SUPPORT DOCUMENT

From education to employment: how long does it take?

Support document

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# Attrition estimations

Attrition in panel data sets is defined as the rate at which people who are interviewed in one wave drop out in the next wave. Attrition is an unavoidable problem of panel data sets (i.e. data sets that interview the same people repeatedly over a longer period of time). People will drop out for many reasons, such as moving without leaving a forwarding address, death, or just because they decide to not respond to any more requests for an interview. Although the study of attrition in the LSAY Y95 cohort data is beyond the remit of the present analysis, we carry out a number of regressions to assess the level and nature of attrition in the LSAY data subsets we use. Attrition can be a severe problem when (i) it is very prevalent (in which case the sample size may be critically reduced) and/or (ii) it has happened in a systematic way (in which case the remaining sample will stop being representative of the surveys target population). Attrition can be more severe for a data set that samples a single cohort and the introduction of replacement/new subjects is not appropriate. Data sets that begin with a targeted sample of young people with the intention to follow them throughout their lives, such as the LSAY Y95, suffer particularly from attrition. By contrast, conventional household surveys, such as the HILDA survey, have various methods to replace their lost subjects and maintain the surveys representativeness of its intended population. The LSAY Y95 data set has suffered from high attrition in terms of its sample size, to the degree that its representativeness may be compromised. From the complete starting sample (i.e. 13 613 Year 9 students), we are only able to analyse the education and first employment experiences of 7641 individuals. However, even a sample size of a few thousand can be sufficiently informative for statistical analysis, so the remaining sample is considered sufficiently large for estimation purposes. The main limitation of the attrition in the LSAY Y95 data is that disaggregation of the data, into sub-categories that are not very prevalent, cause small number problems. There is very little that one can do about this, except exclude the analysis of such small sized sub-categories, or provide a warning about their lack of statistical significance.

### Is attrition non-random?

The remaining concern would be that the observed attrition may have happened in a systematic way. If that is the case then the ability of the sample to represent the population will be endangered and any derived estimates may suffer from bias. This bias may occur due to people dropping out of the sample in ways that are observed (e.g. when more men drop out than women and the data reports the gender of the respondents) or unobserved, by the data. The presence of attrition according to observed characteristics can be established and, to a degree, dealt with; whereas attrition according to unobserved characteristics is much harder to detect and also deal with. Having established a high degree of attrition in the LSAY Y95 dataset, this Appendix presents a number of simple estimations as a preliminary attempt to establish the extent to which this attrition may be systematic in accordance with some observed characteristics of the survey respondents. To establish this we present a binary Probit model to estimate the probability of respondents’, present at the 1995 interview, completeness of information on their education achievement and their first job search duration. Table 1 presents the Probit estimation and Table 2 presents the descriptive statistics of those respondents. The dependent variable takes the value of 1 for those that stayed in the sample (i.e. interviewed in 1995, have education completion information and post-education employment or last interview information) and 0 for those who left the sample (i.e. interviewed in 1995, but have no education completion information, or no post-education employment or last interview information). Estimation in Table 1 allows us a first look at the degree of randomness in the LSAY attrition. We include in the estimation a number of core socio-demographic variables, many of which appear to be statistically significant. The implication of this finding is that the way in which attrition occurred was not random. Table 1 shows clearly that males (*male*), indigenous persons (*indig*), individuals who felt unhappy at school in 1995 (*unhappy*), and individuals with low/poor self-concept of overall ability in 1995 (*ability3*), are less likely to stay in the sample.

Table 1 Probit estimation of attrition

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However, the estimated results in Table 1 show that the level of explanatory power of the observed characteristics are limited. In precise terms, we find that only 2% of the total variation in the attrition variable (*stayers*) can be explained by all the explanatory variables in the estimation. Although this may appear as a small percentage, it should be accompanied by the caveat that Probit estimation in large samples rarely achieves a high explanatory power, as measured by the Pseudo R2 estimator.

Table 2 presents the coefficients of the explanatory variables, included in the Probit estimation, in a way that they can be interpreted as probabilities. For example, Table 2 suggests that: (i) males (*male*) are 4.85% more likely to have dropped out of the sample, relative to females; (ii) people that attended a private school in 1995 (*private*) are 3.12% less likely to have dropped out, relative to their publicly educated peers. All other variables can be interpreted in a similar fashion as probabilities. It should be noted that this is an indicative estimation only.

The summary and descriptive statistics of the dependent and explanatory variables included in the attrition probit estimation are shown in Table 3.

To summarise, the probit estimation in Table 1 suggests that non-random attrition is present in the data we analyse, but it also indicates that the resulting bias may not be as damaging as we initially expected. This is further investigated with additional structure to the estimation procedure used, see below.

Table 2 Probit estimation of survey attrition: marginal effects



Table 3 Summary statistics of variables used in the Probit estimation of attrition



### Does the non-random attrition influence search duration estimates?

Having established the non-random nature of the attrition in the LSAY Y95 data, the pertinent question is the degree to which the attrition may bias our subsequent analysis of search duration. Selection in duration estimation can be extremely complex and is best handled with double hurdle models. However, such an econometric investigation is beyond the scope of this analysis. Instead, we first estimate a simple selection-correction model (often referred to as the Heckman correction model) to provide a simple indication about the likelihood that the non-random selection revealed in the attrition estimation may bias the results of the subsequent estimation of duration of the first job search. The estimated results of the two-step procedure are presented in Table 4. The first step of the estimation is the same as the aforementioned single step probit estimation, in Table 1 (numbers will not agree completely as this estimation is solved numerically and not analytically). The Heckman procedure uses the results from the first step to calculate a correction term, commonly referred to as the Inverse Mills Ratio (IMR), which is then included in the second stage as an explanatory variable. The specification in the second step of the Heckman procedure is an OLS estimation of first job search duration (i.e. the length of time from the completion of highest education to the first period of employment).

While the econometrics behind this result may be too complex for the non-technical reader, the interpretation is very simple: one only has to look at the statistical significance of the IMR variable in the second step. A significant IMR suggests that there is sufficient selection bias and that the inclusion of the IMR has corrected it. Where we see a significant IMR it is always advisable to check if the remaining estimated coefficients in the second step change as a result of its inclusion/exclusion. Table 4 very clearly suggests that the IMR variable (under the name of *lambda* at the bottom of the table) is clearly not respectively significant (with a t-ratio of 0.63 which translates into a p-value of 0.53).

Table 4 Heckman two-step selection model of attrition and subsequent job search duration to first period of employment



The Heckman procedure shows that (i) where there is selection bias (which in this case could be resulting from attrition) that is due to observable characteristics and (ii) where these characteristics have been correctly included in both steps of the estimation[[1]](#footnote-1), the inclusion of the IMR, in the second step, corrects for the selection bias.

The implication of the estimation results in Table 4 is that the non-randomness of the attrition in the LSAY Y95 data is of no consequence on the estimated coefficients in the first period of job search duration specification. One caveat to this is that there could be a large number of people transiting directly from their highest level of education attainment to their first period of employment. Hence, there are many durations that take the value of 0 in the data (i.e. no job search took place). Therefore, we also estimated the Heckman two-step procedure using a Tobit estimation technique in the second step and found that the significance of the IMR variable was equally low (t-ratio of 0.73, which translates into a p-value of 0.47). The advantage of using a Tobit estimation is that it considers the bunching up of many zeros in the dependent variable (*duration1*). This estimation was repeated using different combinations of explanatory variables[[2]](#footnote-2), only to find that the results were largely consistent with the main result of this Appendix. Finally, as stated in the introduction of this appendix, these estimations should be treated as very preliminary results. A more comprehensive analysis of attrition in the context of first job search duration would be recommended, although it is not clear at this stage how far the information contained in the data would be able to support it. The problem of attrition, however, is best prevented through maintaining sample sizes during the survey period, rather than corrected in retrospect.

