary outcome models (of whether early school leavers re-engage or not) because duration analysis:

1) allows us to separate the effect of duration dependence from the effect of the inter-temporal change in the covariates; and

2) does not rely on the assumption that the time to an event (conditional on the set of covariates we are controlling for) follows a normal distribution, which is a highly restrictive (and very often not a reasonable) assumption (Cleves, Gould and Gutierrez 2008).

The duration that we model in this study is a continuous measure of time to re-engagement for early school leavers, measured (in months) from the time of exit from school to the time of first re-engagement in education. We treat time to re-engagement as a continuous variable and not as a discrete variable with re-engagement points corresponding to the commencement of a semester because, unlike school and university

study, VET courses can be commenced throughout the year. From Table 3, it is clear that while early school leavers are most likely to re-engage at the start of the academic year (January-February) and after mid-year (July), there is continuous re-engagement throughout the year.

Table 3: Calendar month of re-engagement in the first 6 years after leaving school

Month of re-engagement	Number of re-engagements	Frequency (%)	Cumulative (%)
January	460	10.85	10.85
February	1,364	32.16	43.01
March	330	7.78	50.79
April	191	4.5	55.29
May	172	4.06	59.35
June	259	6.11	65.46
July	432	10.19	75.64
August	264	6.22	81.87
September	224	5.28	87.15
October	141	3.32	90.47
November	168	3.96	94.44
December	236	5.56	100

Source: LSAY 1995, 1998 and 2003 cohorts, waves 1-7.

Because VET courses are highly modularised with little prior knowledge required for each module, students can start at different times without their learning being penalised. Also, compared to school and university education, VET courses are more frequently taken by modes that do not involve on-campus face-to-face tuition, such as online and distance courses, that allow students freedom to commence study whenever they choose.

Time to re-engagement t is modelled in reduced form and the hazard is assumed to be represented by a Cox Proportional Hazard model:

$$\theta(t, X) = \theta_0(t) . \exp(\beta'X) \tag{1}$$

where $\theta_0(t)$ is the baseline hazard that is common to all individuals and $\exp(\beta'X)$ is an individual-specific function of covariates, known as the 'systematic part' of the hazard. The Cox model is known as a Proportional Hazard because the systematic part scales the baseline hazard which is common to all persons. A feature of the Cox Proportional Hazard model is that the baseline hazard is not restricted by an assumed distribution, but rather takes on a non-parametric form. Such flexibility is important given the non-monotonic nature of the hazard depicted in Figure 1.

To incorporate unobserved heterogeneity into this model, we use the approach proposed by Lancaster (1979), which is to introduce a multiplicative individual specific random effect υ:

$$\theta(t, X) = \theta_0(t).\exp(\beta'X).\upsilon \tag{2}$$

and make standard assumptions that υ has a gamma distribution, a unit mean, constant variance and is distributed independently of t and X (Jenkins 2005).[7] Such a model is commonly known as a Mixed Proportional Hazard (MPH) model. Controlling for unobserved heterogeneity is potentially important because failure to do so has been shown in some contexts to bias result, especially for estimates of duration dependence (Heckman and Singer 1984; Lancaster 1990). That said, it has been shown that such bias is restricted to cases where an inflexible specification of the baseline hazard is assumed (Ridder 1987, Han and Hausman 1990 and Meyer 1990).

We include time-varying factors in our model, such as employment outcomes, that are only observed after the individual has left school.[8] As already mentioned in section 3, we only observe the survey respondents up to wave 7 of each survey cohort. This implies that if an individual re-engages after wave 7, this event will not be recorded in our data. Nonetheless, given the high percentage of early school leavers who re-engage within the observed spell of time, the effects of the right-censoring from incomplete spell information should not significantly affect the explanatory power of the included covariates.

4.1 Estimating duration dependence

As mentioned previously, while the non-parametric baseline hazard is highly flexible, duration dependence is gauged from plotted baseline hazards conditional on model estimates. While such plots give an indication of the direction of duration dependence, it is difficult to interpret its importance relative to the importance of other covariates. Such

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[7] Early literature suggested that the estimated baseline hazard is sensitive to distributions assumptions of the unobserved heterogeneity term (see Heckman and Singer 1984). However, results from subsequent studies by Ridder (1987) and Dolton and de Klaauw (1995) suggest that the sensitivity found in these early studies is due to misspecification of the baseline hazard. In different applications, Ridder (1987) and Dolton and de Klaauw (1995) show that sensitivity apparent in parametric baseline hazards (such as Weibull models) disappears with the use of more flexible non-parametric forms. These findings are further supported by results from a Monte Carlo study by Nicoletti and Rondinelli (2010).

[8] Following the method outlined in Cleves et al. (2010), section 5.1.

information is important for policy makers to design programs that are most cost-effective in encouraging early school leavers back to study.

To attain direct estimates of duration dependence, we also estimate a complementary log-log (clog-log) model with gamma distributed individual heterogeneity, with the following hazard function:

$$h(t,X) = 1 - \exp\left\{-\exp\left[\theta(t) + \beta'X + \upsilon\right]\right\} \Leftrightarrow \log[-\log(1-h)] = \theta(t) + \beta'X + \upsilon \quad (3)$$

which is the exact discrete-time counterpart of the MPH model, with the same β coefficients (Jenkins 1995; Beck, Katz and Tucker 1998).[9] The baseline hazard $\theta(t)$ is estimated by including a series of time interval dummies, which are assumed to give consistent estimates of the duration dependence of the underlying continuous-time hazard within each interval.

In its most flexible form, the clog-log baseline hazard would be in month long intervals. However, because there are declining numbers of observed re-engagements, we create increasingly large intervals to allow for robust estimation. For the first year, there we create 6 two-month intervals, from months thirteen to thirty we create 3 six-month intervals and from month thirty-one we create 1 three-and-a-half-year interval (up to 72 months). Using dummy variables to capture duration dependence means that the estimated coefficients represent the average duration dependence over the given time intervals. Models with other intervals were also estimated, but made little difference to the results.[10]

To test for differences in duration dependence across the sample, we also estimated separate models for males and females and for those above and below the early school leaver median math, reading and combined maths and reading scores at 15. Results from these models produce no significant differences between males and females (consistent with Figure 1) and between high and low academically inclined early school leavers.[11]

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[9] The clog-log is also estimated with normally distributed unobserved heterogeneity, but with no notable difference in estimates. Results are available upon request from the corresponding author.

[10] Results are available upon request from the corresponding author.

[11] Results are available upon request from the corresponding author.

4.2 Model explanatory variables

Although the models estimated in this study are reduced-form, we assume that most of the variation in the re-engagement among early school leavers is due to differences in demand-side factors, in particular, differences in human capital motivations (Becker 1962). Supply-side factors are likely to be relatively unimportant to the chances of re-engaging because VET courses are highly accessible.

Under the human capital model, an individual decides to undertake further education or training if the expected discounted future benefits of doing so outweighs the costs, where the expected future benefits may include finding a job, finding a more satisfying job, higher wages and the utility of study itself. Costs of studying are likely to depend mainly on the opportunity cost of time (the value of time foregone to undertake study), which varies according to individual circumstances and preferences. Other costs associated with returning to study may include tuition fees and non-tuition study costs, such as materials, transport and the disutility of study.

In weighing-up the future costs and benefits of re-engaging, students also must account for the degree of uncertainty surrounding the returns to further study.

School factors

From a policy perspective, an important question is how schools prepare youth so that if they leave school early, they are well-prepared to return to education at a later stage. A possible role for schools is to help reduce the uncertainty of returns to re-engaging faced by early school leavers by helping them to develop a post-school career path. Reducing uncertainty surrounding the returns to further study is likely to be particularly important in countries like Australia where the main pathway back into education is through VET. Unlike continuing general studies at school, the returns to re-engaging through job-specific VET study depends heavily on the choice of course. Students who are undecided about their future career path, and hence the most suitable course, face highly uncertain returns from re-engaging through VET. Assuming that continuing secondary studies is highly undesirable (which from the data in Table 2 it appears to be), when faced with such uncertainty, a rational response may be to delay or to refrain from re-engaging.

The extent to which early school leavers have career plans in place when they leave school is assumed to be captured by the main reason students give for leaving school. All else being equal, we expect that those who leave for employment reasons or because

their preferred training course not offered at school, are more likely to have chosen a career path than those who leave school for other reasons, for example, because they had problems at school/not doing well. The reasons why students report leaving school early are grouped into 6 categories. In particular, I left school: (1) for employment reasons (to get an apprenticeship or traineeship, because I already had an apprenticeship or traineeship or I wanted to earn money); (2) because of problems at school or because I was not doing well at school; (3) because the course I wanted to do was not available at school; (4) because Year 12 is not useful (Year 12 wouldn't help me get a job and I don't need Year 12 to go onto further study); (5) because teachers told me to leave; and (6) because of financial reasons.

An issue with including the main reason for leaving school as an explanatory variable in the duration analysis is the relatively high number of missing observations. Compared to if it was not included, including this variable as an explanatory variable reduces the sample size by around 2000 individuals. However, estimated models results with and without this variable are much the same and due to its importance as a proxy for whether individuals have a career plan upon leaving school, the variable is retained.[12]

Another way that schools may equip youth for post-school study is by improving their numeracy and literacy levels. All else being equal, the cost of returning to study may be higher for youth who do not have basic numeracy and literacy skills because study is more difficult and time consuming. In this study we capture the effect of numeracy and literacy levels by combining each individual's numeracy and reading scores at around age 15.[13] The scores in each LSAY cohort are measured on different scales and to make them comparable, we divide the combined numeracy and reading scores of all students in each cohort into quintiles. Therefore, by construction, an early school leaver who is in the bottom quintile in numeracy and reading is in the bottom quintile among all students in their cohort, not just in the bottom quintile for early school leavers.

In an attempt to retain youth in school, many English speaking countries, have incorporated VET courses into the upper-secondary school curriculum.[14] While the evidence suggests that these have been successful in meeting this objective (Bishop

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[12] Results are available upon request from the corresponding author

[13] In LSAY 1995 and 1998, the numeracy and literacy scores are for students in Year 9, which is when most students are 15.

[14] Encouraging participation in post-school education is one of the prime objectives of VET in schools program, as set out in the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA) 1999.

and Mane 2004), there is no evidence that it helps re-engage early school leavers in education. In this paper, we identify participation in two types of VET courses, those that are associated with an apprenticeship or traineeship and those that are not.

As a control for personal attitudes that may be correlated with both the above factors and the chances of re-engaging, we include student views on school and learning as explanatory variables in the models. Student views on school and learning are entered into the models as individual average responses to statements on education and the school environment. Students are asked to respond, on a 5-point scale, the degree to which they agree with statements such as: *I learn important things at school, I like learning, I enjoy being at school, school will help me in my adult life, learning is worthwhile, teachers help me* and *teachers treat me fairly.*[15]

Employment

A key finding from a previous study on re-engagement patterns of early school leavers over a life-time (Black et al., 2011) is that post-school employment outcomes are an important explanatory factor, which maybe because time in work helps early school leavers develop the confidence in a suitable career path to return to study. We include many of the same employment variables, such as labour market status, whether or not employment is casual or permanent and job satisfaction, measured using a binary variable of whether the job is one that they would like as a career. Consistent with the notion that finding a career path is important to the chances of re-engaging, we expect that those who find a job that they would like as a career are more likely to re-engage.

For early school leavers who are not in work, the opportunity cost of study may be lower, but it depends on their perceived employment prospects, which is captured by the inclusion of regional unemployment rates from the ABS (2011). Regional unemployment rates are either the relevant capital city rate or the relevant rate for the remainder of the state if they do not live in a capital city.

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[15] Before deriving the average scale, responses to negatively worded statements were re-coded to ensure that all components of the index were measured on a positive scale. Initially, we performed a factor analysis to derive 3 factors that were loaded according to their broad classification (attitude to teachers, education in general and the school environment). However, none of the scores were individually significant in the model and were combined for the sake of parsimony.

To try and avoid reverse causation, where re-engaging affects labour market outcomes, all employment variables are lagged by one year.