# Descriptive statistics

Table 5 Education attainment by indigenous status, % (2006)

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| --- | --- | --- | --- |
|   | Male | Female | Total |
|   | Non-indigenous | Indigenous | Non-indigenous | Indigenous | Non-indigenous | Indigenous |
| Postgrad | 3 | 1 | 4 | 2 | 4 | 2 |
| Bachelor | 20 | 6 | 27 | 4 | 24 | 5 |
| Adv dip, dip | 5 | 3 | 6 | 2 | 5 | 3 |
| Cert IV | 2 | 1 | 3 | 3 | 3 | 3 |
| Cert III | 3 | 1 | 6 | 2 | 4 | 2 |
| Cert I & II | 4 | 10 | 4 | 6 | 4 | 8 |
| Year 12 | 40 | 36 | 38 | 30 | 39 | 33 |
| Year 11 | 12 | 14 | 6 | 16 | 8 | 15 |
| Year 10 | 11 | 26 | 7 | 34 | 9 | 30 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 3258 | 69 | 3770 | 89 | 7028 | 158 |

Table 6 Education attainment by disability status, % (2006)

|  |  |  |  |
| --- | --- | --- | --- |
|   | Male | Female | Total |
|   | No disability | Disabled | No disability | Disabled | No disability | Disabled |
| Postgrad | 3 | 0 | 4 | 8 | 4 | 3 |
| Bachelor | 19 | 7 | 27 | 13 | 23 | 10 |
| Adv dip, dip | 5 | 2 | 6 | 6 | 5 | 4 |
| Cert IV | 2 | 2 | 3 | 4 | 3 | 3 |
| Cert III | 3 | 9 | 5 | 8 | 4 | 8 |
| Cert I & II | 4 | 6 | 4 | 6 | 4 | 6 |
| Year 12 | 40 | 32 | 38 | 32 | 39 | 32 |
| Year 11 | 12 | 21 | 6 | 8 | 9 | 16 |
| Year 10 | 11 | 20 | 7 | 17 | 9 | 19 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 3296 | 81 | 3801 | 53 | 7097 | 134 |

Table 7a Education attainment by socioeconomic status of father, % (2006)

|  |  |  |
| --- | --- | --- |
|   | Males | Females |
|   | High: Upper Prof and Managers | Lower Prof and Managers, Para Profs Technical | Trades, Clerks, Sales Reps and Farmers | Low: Sales Assistants, Plant Ops, Labs | High: Upper Prof and Managers | Lower Prof and Managers, Para Profs Technical | Trades, Clerks, Sales Reps and Farmers | Low: Sales Assistants, Plant Ops, Labs |
| Postgrad | 4 | 5 | 2 | 3 | 8 | 5 | 4 | 3 |
| Bachelor | 34 | 24 | 16 | 13 | 40 | 32 | 25 | 20 |
| Adv dip, dip | 4 | 5 | 5 | 5 | 4 | 6 | 6 | 7 |
| Cert IV | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |
| Cert III | 3 | 3 | 3 | 3 | 3 | 5 | 6 | 7 |
| Cert I & II | 2 | 2 | 5 | 5 | 2 | 3 | 4 | 4 |
| Year 12 | 42 | 45 | 40 | 36 | 35 | 37 | 39 | 39 |
| Year 11 | 5 | 7 | 13 | 17 | 2 | 5 | 7 | 8 |
| Year 10 | 3 | 7 | 13 | 16 | 3 | 4 | 7 | 9 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 473 | 705 | 1,130 | 744 | 502 | 794 | 1281 | 912 |

Table 7b Education attainment by socioeconomic status of mother, % (2006)

|  |  |  |
| --- | --- | --- |
|   | Males | Females |
|   | High: Upper Prof and Managers | Lower Prof and Managers, Para Profs Technical | Trades, Clerks, Sales Reps and Farmers | Low: Sales Assistants, Plant Ops, Labs | High: Upper Prof and Managers | Lower Prof and Managers, Para Profs Technical | Trades, Clerks, Sales Reps and Farmers | Low: Sales Assistants, Plant Ops, Labs |
| Postgrad | 6 | 5 | 2 | 2 | 4 | 6 | 5 | 4 |
| Bachelor | 29 | 26 | 19 | 15 | 39 | 37 | 27 | 19 |
| Adv dip, dip | 2 | 5 | 6 | 6 | 5 | 5 | 6 | 7 |
| Cert IV | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 4 |
| Cert III | 4 | 3 | 3 | 4 | 3 | 4 | 6 | 6 |
| Cert I & II | 4 | 4 | 4 | 5 | 1 | 3 | 3 | 3 |
| Year 12 | 41 | 41 | 40 | 38 | 38 | 36 | 38 | 38 |
| Year 11 | 8 | 8 | 13 | 14 | 4 | 5 | 6 | 8 |
| Year 10 | 4 | 7 | 11 | 14 | 5 | 3 | 6 | 10 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 140 | 796 | 937 | 596 | 137 | 887 | 1184 | 728 |

Table 8a Education attainment by father’s level of education, % (2006)

|  |  |  |
| --- | --- | --- |
|  | Male | Female |
|  | No second-ary school | Some second-ary school | All years of second-ary school | Trade or technical qualifica-tion | Degree or dip | No second-ary school | Some second-ary school | All years of second-ary school | Trade or technical qualifica-tion | Degree or dip |
| Postgrad | 3 | 1 | 3 | 2 | 5 | 1 | 4 | 5 | 5 | 7 |
| Bachelor | 14 | 13 | 18 | 18 | 33 | 19 | 20 | 26 | 26 | 42 |
| Adv dip, dip | 7 | 5 | 5 | 6 | 3 | 9 | 6 | 7 | 5 | 4 |
| Cert IV | 1 | 3 | 1 | 3 | 3 | 6 | 3 | 3 | 4 | 1 |
| Cert III | 2 | 4 | 3 | 4 | 2 | 3 | 7 | 5 | 4 | 3 |
| Cert I & II | 4 | 4 | 4 | 5 | 3 | 4 | 5 | 4 | 3 | 1 |
| Year 12 | 36 | 41 | 43 | 38 | 44 | 36 | 38 | 39 | 38 | 38 |
| Year 11 | 18 | 15 | 11 | 12 | 4 | 12 | 7 | 4 | 8 | 3 |
| Year 10 | 14 | 14 | 12 | 12 | 4 | 9 | 10 | 7 | 6 | 1 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 91 | 636 | 426 | 596 | 767 | 95 | 860 | 501 | 608 | 789 |

Table 8b Education attainment by mother’s level of education, % (2006)

|  |  |  |
| --- | --- | --- |
|  | Male | Female |
|  | No second-ary school | Some second-ary school | All years of second-ary school | Trade or technical qualifica-tion | Degree or dip | No second-ary school | Some second-ary school | All years of second-ary school | Trade or technical qualifica-tion | Degree or dip |
| Postgrad | 1 | 2 | 3 | 1 | 5 | 1 | 4 | 6 | 5 | 6 |
| Bachelor | 10 | 16 | 20 | 24 | 29 | 17 | 21 | 25 | 32 | 41 |
| Adv dip, dip | 10 | 5 | 5 | 4 | 4 | 6 | 7 | 5 | 7 | 5 |
| Cert IV | 1 | 2 | 3 | 2 | 3 | 5 | 4 | 2 | 2 | 1 |
| Cert III | 4 | 3 | 3 | 2 | 4 | 4 | 6 | 7 | 3 | 3 |
| Cert I & II | 6 | 4 | 4 | 4 | 3 | 2 | 4 | 5 | 3 | 2 |
| Year 12 | 36 | 42 | 40 | 40 | 43 | 43 | 40 | 38 | 37 | 35 |
| Year 11 | 10 | 14 | 10 | 14 | 6 | 10 | 6 | 6 | 6 | 4 |
| Year 10 | 21 | 11 | 13 | 8 | 4 | 11 | 8 | 7 | 5 | 2 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 80 | 710 | 799 | 204 | 643 | 93 | 1112 | 774 | 241 | 796 |

Table 9 Education attainment by gross hourly pay

|  |  |  |
| --- | --- | --- |
|  | Male | Female |
|  | 5-9 | 10 | 11-15 | 16-30 | 31-50 | 5-9 | 10 | 11-15 | 16-30 | 31-50 |
| Postgrad | 0 | 0 | 3 | 9 | 27 | 0 | 0 | 3 | 14 | 50 |
| Bachelor | 1 | 1 | 22 | 55 | 35 | 6 | 4 | 32 | 62 | 42 |
| Adv dip, dip | 1 | 2 | 9 | 10 | 12 | 2 | 2 | 13 | 6 | 4 |
| Cert IV | 0 | 1 | 5 | 3 | 0 | 1 | 2 | 4 | 4 | 4 |
| Cert III | 1 | 1 | 7 | 5 | 0 | 5 | 4 | 8 | 5 | 0 |
| Cert I & II | 4 | 2 | 6 | 5 | 8 | 3 | 2 | 6 | 2 | 0 |
| Year 12 | 49 | 62 | 43 | 12 | 19 | 56 | 66 | 30 | 7 | 0 |
| Year 11 | 22 | 15 | 4 | 1 | 0 | 13 | 11 | 1 | 0 | 0 |
| Year 10 | 21 | 14 | 1 | 1 | 0 | 14 | 10 | 1 | 0 | 0 |
| Total (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Total (number) | 830 | 842 | 627 | 513 | 26 | 774 | 924 | 856 | 655 | 26 |

# Detailed TPS tabulations

As discussed in the survival and multivariate regression analyses (see main report), there is a clear distinction between the outcomes for the various levels of education completion and across gender. This discussion examines further the influence of these levels of disaggregation on the Total Proportion of Search (TPS)[[3]](#footnote-3).