Socio-demographic factors

Given the important role of parents in the decision to leave school (Buddelmeyer, Hanel and Polidano 2012), they are also likely to influence the decision to return to study. Parents may encourage and/or coerce their children back to study, especially if their children are still living at home. Such actions are likely to depend highly on parents' attitudes to education. While information on what students think their parents want them to do after leaving school may be a good proxy, it is not available in all cohorts of LSAY. Instead, we use mother's highest education, which is found to be highly correlated with perceived parental education aspirations.

Other socio-demographic factors that included the presence of children, place of residence, main language spoken at home, whether or not the respondent is an Aboriginal or Torres Strait Islander and an LSAY cohort identifier. Descriptive statistics of all the explanatory variables can be found in Appendix A.

5. Results

Results presented in Table 4 are from the clog-log and the MPH models with gamma distributed heterogeneity. All estimated coefficients are presented as hazard ratios and have the interpretation of the proportional change in the hazard for a one unit change in an explanatory variable. In the context of this study, the interpretation is the proportional change in the chance of re-engaging in the next period, given that an individual has not re-engaged to date, for a one unit change in an explanatory variable, all else equal. For convenience, we shorten the interpretation to the proportional change in the chance of re-engaging for the first time in the next period, for a one unit change in an explanatory variable.

Table 4: Results for the re-engagement duration models with gamma distributed unobserved heterogeneity

	Clog-log		MPH	
Duration dependence (ref. Case: 0-2 months)	Hazard ratio	t-stat	Hazard ratio	t-stat
3-4 months	0.603***	-4.56	-	-
5-6 months	0.466***	-6.91	-	-
7-9 months	0.577***	-4.78	-	-
10-12 months	0.429***	-5.76	-	-
13-18 months	0.425***	-5.39	-	-
19-24 months	0.437***	-4.18	-	-
25-30 months	0.622**	-2.02	-	-
31-72 months	0.667	-1.39	-	-
School factors				
Main reason for leaving school (ref. case: employment)				
Problems at school/Not doing well at school	0.713***	-3.98	0.755***	-3.93
Year 12 not useful	0.779**	-2.47	0.805**	-2.5
School didn't offer training/courses	1.279***	2.64	1.247***	2.73
Teachers told you to leave	0.726**	-2.07	0.755**	-2.14
Financial reasons	0.676**	-2.41	0.701**	-2.51
Year 9 numeracy and reading score (ref. case: lowest quintile)				
2nd quintile	0.995	-0.06	1.003	0.05
3rd quintile	1.013	0.15	1.041	0.56
4th quintile	1.049	0.44	1.038	0.4
Highest quintile	1.109	0.80	1.086	0.73
Year left school (ref. case: Years 9 or 10)				
Year 11	0.757***	-3.58	0.853**	-2.44
Year 12	0.688***	-2.76	0.789**	-2.04
Positive attitude toward education (1-4)	0.976	-0.35	0.978	-0.36
Intention to complete school (reported in Year 9)	0.914	-1.35	0.924	-1.38
VET in Year 11 or 12 (ref. case: none)				
VET not part of an apprenticeship/traineeship	1.025	0.27	1.02	0.24
VET including apprenticeship/traineeship	1.317	1.54	1.266	1.53
Type of school attended (ref. case: Government)				
Catholic school	1.128	1.37	1.116	1.44
Independent school	1.110	0.94	1.111	1.1
Employment factors				
Regional unemployment rate (%)	1.010	0.32	1.021	0.75
Lagged employment status (ref. case: unemployed)				
Not in the labour force	1.024	0.28	1.074	0.91
Ongoing part-time	1.122	0.87	1.103	0.81
Ongoing full-time	1.017	0.15	1.009	0.09
Casual part-time	1.237**	2.14	1.221**	2.21
Casual full-time	0.848	-1.23	0.86	-1.23
Lagged job satisfaction (ref. case: employed in a career job)				
Not employed in a career job	0.786***	-3.07	0.798***	-3.18
Uncertain whether it is a career job	0.739*	-1.66	0.758*	-1.66

Socio-demographic factors				
Female	0.769***	-4.04	0.799***	-4.13
Respondent has children	0.467***	-3.11	0.516***	-3.01
Mother's highest qualification (ref. case: less than Year 11)				
Year 11 or 12	1.251**	2.55	1.222***	2.64
Completed secondary school	1.291***	2.72	1.289***	3.09
VET qualification	1.419***	3.27	1.363***	3.35
Higher education	1.238**	2.18	1.185**	2.05
Unknown	1.038	0.26	1.06	0.47
Living with Parents	0.951	-0.60	1	0
Aboriginal or Torres Strait Islander	1.173	1.25	1.181	1.48
English as first language	1.030	0.19	1.056	0.41
Log-likelihood	-5307.3		-11899	
Gamma/theta coefficients (variance of heterogeneity)	0.311	0.01	0.109	1.16
Log-likelihood ratio test of variance: p-values	0.01		0.11	
Number of observations[a]	16316		3283	

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

[a] The difference in the number of observations between the two models is due to the different structure of the datasets. Note: all models are estimated using regional and cohort dummies. Results are suppressed to save space; see Table B.1 and B.2 for full results.

A key point is that there are only minor estimated differences in the hazard ratios between the two models, with coefficients from both models generally showing the same direction of impacts and similar magnitudes. One point of difference is the test results for the presence of unobserved heterogeneity. The size of the p-values associated with the loglikelihood ratio tests suggest that controlling for unobserved heterogeneity is important for the clog-log model, but not as important for the MPH model, with a p-value just outside the range of 10% significance. This is consistent with the findings of Ridder (1987), Han and Hausman (1990) and Meyer (1990) that the effect of controlling for unobserved heterogeneity is negligible with a sufficiently flexible specification of the baseline hazard. As a result, the estimated MPH model results are largely consistent with those from the Cox model (MPH without unobserved heterogeneity) and are presented in Table B.1 and Figure B.1 in Appendix B. Without controlling for unobserved heterogeneity, the clog-log model is found to over-estimate negative duration dependence, but have only minor effects on the other parameter estimates (see Table B.2 in Appendix B).

Discussion of results below is centred around the interpretation of the hazard ratios from the MPH model. We make reference to results from the clog-log model only in section 5.1 to put the magnitude of duration dependence estimated from the MPH baseline hazard into perspective.
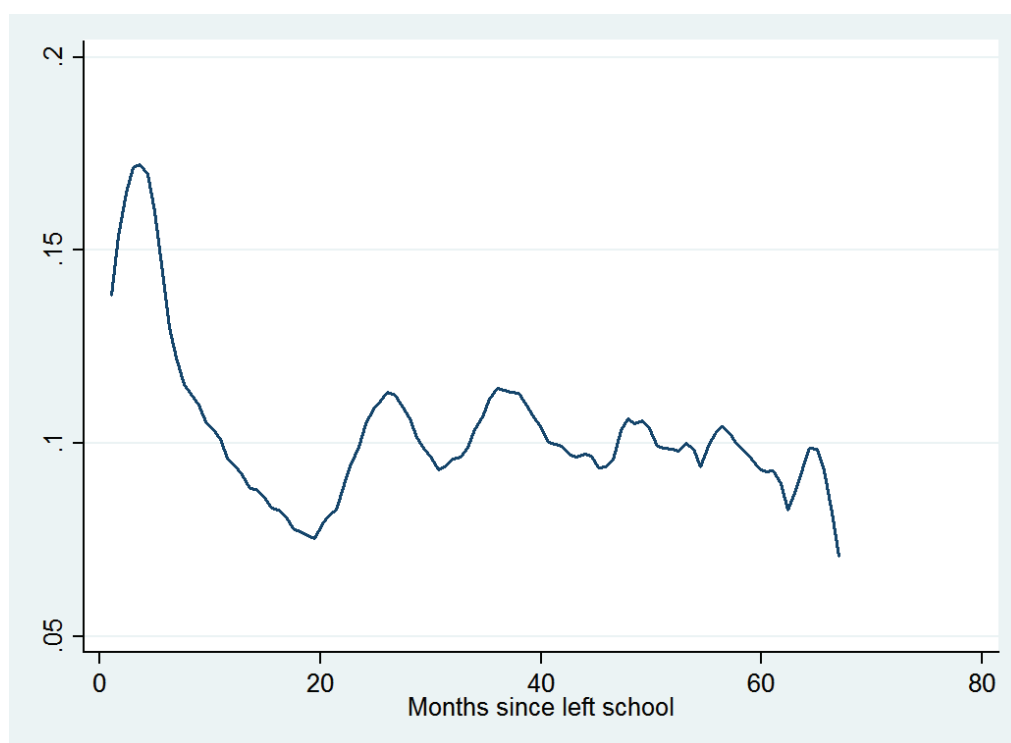
5.1 Duration dependence

The first key research question posed in this paper is, independent of individual heterogeneity, how does the time out from school affect the chances of re-engaging? The fitted baseline hazard function from the MPH model (Figure 2) shows two distinct patterns of duration dependence. In the first 20 months, albeit for an initial jump in the hazard, there is clear evidence of strong negative duration dependence. After around 24 months, there appears to be no or little negative duration dependence, with more pronounced 6 month cyclical spikes in the chances of re-engaging corresponding to beginning and middle of the student intakes. In between the two distinct patterns, there is a period of increasing hazard. Overall, from the peak chance at month 3, the chance of re-engaging in education by the end of year 6 appears to have fallen by more than half.

A possible explanation for the strong negative duration dependence between months 3 and 20 is pressure from family and friends to become financially independent. Upon finishing education, the cultural norm in western societies, especially in more individualised English speaking societies, is that youth should become independent of their parents and find employment as part of their transition to adulthood (Côte and Bynner 2008). While it is often argued that the period of transition to adulthood is being delayed in western countries (Arnett 2004), this is being driven only by the extension in the period of education as more and more youth go onto higher education (Furlong and Cartmel 2007; Evans and Furlong 1997). An alternative explanation for the strong negative duration dependence is that as time passes, the knowledge and skill required to undertake further study is eroded.

The positive inflection in the hazard between 20 and 24 months may represent a psychological tipping point where those who had left school with the intension of re-engaging, but delayed, finally feel pressure to realise their intension.

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Figure 2: Estimated Baseline hazard function from the MPH model

Note: Plotted using a two-month interval.

To gauge how important duration dependence is to the re-engagement of early school leavers relative to other factors, such as past academic performance, consider the hazard ratio estimates for the time interval dummies from the clog-log model (Table 4). Because the time dummies are larger than monthly intervals, we are restricted at examining average duration dependence within the defined intervals, which means that we do not get the same nuanced picture of estimated duration dependence as with the baseline hazard graph for the MPH. Nonetheless, the general patterns observed in the estimated hazard ratios from the clog-log model are consistent with the duration dependence patterns evident in the MPH baseline hazard. In particular, we observe a rapidly declining hazard in the first six months, with the chance of re-engaging at five to six months out from school 59% lower than in the initial period of up to two months. By months thirteen to eighteen, the chance of re-engaging is 66% lower than in the initial period. After month twenty-four there is a discernible increase in the hazard ratio and by the last time interval, the probability of re-engaging is 44% lower than in the initial interval. On the basis of the magnitude and significance of the estimated hazard ratios from the clog-log model in Table 4, we can conclude that duration dependence is the most important factor related to the chances of re-engaging early school leavers found in this study.

5.2 School factors

Other key research questions posed in this paper involve the role of school factors. In particular, how can schools prepare early school leavers for further study after school? What is the likely effectiveness of improving numeracy and literacy levels, delaying school dropout, incorporating vocational courses in the upper-secondary curriculum and improving career counselling?

Results from Table 4 suggest that the most important role of the school may be in helping youth develop a career plan before they leave school. This finding is based on the results that show early school leavers who report leaving school for employment reasons (around half) or because the school does not offer appropriate training, are much more likely to re-engage than those who report leaving for other reasons. For example, the chances of re-engaging in the next period are 25% higher for those who leave school for employment reasons than for those who leave because they either had a problem with school or were not doing well at school. An alternative interpretation is that the positive relationship between the chances of re-engaging and leaving school for employment reasons is related to accepting an apprenticeship or traineeship before leaving school (586 out of 2,468 who report leaving for employment reasons). This alternative interpretation implies reverse causation because re-engagement associated with the formal training of an apprenticeship or traineeship may drive the reason for leaving school. To test for the presence of reverse causation, we re-ran the MPH model and omitted early school leavers who reported leaving school because they had already found an apprenticeship or traineeship. The hazard ratios for reasons for leaving school under the reduced sample were much the same as those presented in Table 4, which does not support the alternative interpretation.[16]

We find limited evidence that enrolling in an upper-secondary school VET course improves the chances of re-engaging after leaving school early. For early school leavers who take a course that is unrelated to an apprenticeship or traineeship, we find no significant evidence that it improves the chances of returning to study. A possible explanation is that these courses are treated as an alternative, and not a stepping stone, to higher level VET courses after school. Undertaking an upper-secondary VET course as part of an apprenticeship or traineeship is associated with a 27% increase in the chances

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[16] The magnitude of the time ratios was much the same, but with larger standard errors due to the smaller sample size. Results are available upon request from the authors.

of re-engaging in education. This large estimated effect is because to complete their apprenticeships or traineeships students have to continue their training beyond their school years, but the result is insignificant because there are only a small number of students who take this path.