Building on the discussion of the influence of school and post-school (i.e. university and VET) graduates on the TPS measures (for all persons), disaggregation by gender is investigated. Figure 1 and Figure 2 illustrate the TPS measures by broad education category (university, VET and school graduates), for males and females respectively. Table 10 and Table 11 provide the exact percentages that correspond to Figure 1 and Figure 2, respectively. In general, at the post-school levels of education completion, the proportion of time spent not in employment is greater for males than females. Furthermore, the gender disparity is more persistent at the university level of education completion compared with the VET level. Interestingly, for both males and females, the effectiveness of the university and VET education pathways on employment outcomes also vary.

At the school levels of education completion, the measures of TPS are approximately equal for both the male and female sub-samples, proportionally. Furthermore, as illustrated in Figure 1 and Figure 2, the TPS measures for both male and female school graduates are well below their post-school graduate counterparts. This indicates that a school level education only has a lower effectiveness on sustaining employment, within a three-year period, compared with post-school levels of education completion.

At the university and VET levels of education, there are a number of differences in the TPS measures between the two levels of education and across gender. For female VET graduates, 50% moved immediately (i.e. approximately zero months searching) from education to employment, shown in Table 11; whereas, males spent approximately one month or less (i.e. 2.8% of 36 months) searching for employment, shown in Table 10. Similarly, for female university graduates, 50% spent approximately one month or less searching for employment (see Table 11), while the equivalent proportion of males spent approximately two months or less searching (see Table 10). Therefore, at the 50% level of each sub-sample, firstly, the TPS measures for female university and VET graduates were consistently lower than their male counterparts, and, secondly, for both males and females, the effectiveness of a VET qualification in sustaining employment was higher in comparison to the university level of education.

However, for the university and VET levels of education, there is a switch in the effectiveness of university and VET qualifications on employment outcomes. While the gender gap in the TPS measures persists, the proportion of total job search time becomes lower for both female and male university graduates compared with VET graduates, at the 75% and 90% sub-sample proportions, respectively. For example, out of all the female (male) VET graduates, 50 (75)% spent a total of approximately zero (eight) months (or less) searching for employment, while 50 (75) percent of female (male) university graduates spent approximately one (six) months or less. The switch in the effectiveness of the university and VET levels of education are clearly illustrated in Figure 1 for males, between the 70 and 80 percentile indicators, and in Figure 2 for females, between the 50 and 70 percentile indicators. Therefore, a university qualification had a higher effectiveness in reducing the proportion of time spent out of employment compared with a VET qualification, for most people (90%), and both were superior to a school level education.

Figure 1 Total job search duration as a proportion of total survey time (capped at 36 months) for males, by broad education category



Note: Includes respondents who exited the survey before obtaining employment, i.e. observations censored at the date of the last interview. These comprise approximately 4% of the total.

Table 10 Total job search duration as a proportion of total survey time (capped at 36 months) for males, by broad education category

|  |  |  |
| --- | --- | --- |
| Highest level of education attainment | Sample Percentile | Total |
| 10 | 25 | 50 | 75 | 90 |
| School (Yr. 9, 10, 11, 12 & Cert. I, II) | 0.0% | 0.0% | 16.7% | 61.1% | 100.0% | 2451 |
| VET (Cert. III, IV & Adv. Dip.) | 0.0% | 0.0% | 2.8% | 23.6% | 66.7% | 368 |
| University (Bachelor, Grad. Dip., Postgrad.) | 0.0% | 0.0% | 5.6% | 25.0% | 52.2% | 786 |
|  |  |  |  |  |  |  |
| Total | 0.0% | 0.0% | 11.1% | 45.8% | 100.0% | 3605 |

Note: Total excludes nine observations where ‘total survey time’ (i.e. denominator of proportion) equalled zero.

Figure 2 Total job search duration as a proportion of total survey time (capped at 36 months) for females, by broad education category



Note: Includes respondents who exited the survey before obtaining employment, i.e. observations censored at the date of the last interview. These comprise approximately 4% of the total.

Table 11 Total job search duration as a proportion of total survey time (capped at 36 months) for females, by broad education category

|  |  |  |
| --- | --- | --- |
| Highest level of education attainment | Sample Percentile | Total |
| 10 | 25 | 50 | 75 | 90 |
| School (Yr. 9, 10, 11, 12 & Cert. I, II) | 0.0% | 0.0% | 16.7% | 61.1% | 100.0% | 2224 |
| VET (Cert. III, IV & Adv. Dip.) | 0.0% | 0.0% | 0.0% | 22.2% | 54.5% | 563 |
| University (Bachelor, Grad. Dip., Postgrad.) | 0.0% | 0.0% | 2.8% | 15.4% | 44.4% | 1231 |
|  |  |  |  |  |  |  |
| Total | 0.0% | 0.0% | 8.3% | 38.5% | 90.0% | 4018 |

Note: Total excludes nine observations where ‘total survey time’ (i.e. denominator of proportion) equalled zero.

To complete the analysis of the influence of education on the proportion of total job search time, the qualifications within the VET level of education are disaggregated and examined. Unfortunately, further disaggregation of the data by gender caused results to suffer a small number problems and are not discussed or presented. Figure 3 illustrates the TPS measures by the VET qualifications: certificates I and II, certificate III, certificate IV, and advanced diploma and diploma. Table 12 provides the exact percentages that correspond to Figure 3.

As illustrated in Figure 3, the VET qualifications are closely aligned, with only the certificates I and II qualifications consistently providing the least effective pathway to a successful employment outcome. The influence of the higher three qualifications on job search is ambiguous. For example, from the TPS measures shown in Table 12, out of all certificate III graduates, 50% transited immediately from education to employment; whereas, for the same proportion of advanced diploma and certificate IV graduates, they spent approximately one month or less searching. When considering the sub-samples at their 75% levels, it is the advanced diploma and certificate III graduates that have the lower total search durations (i.e. approximately 8 months or less), closely followed by the certificate IV graduates (i.e. approximately 9 months or less).

Overall, the differences in search time between the higher VET qualifications and, hence, their effectiveness on employment outcomes, are negligible. However, the similarities in the TPS measures between the certificate III, certificate IV and advanced diploma and diploma qualifications may disguise differences across gender, as seen in the results of the survival and multivariate regression analyses, but are unable to be considered due to data restrictions.

Figure 3 Total job search duration as a proportion of total survey time (capped at 36 months) by VET qualification



Note: Includes respondents who exited the survey before obtaining employment, i.e. observations censored at the date of the last interview. These comprise approximately 4% of the total.

Table 12 Total job search duration as a proportion of total survey time (capped at 36 months) by VET qualification

|  |  |  |
| --- | --- | --- |
| Highest level of education attainment | Sample Percentile | Total |
| 10 | 25 | 50 | 75 | 90 |
| Cert. I & II | 0.0% | 0.0% | 3.1% | 27.4% | 63.9% | 304 |
| Cert. III | 0.0% | 0.0% | 0.0% | 22.2% | 58.3% | 331 |
| Cert. IV | 0.0% | 0.0% | 2.8% | 24.2% | 52.8% | 199 |
| Adv. Dip., Dip. | 0.0% | 0.0% | 2.8% | 22.2% | 59.3% | 401 |
|  |  |  |  |  |  |  |
| Total | 0.0% | 0.0% | 2.8% | 25.0% | 59.3% | 1235 |

Note: Total excludes seven observations where ‘total survey time’ (i.e. denominator of proportion) equalled zero.

# Econometric models of duration

### Introduction

The empirical analysis examines the duration of the (first) spell of non-employment after completion of the highest level of education the individual has achieved using the hazard function. The hazard rate represents the probability of leaving unemployment (a particular state) within a specific interval (which depends on the frequency with which data are collected) conditional on not having left unemployment (the initial state) up to the starting time of the interval.

The duration variable is referred to as grouped duration data as duration is only known to fall into a certain time interval, the exact duration is unknown (i.e. data are reported at the month level not daily).

### Concepts in Hazard Model Analysis

The survival function, S(t), is the cumulative frequency of the proportion of the sample who do not experience the event by time t (i.e. individuals in the LSAY do not exit non-employment/unemployment and enter employment—they survive in non-employment). S(t) can therefore be interpreted as the probability employment will not occur until time t. Plots of S(t) can compare the survival rate for various groups and statistical differences can be examined (see e.g. Kaplan-Meier below).

The cumulative probability function, F(t), is simply 1 - S(t) and S(t) = 1 – F(t).

Probability density function, f(t), is the area under the curve representing the (unconditional—not dependent on explanatory variables) instantaneous probability (at time t) of the event (exit to employment).

Hazard rate, h(t), is the probability that the event (exit to employment) will occur in the next time period (t+1) given that the individual is not employed at time t (where h(t) is also commonly referred to as the failure rate or transition rate). The hazard rate can also be expressed as h(t) = f(t)/S(t).

The Hazard function is the specification of the shape across time of h(t).

The cumulative hazard function is the integration of H(t) from time zero to time t.

The baseline hazard is the form the hazard ratio takes before explanatory variables are accounted for. The baseline therefore applies to all individuals in the sample, they differ from each other due to the influence of explanatory variables.

### Non-parametric methods

Common non-parametric methods for examining the survivor and cumulative hazard function are the Kaplan-Meier and Nelson-Aalen methods respectively. For these models all that is required is an ordering of the duration data—models do not make assumptions about the shape of the hazard function, or the influence of explanatory variables. Influence of other variables can be shown by stratification of the data into groups (e.g. gender); but the models are further restricted as they cannot handle continuous data. They are referred to as event history analysis where time is the only salient variable.

The Kaplan-Meier model is specified:

 (1)

where di where *i* are individuals who exit to employment (duration ends), ni is the number of individuals at risk (who are currently not employed but have exited education), and S(t) is the Kaplan-Meier ‘survivor’ function (i.e. the probability an individual will not exit to employment).

###  Semi-parametric methods

A number of hazard model specifications are available: for example, a discrete-time Cox proportional hazard semi-parametric model does not require detailed knowledge of the distribution of the hazard function model to examine duration or time-to-first job. The discrete time proportional hazard model approach is practical because it allows investigation of the duration dependence, i.e. how the probability of getting a job changes with search duration. Moreover, proportional hazard model allows the hazard function to be conditional on explanatory variables such as gender, ethnicity, education level, and family background.

### Complementary log-log model (cloglog)

The discrete-time proportional hazard model can be specified in the complementary log-log form:

 (2)

where the logarithm of the integral of the baseline hazard, γj, over the interval [tj-1, tj] is specified as:

 (3)

The complementary log-log hazard function can be interpreted as the discrete-time model corresponding to an underlying continuous time proportional hazard model. It is similar to a logistic regression, but tends to have a fatter tail as the function approaches zero and by being ‘steeper’ in the vicinity of one (which means a ‘one’ response is a rare event).

Where:

* *i* denotes the individual.
* *j* denotes the time interval.
* **X** is a vector of explanatory variables.
* β is the vector of unknown parameters to be estimated, they show the effects of the explanatory variables X on the hazard rate.
* vi is the model error term (a Gamma distributed random variable with unit mean and variance) which estimates the part of unobserved heterogeneity between individuals that is constant over time.
* γj is the baseline hazard or probability of exiting unemployment given ‘survival’ at the start of the interval denoted as *j*. It is the ‘value’ of hazard from which individuals in the data deviate at each time period, i.e. it is common to all individuals. Intuitively explained, γj is like a dummy variable which estimates the way unobserved heterogeneity in the data varies by the duration of the spell.

We interpret the dependent variable, duration dependence hj(xij), as the probability that an individual *i* will exit unemployment for employment between the beginning and the end of the *j*th period, given his/her attribute set , X at that time.

# ClogLog discrete-time flexible hazard model extended results

Table 13 Full-Time Permanent (‘Good’) Job MALES: Complementary log-log regression (Education in six categories)

| Variable | Coefficient | Std. Err | z-statistic | p-value |
| --- | --- | --- | --- | --- |
| Education < YR12 (Base) |  |  |  |  |
|  Education YR12 | 0.4349 | 0.0569 | 7.6500 | 0.0000 |
|  Education Cert I or II | 0.9373 | 0.1239 | 7.5600 | 0.0000 |
|  Education Cert III or IV | 0.9764 | 0.1052 | 9.2800 | 0.0000 |
|  Education Diploma or Adv Dip | 0.7796 | 0.1192 | 6.5400 | 0.0000 |
|  Education University | 1.0030 | 0.0716 | 14.0100 | 0.0000 |
| Age | -0.0291 | 0.0567 | -0.5100 | 0.6080 |
| Indigenous (Not Indigenous) | -0.2049 | 0.1660 | -1.2300 | 0.2170 |
| Disability (No Disability) | 0.0301 | 0.1227 | 0.2500 | 0.8060 |
| ACT (Base) |  |  |  |  |
|  NSW | -0.0217 | 0.1270 | -0.1700 | 0.8640 |
|  VIC | -0.0185 | 0.1258 | -0.1500 | 0.8830 |
|  QLD | 0.0736 | 0.1296 | 0.5700 | 0.5700 |
|  SA | -0.0448 | 0.1353 | -0.3300 | 0.7410 |
|  WA | 0.1058 | 0.1359 | 0.7800 | 0.4370 |
|  TAS | -0.0801 | 0.1590 | -0.5000 | 0.6150 |
|  NT | 0.2403 | 0.1884 | 1.2800 | 0.2020 |
| Metropolitan (Base) |  |  |  |  |
|  Regional | 0.1301 | 0.0572 | 2.2700 | 0.0230 |
|  Rural/Remote | 0.1097 | 0.0633 | 1.7300 | 0.0830 |
| School Government (Base)e |  |  |  |  |
|  School Catholic | -0.1057 | 0.0598 | -1.7700 | 0.0770 |
|  School Independent | -0.2593 | 0.0629 | -4.1200 | 0.0000 |
| Country of Birth Australia (Base) |  |  |  |  |
|  Country of Birth \_ESB | -0.2659 | 0.1480 | -1.8000 | 0.0720 |
|  Country of Birth \_NESB | -0.2704 | 0.1106 | -2.4500 | 0.0140 |
| Country of Birth Mother Aust (Base) |  |  |  |  |
|  Country of Birth Mother ESB | -0.0733 | 0.0786 | -0.9300 | 0.3510 |
|  Country of Birth Mother NESB | -0.1577 | 0.0878 | -1.8000 | 0.0720 |
| Country of Birth Father Aust (Base) |  |  |  |  |
|  Country of Birth Father ESB | 0.0490 | 0.0747 | 0.6600 | 0.5120 |
| Country of Birth Father NESB | -0.0752 | 0.0802 | -0.9400 | 0.3480 |
| Baseline Coefficients |  |  |  |  |
| Sep-95 | -2.2028 | 0.8607 | -2.5600 | 0.0100 |
| Oct-95 | -2.9824 | 0.8623 | -3.4600 | 0.0010 |
| Nov-95 | -1.5679 | 0.8584 | -1.8300 | 0.0680 |
| Dec-95 | -3.0876 | 0.8625 | -3.5800 | 0.0000 |
| Jan-96 | -3.5911 | 0.8660 | -4.1500 | 0.0000 |
| Feb-96 | -4.2765 | 0.8792 | -4.8600 | 0.0000 |
| Mar-96 | -4.1087 | 0.8740 | -4.7000 | 0.0000 |
| Apr-96 | -3.8180 | 0.8700 | -4.3900 | 0.0000 |
| May-96 | -4.3154 | 0.8793 | -4.9100 | 0.0000 |
| Jun-96 | -4.8032 | 0.8940 | -5.3700 | 0.0000 |
| Jul-96 | -4.7370 | 0.8921 | -5.3100 | 0.0000 |
| Aug-96 | -5.2221 | 0.9140 | -5.7100 | 0.0000 |
| Sep-96 | -5.9857 | 0.9681 | -6.1800 | 0.0000 |
| Oct-96 | -3.4482 | 0.8696 | -3.9700 | 0.0000 |
| Nov-96 | -2.0232 | 0.8618 | -2.3500 | 0.0190 |
| Dec-96 | -3.9010 | 0.8791 | -4.4400 | 0.0000 |
| Jan-97 | -4.1025 | 0.8863 | -4.6300 | 0.0000 |
| Feb-97 | -4.7016 | 0.9060 | -5.1900 | 0.0000 |
| Mar-97 | -5.0607 | 0.9219 | -5.4900 | 0.0000 |
| Apr-97 | -4.1532 | 0.8873 | -4.6800 | 0.0000 |
| May-97 | -4.7453 | 0.9101 | -5.2100 | 0.0000 |
| Jun-97 | -5.2779 | 0.9432 | -5.6000 | 0.0000 |
| Jul-97 | -5.0219 | 0.9159 | -5.4800 | 0.0000 |
| Aug-98 | -4.9103 | 0.9143 | -5.3700 | 0.0000 |
| Aug-99 | -4.4290 | 0.8635 | -5.1300 | 0.0000 |
| Aug-00 | -4.6071 | 0.8679 | -5.3100 | 0.0000 |
| Aug-01 | -5.1795 | 0.8742 | -5.9200 | 0.0000 |
| Aug-02 | -5.2745 | 0.8824 | -5.9800 | 0.0000 |
| Aug-03 | -5.5049 | 0.8939 | -6.1600 | 0.0000 |
| Aug-04 Plus | -6.8435 | 0.9310 | -7.3500 | 0.0000 |