While improving numeracy and literacy levels may improve school completion, evidence presented in this paper suggests that it may not affect the chances of re-engaging early school leavers in education. To test the robustness of this finding we re-estimated models in Table 4 with alternative specifications of numeracy and literacy levels. In particular, we estimated models with: only one of the two variables at a time, the variables as percentiles instead of quintiles and no other variables included (to test for multicollinearity), but found no significant effects.[17] The most likely explanation for this result is that because lower levels of VET courses in Australia have no minimum academic requirements, pathways back into education for early school leavers are highly accessible, even for those with relatively poor numeracy and literacy compared to their peers at age 15.

We also find no evidence that delaying the timing of school dropout improves the chances of re-engaging early school leavers. We estimate that the likelihood of re-engagement decreases with years of schooling, which suggests that early school leavers substitute time in school for time in post-school study. On average, we estimate that relative to those who leave school in Year 9 or Year 10, the chances of re-engaging for the first time in a given period are 15% and 20% *lower* for those who left school in Year 11 and Year 12 respectively.

5.3 Employment outcomes

The importance of finding a career path in the decision to re-engage is evidenced by the relatively large and positive effect that finding a post-school career job has on the chances of re-engaging. On average, relative to those who work in a career job, the chances of re-engaging in a given period is 20% lower for those who *do not* work in a career job and is 25% lower for those who are uncertain.

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[17] The lack of significance is not a result of a lack of variation in the Year 9 numeracy and reading quintiles. Refer to Table A.1 in Appendix A for the mean values of the descriptive statistics. Results from alternative models are available upon request from the corresponding author.

We find no strong evidence that the chances of re-engaging depends on labour market status. The only significant estimated hazard ratio is for casual part-time employment. We estimate that those employed on a casual part-time basis are 22% more likely to re-engage than those who are unemployed. Part-time casual jobs are associated with low-skilled service sector jobs, especially in retail and hospitality, that are often filled by students. Thus, it is likely that early school leavers who take on these jobs do so with the intension of returning to education in the near future. A point of note is that the insignificant result for finding an ongoing full-time job is not because it is highly correlated with finding a career job. For youth, working in an ongoing full-time job is not highly correlated with being in a career job and omitting the career job variable makes little difference to the estimated employment status results.

5.4 Socio-demographic factors

We find some evidence that socio-demographic factors are important in explaining the chances of re-engaging early school leavers. In particular, we estimate that females are 20% less likely than males to re-engage in a given month. The lower rate of re-engagement among female early school leavers is likely to be because VET is often associated with preparation for male dominated jobs. The low rate of female participation in VET is recognised by the Australian Government who have established a National VET Equity Advisory Council (NVEAC), with a stated objective of improving female participation and performance in VET (NVEAC 2011). The association between VET and preparation for male dominated jobs stems from a long history in Australia of VET (since the start of the 19th century) being focussed on technical training in agriculture, mining and manufacturing. VET's purview only expanded to include training in the services sector in the late 1980s.

Having dependent children is also estimated to reduce the chances of females re-engaging by around 48%, which is almost entirely related to the low re-engagement rate of single mothers (83% of respondents declaring to have one or more dependent children are women).

Consistent with Hill and Jepsen (2007), we find that socio-economic status, as measured by mother's highest education attainment is estimated to not only affect the chances of school completion (Marks and McMillan 2001), but also the chances of re-engaging in

post-school education.[18] However, there is only significant differences in the chances of re-engaging between those whose mothers completed at least some upper-secondary school education (Year 11 or Year 12) and those who did not.[19] Early school leavers whose mothers completed some secondary school education may be more likely to re-engage because their parents have higher educational expectations.

6. Conclusions

This is the first study to estimate the role of duration dependence in explaining the chances of re-engaging early school leavers with controls for both observed and unobserved heterogeneity. Overall, we find that negative duration dependence is the most important factor explaining the chances of re-engagement of early school leavers, with those out of school for 1 year already having a 65% lower chance of returning to education than those who have just left school. This finding supports the use of coercive measures to return early school leavers back to education early, such as the Australian Government 'Learn or Earn' requirements in 2010, that require early school leavers under 21 to return to education to access income support.[20] At the time of writing, there was insufficient LSAY data to allow an explicit policy evaluation, this is a topic for future research.

In this study we also uncover an important role for schools in preparing early school leavers for post-school education. In particular, we find that schools can play a role in providing high quality career counselling to help youth find suitable career and post-school courses. This finding is based on results that show relatively high re-engagement rates among those who report leaving school for employment or to commence a course that is not available in school and among those who find career jobs after leaving school. Finding a post-school career path is likely to be important in countries, such as Australia, Netherlands, New Zealand and the United Kingdom where there are highly accessible second-chance vocational education options. By its nature, vocational education is job-

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[18] Education and occupation categories of both parents included together in an early specification of the model, but only mother's education was significant.

[19] Using t-tests, we find no significant differences between the chances of re-engaging for those whose mother has a secondary school qualification and those whose mother has post-school qualifications and no significant differences between those whose mother has a VET qualification and those whose mother has a higher education qualification.

[20] Under the Learn or Earn requirements, those under 21 on income support without a Year 12 qualification or equivalent are required to be in full-time study, employment or a combination of the two.

specific, which means that those without a chosen a career path face substantial uncertainty surrounding the benefits of further study and may delay or refrain from further study. Although such students in Australia have the option of continuing their general secondary education, either in or outside of the school environment, this path is almost never followed. To ensure early school leavers have access to career counselling, it is important that it is incorporated early into the school curriculum and not left until the upper-secondary level when many have already left school.