Note: Log pseudo likelihood = -8679.1594; Prob > chi2 = 0.0000; Wald chi2(55) = 21950.87; Std. Err. adjusted for 3922 clusters in id.

Table 14 Full-Time & Permanent (‘Good’) Job FEMALES: Complementary log-log regression (Education in six categories)

| Variable | Coefficient | Std Err | z-statistic | p-value |
| --- | --- | --- | --- | --- |
| Education < YR12 (Base) |  |  |  |  |
|  Education YR12 | 0.7552 | 0.0774 | 9.76 | 0.0000 |
|  Education Cert I or II | 1.6411 | 0.1407 | 11.66 | 0.0000 |
|  Education Cert III or IV | 1.4733 | 0.1079 | 13.65 | 0.0000 |
|  Education Diploma or Adv Dip | 1.4369 | 0.1128 | 12.74 | 0.0000 |
|  Education University | 1.5970 | 0.0800 | 19.95 | 0.0000 |
| Age | -0.0369 | 0.0580 | -0.64 | 0.5240 |
| Indigenous (Not Indigenous) | -0.0520 | 0.1658 | -0.31 | 0.7540 |
| Disability (No Disability) | -0.5234 | 0.2341 | -2.24 | 0.0250 |
| ACT (Base) | - | - | - | - |
|  NSW | 0.1086 | 0.1172 | 0.93 | 0.3540 |
|  VIC | 0.0205 | 0.1146 | 0.18 | 0.8580 |
|  QLD | -0.0637 | 0.1238 | -0.51 | 0.6070 |
|  SA | -0.0652 | 0.1214 | -0.54 | 0.5910 |
|  WA | 0.0718 | 0.1254 | 0.57 | 0.5670 |
|  TAS | 0.1177 | 0.1474 | 0.80 | 0.4250 |
|  NT | 0.3553 | 0.1847 | 1.92 | 0.0540 |
| Metropolitan (Base) | - | - | - | - |
|  Regional | -0.0305 | 0.0561 | -0.54 | 0.5860 |
|  Rural/Remote | -0.0275 | 0.0617 | -0.45 | 0.6550 |
| School Government (Base)e | - | - | - | - |
|  School Catholic | -0.0597 | 0.0549 | -1.09 | 0.2770 |
|  School Independent | -0.1833 | 0.0630 | -2.91 | 0.0040 |
| Country of Birth Australia (Base) | - | - | - | - |
|  Country of Birth \_ESB | -0.1210 | 0.1381 | -0.88 | 0.3810 |
|  Country of Birth \_NESB | -0.2674 | 0.1069 | -2.50 | 0.0120 |
| Country of Birth Mother Aust (Base) |  |  |  |  |
|  Country of Birth Mother ESB | -0.0457 | 0.0737 | -0.62 | 0.5360 |
|  Country of Birth Mother NESB | -0.0532 | 0.0815 | -0.65 | 0.5140 |
| Country of Birth Father Aust (Base) | - | - | - | - |
|  Country of Birth Father ESB | -0.0888 | 0.0785 | -1.13 | 0.2580 |
| Country of Birth Father NESB | -0.1591 | 0.0746 | -2.13 | 0.0330 |
| Baseline Coefficients | -2.4923 | 0.8722 | -2.86 | 0.0040 |
| Sep-95 | -3.4366 | 0.8728 | -3.94 | 0.0000 |
| Oct-95 | -2.0000 | 0.8707 | -2.30 | 0.0220 |
| Nov-95 | -3.4538 | 0.8749 | -3.95 | 0.0000 |
| Dec-95 | -4.2028 | 0.8811 | -4.77 | 0.0000 |
| Jan-96 | -4.8555 | 0.8892 | -5.46 | 0.0000 |
| Feb-96 | -4.1956 | 0.8824 | -4.75 | 0.0000 |
| Mar-96 | -4.7091 | 0.8877 | -5.30 | 0.0000 |
| Apr-96 | -6.0526 | 0.9412 | -6.43 | 0.0000 |
| May-96 | -5.7299 | 0.9204 | -6.23 | 0.0000 |
| Jun-96 | -5.4140 | 0.9033 | -5.99 | 0.0000 |
| Jul-96 | -6.1711 | 0.9503 | -6.49 | 0.0000 |
| Aug-96 | -5.9038 | 0.9343 | -6.32 | 0.0000 |
| Sep-96 | -3.9906 | 0.8799 | -4.54 | 0.0000 |
| Oct-96 | -2.5492 | 0.8731 | -2.92 | 0.0040 |
| Nov-96 | -4.4452 | 0.8906 | -4.99 | 0.0000 |
| Dec-96 | -5.2988 | 0.9130 | -5.80 | 0.0000 |
| Jan-97 | -5.5525 | 0.9274 | -5.99 | 0.0000 |
| Feb-97 | -5.2071 | 0.9107 | -5.72 | 0.0000 |
| Mar-97 | -4.7898 | 0.8969 | -5.34 | 0.0000 |
| Apr-97 | -5.5209 | 0.9269 | -5.96 | 0.0000 |
| May-97 | -5.8728 | 0.9463 | -6.21 | 0.0000 |
| Jun-97 | -6.0248 | 0.9639 | -6.25 | 0.0000 |
| Jul-97 | -6.2049 | 0.9779 | -6.34 | 0.0000 |
| Aug-98 | -4.8403 | 0.8745 | -5.53 | 0.0000 |
| Aug-99 | -5.3360 | 0.8780 | -6.08 | 0.0000 |
| Aug-00 | -5.7342 | 0.8833 | -6.49 | 0.0000 |
| Aug-01 | -5.6395 | 0.8864 | -6.36 | 0.0000 |
| Aug-02 | -6.7395 | 0.9244 | -7.29 | 0.0000 |
| Aug-03 plus | -8.0781 | 0.9853 | -8.20 | 0.0000 |

Log pseudo likelihood = -9173.3045; Prob > chi2 = 0.0000; Wald chi2(55) = 22377.11; Std. Err. adjusted for 4378 clusters in id.

Table 15 Any Job MALES: Complementary log-log regression (Education in six categories)

| Variable | Coefficient | Std Err | z-statistic | p-value |
| --- | --- | --- | --- | --- |
| Education < YR12 (Base) |  |  |  |  |
|  Education YR12 | 1.2597 | 0.0464 | 27.15 | 0.0000 |
|  Education Cert I or II | 1.4343 | 0.1428 | 10.04 | 0.0000 |
|  Education Cert III or IV | 1.6153 | 0.0895 | 18.06 | 0.0000 |
|  Education Diploma or Adv Dip | 1.4738 | 0.1115 | 13.21 | 0.0000 |
|  Education University | 1.6780 | 0.0619 | 27.12 | 0.0000 |
| Age | -0.0257 | 0.0444 | -0.58 | 0.5620 |
| Indigenous (Not Indigenous) | -0.3620 | 0.1299 | -2.79 | 0.0050 |
| Disability (No Disability) | -0.1127 | 0.1240 | -0.91 | 0.3640 |
| ACT (Base) |  |  |  |  |
|  NSW | -0.0671 | 0.0975 | -0.69 | 0.4910 |
|  VIC | -0.0141 | 0.0961 | -0.15 | 0.8830 |
|  QLD | -0.0016 | 0.1017 | -0.02 | 0.9870 |
|  SA | -0.0100 | 0.1080 | -0.09 | 0.9260 |
|  WA | -0.0082 | 0.1070 | -0.08 | 0.9390 |
|  TAS | -0.0589 | 0.1259 | -0.47 | 0.6400 |
|  NT | 0.2035 | 0.1540 | 1.32 | 0.1860 |
| Metropolitan (Base) |  |  |  |  |
|  Regional | -0.0382 | 0.0489 | -0.78 | 0.4340 |
|  Rural/Remote | -0.0621 | 0.0530 | -1.17 | 0.2410 |
| School Government (Base)e |  |  |  |  |
|  School Catholic | 0.0909 | 0.0482 | 1.89 | 0.0590 |
|  School Independent | -0.0133 | 0.0515 | -0.26 | 0.7960 |
| Country of Birth Australia (Base) |  |  |  |  |
|  Country of Birth \_ESB | -0.0910 | 0.1069 | -0.85 | 0.3940 |
|  Country of Birth \_NESB | -0.2759 | 0.0776 | -3.55 | 0.0000 |
| Country of Birth Mother Aust (Base) |  |  |  |  |
|  Country of Birth Mother ESB | 0.0577 | 0.0632 | 0.91 | 0.3610 |
|  Country of Birth Mother NESB | -0.1993 | 0.0675 | -2.95 | 0.0030 |
| Country of Birth Father Aust (Base) |  |  |  |  |
|  Country of Birth Father ESB | 0.0060 | 0.0650 | 0.09 | 0.9270 |
| Country of Birth Father NESB | -0.1133 | 0.0647 | -1.75 | 0.0800 |
| Baseline Coefficients |  |  |  |  |
| Sep-95 | -1.0909 | 0.6747 | -1.62 | 0.1060 |
| Oct-95 | -2.1520 | 0.6780 | -3.17 | 0.0020 |
| Nov-95 | -2.1389 | 0.6770 | -3.16 | 0.0020 |
| Dec-95 | -2.5368 | 0.6808 | -3.73 | 0.0000 |
| Jan-96 | -2.7025 | 0.6841 | -3.95 | 0.0000 |
| Feb-96 | -3.0665 | 0.6887 | -4.45 | 0.0000 |
| Mar-96 | -3.3212 | 0.6963 | -4.77 | 0.0000 |
| Apr-96 | -2.9711 | 0.6908 | -4.30 | 0.0000 |
| May-96 | -2.9475 | 0.6920 | -4.26 | 0.0000 |
| Jun-96 | -3.3885 | 0.7022 | -4.83 | 0.0000 |
| Jul-96 | -2.3019 | 0.6836 | -3.37 | 0.0010 |
| Aug-96 | -2.2977 | 0.6844 | -3.36 | 0.0010 |
| Sep-96 | -2.1523 | 0.6904 | -3.12 | 0.0020 |
| Oct-96 | -2.7793 | 0.6977 | -3.98 | 0.0000 |
| Nov-96 | -3.0488 | 0.7198 | -4.24 | 0.0000 |
| Dec-96 | -3.3745 | 0.7239 | -4.66 | 0.0000 |
| Jan-97 | -3.4000 | 0.7348 | -4.63 | 0.0000 |
| Feb-97 | -3.8046 | 0.7740 | -4.92 | 0.0000 |
| Mar-97 | -3.7606 | 0.7662 | -4.91 | 0.0000 |
| Apr-97 | -3.8640 | 0.7937 | -4.87 | 0.0000 |
| May-97 | -3.2088 | 0.7300 | -4.40 | 0.0000 |
| Jun-97 | -2.2417 | 0.7031 | -3.19 | 0.0010 |
| Jul-97 | -2.2159 | 0.7024 | -3.15 | 0.0020 |
| Aug-97 | -2.8539 | 0.7389 | -3.86 | 0.0000 |
| Aug-98 | -3.4634 | 0.6740 | -5.14 | 0.0000 |
| Aug-99 | -3.0281 | 0.6827 | -4.44 | 0.0000 |
| Aug-00 | -3.9087 | 0.7456 | -5.24 | 0.0000 |
| Aug-01 | -4.5662 | 0.8044 | -5.68 | 0.0000 |
| Aug-02 | -3.3190 | 0.7293 | -4.55 | 0.0000 |
| Aug-03 | -4.0572 | 0.7908 | -5.13 | 0.0000 |
| Aug-04 | -4.4671 | 0.8657 | -5.16 | 0.0000 |
| Aug-05 | -2.0022 | 0.6685 | -2.99 | 0.0030 |

Log pseudo likelihood = -7164.7229; Prob > chi2 = 0.0000; Wald chi2(57) = 9981.63; Std. Err. adjusted for 4906 clusters in id.

Table 16 Any Job FEMALES: Complementary log-log regression (Education in six categories)

| Variable | Coefficient | Std Err | z-statistic | p-value |
| --- | --- | --- | --- | --- |
| Education < YR12 (Base) |  |  |  |  |
|  Education YR12 | 1.4970 | 0.0527 | 28.39 | 0.000 |
|  Education Cert I or II | 2.0105 | 0.1040 | 19.34 | 0.000 |
|  Education Cert III or IV | 1.9776 | 0.0884 | 22.38 | 0.000 |
|  Education Diploma or Adv Dip | 2.1587 | 0.0955 | 22.61 | 0.000 |
|  Education University | 2.0840 | 0.0572 | 36.46 | 0.000 |
| Age | 0.0138 | 0.0444 | 0.31 | 0.756 |
| Indigenous (Not Indigenous) | -0.3662 | 0.1274 | -2.88 | 0.004 |
| Disability (No Disability) | 0.0275 | 0.1390 | 0.20 | 0.843 |
| ACT (Base) |  |  |  |  |
|  NSW | -0.0827 | 0.1110 | -0.75 | 0.456 |
|  VIC | -0.0902 | 0.1108 | -0.81 | 0.416 |
|  QLD | -0.1338 | 0.1155 | -1.16 | 0.246 |
|  SA | -0.0840 | 0.1146 | -0.73 | 0.463 |
|  WA | 0.0509 | 0.1164 | 0.44 | 0.662 |
|  TAS | -0.2620 | 0.1352 | -1.94 | 0.053 |
|  NT | -0.0126 | 0.1544 | -0.08 | 0.935 |
| Metropolitan (Base) |  |  |  |  |
|  Regional | -0.1217 | 0.0467 | -2.61 | 0.009 |
|  Rural/Remote | -0.1205 | 0.0497 | -2.42 | 0.015 |
| School Government (Base)e |  |  |  |  |
|  School Catholic | 0.0780 | 0.0455 | 1.71 | 0.087 |
|  School Independent | -0.0623 | 0.0482 | -1.29 | 0.196 |
| Country of Birth Australia (Base) |  |  |  |  |
|  Country of Birth \_ESB | -0.2156 | 0.0928 | -2.32 | 0.020 |
|  Country of Birth \_NESB | -0.2612 | 0.0799 | -3.27 | 0.001 |
| Country of Birth Mother Aust (Base) |  |  |  |  |
|  Country of Birth Mother ESB | -0.0305 | 0.0744 | -0.41 | 0.682 |
|  Country of Birth Mother NESB | -0.1075 | 0.0636 | -1.69 | 0.091 |
| Country of Birth Father Aust (Base) |  |  |  |  |
|  Country of Birth Father ESB | 0.1927 | 0.0632 | 3.05 | 0.002 |
| Country of Birth Father NESB | -0.2479 | 0.0599 | -4.14 | 0.000 |
| Baseline Coefficients |  |  |  |  |
| Sep-95 | -1.7282 | 0.6712 | -2.57 | 0.010 |
| Oct-95 | -3.2004 | 0.6766 | -4.73 | 0.000 |
| Nov-95 | -3.1271 | 0.6760 | -4.63 | 0.000 |
| Dec-95 | -3.2186 | 0.6793 | -4.74 | 0.000 |
| Jan-96 | -3.5544 | 0.6847 | -5.19 | 0.000 |
| Feb-96 | -3.9094 | 0.6901 | -5.66 | 0.000 |
| Mar-96 | -3.7040 | 0.6950 | -5.33 | 0.000 |
| Apr-96 | -4.0899 | 0.6990 | -5.85 | 0.000 |
| May-96 | -4.1081 | 0.7028 | -5.85 | 0.000 |
| Jun-96 | -4.1366 | 0.7048 | -5.87 | 0.000 |
| Jul-96 | -3.3848 | 0.6920 | -4.89 | 0.000 |
| Aug-96 | -3.2918 | 0.6889 | -4.78 | 0.000 |
| Sep-96 | -2.8192 | 0.6844 | -4.12 | 0.000 |
| Oct-96 | -3.5444 | 0.6940 | -5.11 | 0.000 |
| Nov-96 | -3.7285 | 0.7113 | -5.24 | 0.000 |
| Dec-96 | -4.5768 | 0.7582 | -6.04 | 0.000 |
| Jan-97 | -4.2146 | 0.7312 | -5.76 | 0.000 |
| Feb-97 | -4.1570 | 0.7455 | -5.58 | 0.000 |
| Mar-97 | -4.1885 | 0.7628 | -5.49 | 0.000 |
| Apr-97 | -3.8472 | 0.7171 | -5.36 | 0.000 |
| May-97 | -3.6811 | 0.7280 | -5.06 | 0.000 |
| Jun-97 | -3.3530 | 0.7168 | -4.68 | 0.000 |
| Jul-97 | -3.1624 | 0.7129 | -4.44 | 0.000 |
| Aug-98 | -2.9152 | 0.7078 | -4.12 | 0.000 |
| Aug-99 | -4.0968 | 0.7001 | -5.85 | 0.000 |
| Aug-00 | -3.9832 | 0.7017 | -5.68 | 0.000 |
| Aug-01 | -4.1125 | 0.7113 | -5.78 | 0.000 |
| Aug-02 | -4.2570 | 0.7527 | -5.66 | 0.000 |
| Aug-03 | -4.3514 | 0.7906 | -5.50 | 0.000 |
| Aug-04 | -3.8485 | 0.7226 | -5.33 | 0.000 |
| Aug-05 | -4.1668 | 0.8392 | -4.97 | 0.000 |
| Aug-06 | -2.4113 | 0.6749 | -3.57 | 0.000 |