We find no evidence that improving school academic outcomes, such as improving numeracy and literacy and delaying exit from school, helps early school leavers re-engage in education. This finding is likely to be due to the highly accessible nature of second chance options in Australia. For countries with similarly accessible second chance pathways, the above findings underline the importance of taking a broad view of student preparedness for post-school study.

7. References

Arnett, J. (2004). *Emerging adulthood: the winding road from the late teens through the twenties.* NewYork, Oxford University Press.

Australian Bureau of Statistics (ABS) (2001). *Australian Standard Classification of Education (ASCED).* ABS cat. no. 1272.0, Canberra, ABS.

Australian Bureau of Statistics (ABS) (2010). *Schools Australia.* ABS cat. no. 4221.0, Canberra, ABS.

Australian Bureau of Statistics (ABS) (2011). *Australian social trends, Year 12 attainment.* ABS cat. no. 4102.0, Canberra, ABS.

Beck, N., Katz, J. and Tucker, R. (1998). Taking time seriously: time-series-cross-section analysis with a binary dependent variable. *American Journal of Political Science*, vol. 42(4), pp. 1260-88.

Becker, G. (1962). Investment in Human Capital: A Theoretical Analysis, *Journal of Political Economy* 70, 9-49.

Bishop, J. H. and F. Mane (2004). The impacts of career-technical education on high school labor market success, *Economics of Education Review* 23(4), 381-402.

Black, D., Polidano, C. and Tseng, Y. (2012). The Re-engagement in Education of Early School Leavers., *Economic Papers* 31(2), 202-15,

Buddelmeyer, H. Hanel, B. and Polidano, C. (2012). Decomposing the SES school completion gap in Australia, paper presented at the *Third International Workshop on Applied Economics of Education*, Catanzaro, June 17-19.

Chapman, C., Laird, J. and KewalRamani, A. (2011). *Trends in high school dropout and completion rates in the United States: 1972-2009, Compendium Report,* Washington DC, National Centre for Education Statistics.

Cleves, M., Gould, M. and Gutierrez, R. (2008). *An introduction to survival analysis using Stata*, College Station, Stata Press.

Council of Australian Governments (COAG) (2009). *Council of Australian Governments Hobart Communiqué.* Hobart (April 30), COAG.

Côte, J. and Bynner, J. (2008). Changes in the transition to adulthood in the UK and Canada: the role of structure and agency in emerging adulthood. *Journal of Youth Studies* 11(3), 251-268.

Dolton, P., and van der Klaauw, W. (1995). Leaving teaching in the UK: A duration analysis. *The Economic Journal* 105(429), 431-444.

European Commission (2011).*Tackling early school leaving: a contribution to the Europe 2020 Agenda*, communication from the Commission to the European Parliament, Brussels, the European Economic and Social Committee and the Committee of the Regions.

Evans, K. and Furlong, A. (1997). Metaphors of youth transitions: niches, pathways, trajectories or navigations, in J. Bynner, L. Chisholm and A. Furlong, (eds.) *Youth, citizenship and social change.* Aldershot, Ashgate.

Furlong, A. and Cartmel, F., (2007). *Young people and social change: Individualization and risk in late modernity* (2nd edn.), Buckingham, Open University Press.

GHK (2005). *Study on access to education and training, basic skills and early school leavers, Report to the European Commission*, Ref. DG EAC 38/04, London, GHK.

Han, A. and Hausman, J. (1990). Flexible parametric estimation of duration and competing risk models, *Journal of Applied Econometrics* 5, 1-28.

Heckman, J. and Rubinstein, Y. (2001). The Importance of Noncognitive Skills: Lessons from the GED Testing Program, *American Economic Review* 91, 145-49.

Heckman, J. and Singer, B. (1984). A method for minimizing the distributional assumptions in econometric models for duration data, *Econometrica* 52, 271-320.

Hill, L. and Jepsen, C. (2007). Positive outcomes from poor starts: Predictors for dropping back in, *Economics of Education Review* 26, 588-603.

Jenkins, S. (1995). Easy estimation methods for discrete-time duration models, *Oxford Bulletin of Economics and Statistics*, 57(1), 129-137.

Jenkins, S. (2005). Survival analysis, http://www.iser.essex.ac.uk/files/ teaching/stephenj/ec968/pdfs/ec968lnotesv6.pdf (accessed April 13 2012).

Lancaster, T. (1979). Econometric methods for the duration of unemployment, *Econometrica* 47, 939-56.

Lancaster, T. (1990). *The Econometric Analysis of Transition Data.* Cambridge, University Press.

Marks, G. and McMillan, J. (2001). Early school leavers: who are they, why do they leave, and what are the consequences? Paper presented at the *Understanding Youth Pathways Research Conference*, Australian Council for Education Research, Melbourne, October 15-16.

Meyer, B. (1990). Unemployment insurance and unemployment spells, *Econometrica* 58(4), 757-82.

Ministerial Council on Employment Education and Training and Youth Affairs (MCEETYA) 1999, *Common and Agreed National Goals for Schooling in the Twenty-first Century*, Canberra, MCEETYA.

National Centre for Vocational Education Research (NCVER) (2010). *Australian vocational education and training statistics, students and courses 2009*, Adelaide, NCVER.

National VET Equity Advisory Council (NVEAC) (2011). Equity blueprint 2011-2016, NVEAC, Melbourne.

Nicoletti, C. and Rondinelli, C. (2010). The (mis)specification of discrete duration models with unobserved heterogeneity: a Monte Carlo study, *Journal of Econometrics* 159(1), 1-13.

Organization for Economic Co-operation and Development (OECD) 2010. *Off to a Good Start? Jobs for Youth*, Paris, OECD.

Ridder, G. (1987). The sensitivity of duration models to misspecified unobserved heterogeneity and duration dependence, A&E Report 7/87, University of Amsterdam.

Rumberger, R. and Lamb, S. (2003). The early employment and further education experiences of high school dropouts: a comparative study of the United States and Australia, *Economics of Education Review* 22, 353-366.

UNESCO 1997, *International standard classification of education (ISCED) 1997*, Paris, UNESCO.

Wheelahan, L. and Moodie, G. (2011). *Rethinking skills in vocational education and training: From competencies to capabilities*, Sydney, NSW Department of Education and Communities.

Appendix A: Descriptive statistics

Table A.1: Descriptive statistics for all model variables

Variable	Number of observations	Mean	Std. deviation
Duration dependence[a]			
0-2 months	28047	0.218	0.413
3-4 months	28047	0.128	0.334
5-6 months	28047	0.094	0.292
7-9 months	28047	0.111	0.314
10-12 months	28047	0.082	0.275
13-18 months	28047	0.119	0.324
19-24 months	28047	0.084	0.278
25-30 months	28047	0.057	0.232
31-72 months	28047	0.105	0.307
Socio-demographic factors			
Female	6612	0.469	.0499
Respondent has children	6612	0.016	0.126
Mother's highest qualification:			
Less than Year 11	6612	0.309	0.462
Year 11 or 12	6612	0.169	0.374
Completed secondary school	6612	0.168	0.374
VET qualification	6612	0.121	0.327
Higher education	6612	0.157	0.364
Unknown	6612	0.076	0.265
Living with Parents	6183	0.867	0.339
Type of residential area			
Metropolitan	6523	0.500	0.500
Regional	6523	0.307	0.462
Rural	6523	0.193	0.394
State of Residence			
New South Wales	6612	0.237	-
Victoria	6612	0.159	-
Queensland	6612	0.127	-
South Australia	6612	0.137	-
Western Australia	6612	0.168	-
Tasmania	6612	0.082	-
Northern Territory	6612	0.055	-
Australian Capital Territory	6612	0.034	-
Aboriginal or Torres Strait Islander	6314	0.058	0.233
English as first language	6326	0.954	0.210
LSAY cohort			
1995	6612	0.412	0.492
1998	6612	0.262	0.439
2003	6612	0. 326	0.468

School factors

Main reason for leaving school			
Want / have an employment	5101	0.451	0.498
Problems at school/Not doing well at school	5101	0.202	0.402
Year 12 not useful	5101	0.134	0.340
School didn't offer training/courses	5101	0.131	0.337
Teachers told you to leave	5101	0.041	0.199
Financial reasons	5101	0.040	0.196
Year 9 numeracy and reading score			
Lowest quintile	6591	0.336	0.472
2nd quintile	6591	0.232	0.422
3rd quintile	6591	0.212	0.409
4th quintile	6591	0.132	0.338
Highest quintile	6591	0.089	0.285
Year left school			
Years 9 or 10	6609	0.308	0.462
Year 11	6609	0.428	0.495
Year 12	6609	0.264	0.441
Positive attitude toward education (1-4)	6492	2.746	0.458
Intention to complete school (reported in Year 9)	6612	0.542	0.498
VET in Year 11 or 12			
None	6612	0.826	.0379
VET not part of an apprenticeship/traineeship	6612	0.143	0.350
VET including apprenticeship/traineeship	6612	0.031	0.174
Type of school attended			
Government	6612	0.768	0.422
Catholic school	6612	0.144	0.351
Independent school	6612	0.088	0.284
Regional unemployment rate (%)	6598	6.921	1.842
Employment outcomes			
Lagged employment status			
Unemployed	5428	0.169	0.375
Not in the labour force	5428	0.347	0.476
Ongoing part-time	5428	0.068	0.252
Ongoing full-time	5428	0.118	0.322
Casual part-time	5428	0.246	0.431
Casual full-time	5428	0.053	0.223
Lagged job satisfaction			
Employed in a career job	6170	0.702	0.458
Not employed in a career job	6170	0.277	0.448
Uncertain whether it is a career job	6170	0.021	0.144

[a] Number of observations based on a month-based discrete specification.

Appendix B: Other results

Table B.1: Estimated results from MPH and Cox proportional hazard models

	MPH		Cox Proportional Hazard Model	
	Hazard ratio	t-stat	Hazard ratio	t-stat
Socio-demographic factors				
Female	0.799***	-4.13	0.838***	-3.58
Respondent has children	0.516***	-3.01	0.550***	-2.88
Mother's highest qualification (ref. case: less than Year 11)				
Year 11 or 12	1.222***	2.64	1.180**	2.38
Completed secondary school	1.289***	3.09	1.243***	2.90
VET qualification	1.363***	3.35	1.297***	3.08
Higher education	1.185**	2.05	1.141*	1.75
Unknown	1.060	0.47	1.054	0.46
Living with Parents	1.000	-0.00	1.007	0.09
State of residence (ref. case: NSW)				
Victoria	0.911	-1.14	0.924	-1.06
Queensland	0.813**	-2.26	0.842**	-2.05
South Australia	0.822**	-2.04	0.839**	-2.00
West Australia	1.076	0.80	1.039	0.46
Tasmania	1.019	0.18	1.028	0.29
ACT	0.856	-0.91	0.859	-0.97
North Territory	0.907	-0.59	0.939	-0.41
Type of residential area (ref. case: metropolitan)				
Regional	1.055	0.79	1.051	0.80
Rural	1.148*	1.71	1.126	1.61
Aboriginal or Torres Strait Islander	1.181	1.48	1.161	1.45
English as first language	1.056	0.41	1.064	0.52
LSAY cohort (ref. case: 1995)				
LSAY 1998 cohort	0.762***	-3.11	0.802***	-2.75
LSAY 2003 cohort	0.970	-0.27	0.994	-0.06
School factors				
Main reason for leaving school (ref. case: employment)				
Problems at school/Not doing well at school	0.755***	-3.93	0.802***	-3.38
Year 12 not useful	0.805**	-2.50	0.843**	-2.15
School didn't offer training/courses	1.247***	2.73	1.196**	2.42
Teachers told you to leave	0.755**	-2.14	0.812*	-1.74
Financial reasons	0.701**	-2.51	0.746**	-2.26
Year 9 numeracy and reading score (ref. case: lowest quintile)				
2nd quintile	1.003	0.05	1.004	0.06
3rd quintile	1.041	0.56	1.054	0.80
4th quintile	1.038	0.40	1.033	0.39
Highest quintile	1.086	0.73	1.056	0.53
Year left school (ref. case: Years 9 or 10)				
Year 11	0.853**	-2.44	0.893*	-1.91
Year 12	0.789**	-2.04	0.843	-1.59