Log pseudo likelihood = -6901.0974; Prob > chi2 = 0.0000; Wald chi2(57) = 9782.53; Std. Err. adjusted for 5199 clusters in id.

# Sensitivity analysis of grouping education levels

As noted in the text, there are 12 (usable) education levels reported in the LSAY. First, it is not possible (see text in body of the main report) or necessary (e.g. differentiating between labour market outcome for year 10 or below will not be particularly instructive) to maintain the complete set.

In addition, as noted previously, there are a number of ways the educational categories can be aggregated and it is the purpose of this section to assess whether aggregation of education levels alters results to an extent where interpretation changes.

Complementary log-log (cloglog) models are estimated for those with ‘any job’ and those with a ‘good job’, separately for males and females and the conclusion reached is that although there are differences in the coefficients for education, they are not material to interpretation.

Twelve education groups: Data as presented in the LSAY

* Postgraduate (masters or doctorate)
* Graduate diploma or graduate certificate
* Bachelor degree
* Advanced diploma or diploma
* Certificate IV
* Certificate III
* Certificate II
* Certificate I
* Year 12 high school
* Year 11 high school
* Year 10 high school
* The initial Year 9 at the start of the survey

Six education groups

* University (bachelors to post-graduate qualification)
* Diploma or advanced diploma
* Certificate III or certificate IV
* Certificate I or certificate II
* Year 12
* Less than Year12 high school (the base case in the regression models)

Five education groups

* University (bachelors to post-graduate qualification)
* Diploma or advanced diploma
* Certificate III or certificate IV
* Certificate I or certificate II
* Year 12 (the base case in the regression models)

Three education groups (A):

* University (bachelors to post-graduate qualification), diploma or advanced diploma
* VET (certificate III or certificate IV)
* School, certificate I, or certificate II (the base case in the regression models)

Three education groups (B):

* University (bachelors to post-graduate qualification), diploma or advanced diploma
* VET (certificate III or certificate IV)
* Year 12, certificate I, or certificate II (the base case in the regression models).

Estimated exponential coefficient for education level in the various model are provided in Table 17 below; *p*-values are not reported as they are always reported as *p* =  0.000.

Table 17 Duration models, various groupings of highest education level

|  | AJ Males | AJ Fem | FTP Males | FTP Males |
| --- | --- | --- | --- | --- |
|  | Exp(β) | Exp(β) | Exp(β) | Exp(β) |
| Model: 6-Categories |  |  |  |  |
| Less than YR12 (Base) | - |  | - |  |
| Year 12 | 3.5244 | 4.4681 | 1.5449 | 2.1281 |
| Certificate I or Cert II | 4.1965 | 7.4673 | 2.5530 | 5.1609 |
| Certificate III or Cert IV | 5.0293 | 7.2251 | 2.6549 | 4.3638 |
| Diploma or Adv Dip | 4.3659 | 8.6600 | 2.1806 | 4.2076 |
| University (Bachelors to Post-Graduate) | 5.3549 | 8.0364 | 2.7264 | 4.9383 |
| Model: 5-Categories  |  |  |  |  |
| Year 12 (Base) | - | - | - | - |
| Certificate I or Certificate II | 1.2169 | 1.6621 | 1.6535 | 2.4678 |
| Certificate III or Cert IV | 1.4543 | 1.0028 | 1.7394 | 2.0558 |
| Diploma or Adv Diploma | 1.2198 | 1.8506 | 1.4578 | 1.9806 |
| University (Bachelors to Post-Graduate) | 1.4965 | 1.7216 | 1.7625 | 2.3059 |
| Model: 3A-Categories |  |  |  |  |
| School, Certificate I, or Certificate II (Base case) |  |  | - |  |
| VET (Cert III or IV) | 1.3460 | 1.6194 | 1.7037 | 2.1743 |
| University or diploma/advanced dip | 1.4353 | 1.7403 | 1.7015 | 2.2507 |
| Model: 3B-Categories |  |  |  |  |
| Year 12, Certificate I, or Certificate II (Base case)- |  |  | - |  |
| VET (Cert III or Cert IV) | 2.5611 | 3.0298 | 2.000 | 2.6359 |
| University or diploma/advanced dip | 2.5787 | 3.2448 | 1.9609 | 2.7363 |

Notes: (1) p-values are not reported as they are always reported as p = 0.000. (2) AJ represents “any job”; FTP represents Full-time permanent employment (a “good” job).

As expected, in models in which those with less than Year 12 education are excluded (Model 3B and Model 5), the impact of education is smaller in size. But, relative impacts between education levels are consistent and the relationship between ‘any job’ and a ‘good’ job is also maintained. We conclude the results are both robust and meaningful.

# Complete estimation

Table 18 below is the full version of Table 4 in the main report. It is also used to calculate the profiles in Box 1 in the main report.