Positive attitude toward education (1-4)	0.978	-0.36	0.976	-0.45
Intention to complete school (reported in Year 9)	0.924	-1.38	0.935	-1.29
VET in Year 11 or 12 (ref. case: none)				
VET not part of an apprenticeship/traineeship	1.020	0.24	1.014	0.19
VET including apprenticeship/traineeship	1.266	1.53	1.207	1.34
Type of school attended (ref. case: Government)				
Catholic school	1.116	1.44	1.101	1.38
Independent school	1.111	1.10	1.100	1.09
Employment factors				
Regional unemployment rate (%)	1.021	0.75	1.016	0.63
Lagged employment status (ref. case: unemployed)				
Not in the labour force	1.074	0.91	1.050	0.66
Ongoing part-time	1.103	0.81	1.066	0.56
Ongoing full-time	1.009	0.09	0.981	-0.20
Casual part-time	1.221**	2.21	1.166*	1.81
Casual full-time	0.860	-1.23	0.859	-1.31
Lagged of job satisfaction (ref. case: employed in a career job)				
Not employed in a career job	0.798***	-3.18	0.825***	-2.90
Uncertain whether it is a career job	0.758*	-1.66	0.791	-1.48
Log-likelihood	-11899		-12085.7	
Gamma/theta coefficients (variance of heterogeneity)	0.109	1.16		
Log-likelihood ratio test of variance: p-values	0.110			
Number of observations	3283		3283	

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

Table B.2: Clog-log results with and without gamma distributed unobserved heterogeneity

	Clog-log with unobserved heterogeneity		Clog-log without unobserved heterogeneity	
Duration dependence (ref. Case: 0-3 months)	Hazard ratio	t-stat	Hazard ratio	t-stat
3-4 months	0.603***	-4.56	0.522***	-6.40
5-6 months	0.466***	-6.91	0.384***	-10.33
7-9 months	0.577***	-4.78	0.444***	-9.91
10-12 months	0.429***	-5.76	0.310***	-10.93
13-18 months	0.425***	-5.39	0.284***	-13.10
19-24 months	0.437***	-4.18	0.263***	-11.42
25-30 months	0.622**	-2.02	0.335***	-8.46
31-70 months	0.667	-1.39	0.280***	-10.96
Socio-demographic factors				
Female	0.769***	-4.04	0.816***	-4.10
Respondent has children	0.467***	-3.11	0.521***	-3.13
Mother's highest qualification (ref. case: less than Year 11)				
Year 11 or 12	1.251**	2.55	1.208***	2.71
Completed secondary school	1.291***	2.72	1.250***	2.96
VET qualification	1.419***	3.27	1.346***	3.50
Higher education	1.238**	2.18	1.172**	2.09
Unknown	1.038	0.26	1.045	0.38
Living with Parents	0.951	-0.60	0.990	-0.15
State of residence (ref. case: NSW				
Victoria	0.906	-1.05	0.932	-0.95
Queensland	0.784**	-2.28	0.821**	-2.34
South Australia	0.809*	-1.92	0.820**	-2.26
West Australia	1.079	0.72	1.058	0.67
Tasmania	1.023	0.19	1.033	0.34
ACT	0.843	-0.86	0.873	-0.87
North Territory	0.814	-1.09	0.900	-0.69
Type of residential area (ref. case: metropolitan)				
Regional	1.066	0.82	1.073	1.13
Rural	1.190*	1.88	1.173**	2.16
Aboriginal or Torres Strait Islander	1.173	1.25	1.154	1.38
English as first language	1.030	0.19	1.063	0.51
LSAY cohort (ref. case: 1995)				
LSAY 1998 cohort	0.709***	-3.39	0.755***	-3.47
LSAY 2003 cohort	0.919	-0.65	0.992	-0.07
School factors				
Main reason for leaving school (ref. case: employment)				
Problems at school/Not doing well at school	0.713***	-3.98	0.769***	-4.01
Year 12 not useful	0.779**	-2.47	0.822**	-2.45
School didn't offer training/courses	1.279***	2.64	1.259***	3.10
Teachers told you to leave	0.726**	-2.07	0.795*	-1.91
Financial reasons	0.676**	-2.41	0.724**	-2.47
Year 9 numeracy and reading score (ref. case: lowest quintile				
2nd quintile	0.995	-0.06	1.004	0.07
3rd quintile	1.013	0.15	1.074	1.07
4th quintile	1.049	0.44	1.052	0.60

Highest quintile	1.109	0.80	1.097	0.90
Year left school (ref. case: Years 9 or 10)				
Year 11	0.757***	-3.58	0.805***	-3.64
Year 12	0.688***	-2.76	0.758**	-2.58
Positive attitude toward education (1-4)	0.976	-0.35	0.960	-0.75
Intention to complete school (reported in Year 9)	0.914	-1.35	0.930	-1.37
VET in Year 11 or 12 (ref. case: none)				
VET not part of an apprenticeship/traineeship	1.025	0.27	1.011	0.14
VET including apprenticeship/traineeship	1.317	1.54	1.239	1.52
Type of school attended (ref. case: Government)				
Catholic school	1.128	1.37	1.127*	1.70
Independent school	1.110	0.94	1.113	1.21
Employment factors				
Regional unemployment rate (%)	1.010	0.32	1.010	0.37
Lagged employment status (ref. case: unemployed)				
Not in the labour force	1.024	0.28	1.010	0.13
Ongoing part-time	1.122	0.87	1.068	0.57
Ongoing full-time	1.017	0.15	0.975	-0.26
Casual part-time	1.237**	2.14	1.194**	2.08
Casual full-time	0.848	-1.23	0.831	-1.59
Lagged job satisfaction (ref. case: employed in a career job)				
Not employed in a career job	0.786***	-3.07	0.808***	-3.21
Uncertain whether it is a career job	0.739*	-1.66	0.766*	-1.68
Log-likelihood	-5307.3		-5313.1	
Gamma/theta coefficients (variance of heterogeneity)	0.311	0.095		
Log-likelihood ratio test of variance: p-values	0.000			
Number of observations	16316		16316	

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

Figure B.1: Estimated baseline hazard function from MPH and Cox proportional hazard models

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