Table 18 Duration estimation: From education to employment

|  Variable | Model 1: | Model 2: | Model 3: | Model 4: |
| --- | --- | --- | --- | --- |
|  | ANY job (Males) | ANY job (Females) | FTP Job (Males) | FTP job (Females) |
| Education < YR12 (Base) |  |  |  |  |
|  Education YR12 | 3.52\*\*\* | 4.47\*\*\* | 1.54\*\*\* | 2.13\*\*\* |
|  Education Cert I or II | 4.20\*\*\* | 7.47\*\*\* | 2.55\*\*\* | 5.16\*\*\* |
|  Education Cert III or IV | 5.03\*\*\* | 7.23\*\*\* | 2.65\*\*\* | 4.36\*\*\* |
|  Education Diploma or Adv Dip | 4.37\*\*\* | 8.66\*\*\* | 2.18\*\*\* | 4.21\*\*\* |
|  Education University | 5.35\*\*\* | 8.04\*\*\* | 2.73\*\*\* | 4.94\*\*\* |
| Age | 0.97 | 1.01 | 0.97 | 0.96 |
| Indigenous (Base, Not Indigenous) | 0.70\*\* | 0.69\*\* | 0.81 | 0.95 |
| Disability (Base, No Disability) | 0.89 | 1.03 | 1.03 | 0.59\* |
| ACT (Base) |  |  |  |  |
|  NSW | 0.94 | 0.92 | 0.98 | 1.11 |
|  VIC | 0.99 | 0.91 | 0.98 | 1.02 |
|  QLD | 1.00 | 0.87 | 1.08 | 0.94 |
|  SA | 0.99 | 0.92 | 0.96 | 0.94 |
|  WA | 0.99 | 1.05 | 1.11 | 1.07 |
|  TAS | 0.94 | 0.77 | 0.92 | 1.12 |
|  NT | 1.23 | 0.99 | 1.27 | 1.43 |
| Metropolitan (Base) |  |  |  |  |
|  Regional | 0.96 | 0.89\*\* | 1.14\* | 0.97 |
|  Rural/Remote | 0.94 | 0.89\* | 1.12 | 0.97 |
| School Government (Base)e |  |  |  |  |
|  School Catholic | 1.10 | 1.08 | 0.90 | 0.94 |
|  School Independent | 0.99 | 0.94 | 0.77\*\*\* | 0.83\*\* |
| Country of Birth Australia (Base) |  |  |  |  |
|  Country of Birth \_ESB | 0.91 | 0.81\* | 0.77 | 0.89 |
|  Country of Birth \_NESB | 0.76\*\*\* | 0.77\*\* | 0.76\* | 0.77\* |
| Country of Birth Mother Aust (Base) |  |  |  |  |
|  Country of Birth Mother ESB | 1.06 | 0.97 | 0.93 | 0.96 |
|  Country of Birth Mother NESB | 0.82\*\* | 0.90 | 0.85 | 0.95 |
| Country of Birth Father Aust (Base) |  |  |  |  |
|  Country of Birth Father ESB | 1.01 | 1.21\*\* | 1.05 | 0.91 |
|  Country of Birth Father NESB | 0.89 | 0.78\*\*\* | 0.93 | 0.85\* |
| Base average duration | 435 | 550 | 481 | 584 |
| Wald Chi2 test (p-value) | 9 982 (0.00) | 9 783 (0.00) | 21 951 (0.00) | 22 377 (0.00) |

Notes: (1) stars denote statistical significance \* p<0.05; \*\* p<0.01; \*\*\* p<0.001. (3) The model is a complementary log-log (cloglog) model. Reported estimates are the “odds ratio” calculated as eβ. (4) Sample sizes do not match across models due to differing rates of missing values (or item non-response).

# Flexible baseline hazard estimates

The baseline hazard provides a view of the impact of the passage of time on the probability of obtaining a job when the influence of educational level, and the significant control (or explanatory) variables have been take into account.

There are a number of alternative to specifying the functional form of the baseline hazard function (e.g. time, time squared, time cubed) but preliminary models indicated no need to go beyond the easily interpreted time in observed units.

Given the distribution of time to employment, the most satisfactory representation of time is to include variables for the first 24 months (monthly), followed by an annual variable for the next 5 years, and to complete the specification with a variable covering the remained of the period.

Figure 4 below provides a representation of the baseline hazard for those whose first job is a ‘good job’ (full-time permanent), and Figure 5 which follows the baseline hazard for those whose first job is designated as ‘any job’. Both figures are the time-variables from the models based on educational attainment in six categories.

Figure 4 Baseline hazard: full-time and permanent employment (education in six categories)



A comparison of the models demonstrates that there is some differences in timing of the peaks that indicated an increase in the probability of remaining out of employment—given we have controlled for educational attainment and other control variables. An interesting factor that emerges from the figures is that for employment in a ‘good job’ there are few differences in the baseline hazard between males and females, and differences tend to favour females. There is an increased likelihood that males will remain out of employment—with a definite advantage to females at those peaks.

The peaks appear to coincide with the end of the calendar year and may possibly be attributed to both labour market supply and demand factors. For example:

* Many students leave school at the end of the year in the early years of education and hence there are an increased number seeking employment compared to those who gain employment.
* The end of the year coincides with the recruitment programme in the retail sector which increases the demand for labour and probably increases the supply.
* In addition, generally, interviews in the LSAY take place at the end of the year and this may influence the distribution of employed and not employed.

Figure 5 Baseline hazard: any form of employment (education in six categories)



Table 19 below provides the estimated coefficient for the time-variable in the cloglog models for ‘any job’ and for the first ‘good job’ (by gender). The coefficients are converted from the cloglog ‘log odds ratio’ to the more accessible ‘odds ratio’ or ‘hazard rates’ (interpreted in this case as the ‘hazard’ that individuals will remain not employed. Clearly, by the time an individual (males or female) reaches about two years from the time they finishing their highest level of education, the probability of remaining not employed is very small (conversely, the probability of finding a job is high).

Table 19 Baseline Hazard (exp(β))

| Date | AJ Male | AJ Female | FTP Males | FTP Females |
| --- | --- | --- | --- | --- |
| Sep-95 | 0.3359 | 0.1776 | 0.1105 | 0.0827 |
| Oct-95 | 0.1162 | 0.0407 | 0.0507 | 0.0322 |
| Nov-95 | 0.1178 | 0.0438 | 0.2085 | 0.1353 |
| Dec-95 | 0.0791 | 0.0400 | 0.0456 | 0.0316 |
| Jan-96 | 0.0670 | 0.0286 | 0.0276 | 0.0150 |
| Feb-96 | 0.0466 | 0.0201 | 0.0139 | 0.0078 |
| Mar-96 | 0.0361 | 0.0246 | 0.0164 | 0.0151 |
| Apr-96 | 0.0512 | 0.0167 | 0.0220 | 0.0090 |
| May-96 | 0.0525 | 0.0164 | 0.0134 | 0.0024 |
| Jun-96 | 0.0338 | 0.0160 | 0.0082 | 0.0032 |
| Jul-96 | 0.1001 | 0.0339 | 0.0088 | 0.0045 |
| Aug-96 | 0.1005 | 0.0372 | 0.0054 | 0.0021 |
| Sep-96 | 0.1162 | 0.0597 | 0.0025 | 0.0027 |
| Oct-96 | 0.0621 | 0.0289 | 0.0318 | 0.0185 |
| Nov-96 | 0.0474 | 0.0240 | 0.1322 | 0.0781 |
| Dec-96 | 0.0342 | 0.0103 | 0.0202 | 0.0117 |
| Jan-97 | 0.0334 | 0.0148 | 0.0165 | 0.0050 |
| Feb-97 | 0.0223 | 0.0157 | 0.0091 | 0.0039 |
| Mar-97 | 0.0233 | 0.0152 | 0.0063 | 0.0055 |
| Apr-97 | 0.0210 | 0.0213 | 0.0157 | 0.0083 |
| May-97 | 0.0404 | 0.0252 | 0.0087 | 0.0040 |
| Jun-97 | 0.1063 | 0.0350 | 0.0051 | 0.0028 |
| Jul-97 | 0.1091 | 0.0423 | 0.0066 | 0.0024 |
| Aug-97 | 0.0576 | 0.0542 | 0.0074 | 0.0020 |
| 1998 | 0.0313 | 0.0166 | 0.0119 | 0.0079 |
| 1999 | 0.0484 | 0.0186 | 0.0099 | 0.0048 |
| 2000 | 0.0201 | 0.0164 | 0.0056 | 0.0032 |
| 2001 | 0.0104 | 0.0142 | 0.0051 | 0.0036 |
| 2002 | 0.0362 | 0.0129 | 0.0041 | 0.0012 |
| 2003 | 0.0173 | 0.0213 | 0.0011 | 0.0003 |

Notes: (1) The baseline hazard coefficient is the exponential of the estimated coefficient (exp(β)). (2) All time specific dummy variables are significant at the 0.000% level. (3) Baseline hazard is give and including 2003 (e.g. about 100 months).

1. Some observable characteristics may only be suitable for one-step, but not the other: typically, it is helpful to have such characteristics—called exclusion restrictions—for correct estimation. [↑](#footnote-ref-1)
2. The Tobit estimation technique can on occasion be sensitive to the model specification. [↑](#footnote-ref-2)
3. The proportion of (total) time spent by respondents not employed (and assumed to be time spent searching for employment) during the first 36 months (three years) since completing their highest level of education within their survey timeframe (i.e. the timeframe that respondents are observed for). [↑](#footnote-ref-3)