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ABSTRACT

The Dynamics of Study-Work Choice and Its Effect on Intended and Actual University Attainment*

We study the dynamics of study-work choices of Australian high school students and how these choices affect intended and actual enrolment in universities when they finish their school education. A dynamic random effect multi-equation model is constructed and estimated. We find that study-work choices are state dependent, driven by student heterogeneity and the school environment they are in. They are also related to behaviours of the fellow students in the same school. We find that study-work choices significantly affect enrolment in universities but they hardly have any effect on students' preference for university attainment.

JEL Classification: I21, C33

Keywords: study-work choices, university enrolment, dynamic models

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1. Introduction

Working while in school is common among high school students in developed countries. For example, in the US, 92 percent of males ages 22-27 in 1997 reported some work experience while they were in high school (Hotz et al, 2002). In Canada, about 66 percent of high school graduates in 1991 had a job while in high school (Parent, 2006). In Australia, about 56 percent of the Year 12[1] students in 2001 worked during that year (according to the Longitudinal Surveys of Australian Youth, LSAY). Generally, a few motives have been suggested to explain why students are taking on part-time jobs: to gain work experience; to achieve a degree of financial independence; or as a job market signal to future employers (Commonwealth of Australia 2009). For a small proportion of students, part-time work provides a necessary contribution to household income.

The literature shows that combining work with high school education (study-work hereafter) can have long-term consequences for individuals' educational attainment and labour market outcomes.[2] Nevertheless, conclusions from various studies on the directions of the effects are mixed. Some of the works find it has negative impacts on students (e.g., Greenberger and Steinberg, 1986; Tyler, 2003; and Stinerbrickner and Stinebrickner, 2003). For example, Stinerbrickner and Stinebrickner (2003), by investigating a work program in a college, find that working during college can have a harmful impact on grade performance. Tyler (2003), using the National Education Longitudinal Survey of 1988, also concludes that working more hours could lead to low scores in math. Other studies tend to find that modest involvement in paid work may be beneficial. For example, Ruhm (1997) find that early work experience leads to higher future wages and that although too heavy work commitment lowers the probability of graduation, students working 10 hours per week during senior year were more likely to graduate than those who did not work at all. Light (2001) finds that return to school would be overestimated by 25-44 percent without properly controlling for in-school work experience. In another words, part of the return to education is due to in-school work experience. Similarly, Cabus and Haelermans (2017) also find that students with in-school experiences earn about 22 percent more in the first year of labour than otherwise.[3]

Study-work choice depends upon students' characteristics, such as their demographic backgrounds and the environment around them. But more importantly it is also a dynamic process. This is because the choice in early years could affect relative returns of study and work later on, so that the choice may affect the pathway of study and the long term education and employment outcomes. On the one hand, study-work may affect students' academic outcomes and confidence in the school environment and may influence effort and future

[1] In Australia, grades are called 'year'. For example, Year 12 means Grade 12 or senior year in North America.

[2] See for example Meyer and Wise (1982); Greebberger and Steinberg (1986); Cameron and Heckman (1993, 1998); Carr, Wright and Brody (1996); Ruhm (1997); Schoenhals, Tienda and Schneider (1998); Eckstein and Wolpin (1999); Oettinger (1999); Hotz et al. (2002); and Parent (2006).

[3] The Australian literature (see for example, Robinson 1996, 1999; Dwyer et al. 1999; Marks, Fleming and McMillan 2000; Vickers, Lamb and Hinkley 2003; Biddle 2007; Polidano and Zakirova 2011), which consists of mostly descriptive studies, reaches a similar conclusion that in school work is generally beneficial, provided that working time commitment is not too extensive. As an example, Anlezark and Lim (2011) using LSAY data provided an informative description on prevalence of study-work in Australia. Their findings indicate a modest negative impact on educational outcomes for those working longer hours.

achievements in school. But the direction the effect could go both ways. This is because working may mean less time for study, but it may also make students study more efficiently. On the other hand, students not only obtain earnings but also gain labour market experiences which increase their future human capital. In other words, students make decisions to combine work and study dynamically and their previous choices are highly likely to affect subsequent study-work decisions and educational outcomes (often called 'state dependence' by economists).

However, the dynamics of study-work choices and the cumulative impact of study-work on pathways to higher education are far less well understood. For example, it is not well understood whether and how study-work choices in early years affect the ones in later years. It is not known very well how study-work choice may affect motivation and prospect of academic success during and after school years. It is also unclear how these study-work choices are affected by the school environment.

The aims of this paper are threefold. Firstly, we describe the transition of study-work choices. In particular, we distinguish the impacts of students' heterogeneity and those of state dependence. Distinguishing the role of state dependence and heterogeneity in this process has important policy implications---it helps to inform policy makers when and whom any intervention should target. Secondly, we estimate the consequences of study-work on students' preference and outcomes for higher education measured by intended and actual university enrolment. Thirdly, Biddle (2007) conjectures that peer effects may play an important role in determining study-work preferences. Although it is difficult to identify peer effect itself, we attempt to take it into account and look at how students' intentions to progress to higher education are related to their peers'.

We construct a joint model of study-work decisions and enrolment in universities of the secondary school students, using panel data methods specifically designed to capture the dynamic aspects of these processes. The joint model takes into account self-selection of students into the group who combine school and work by virtue of their characteristics. Study-work choices and transitions are considered among three states — study only; study with some work (less than 15 hours per week[4]); and study with intensive work (15 hours or more per week) — and modelled to vary with individual characteristics, family backgrounds and school environments. The dynamic aspects of the process are captured by relating students' current study-work choices to their lagged work state, and by allowing for intrinsic correlations between unobserved preferences. The basic framework is similar to those in, for example, Cameron and Heckman (1993, 1998) and Hotz et al. (2002), and to models applied in other contexts such as labour market mobility (e.g. Maloney 1999; Gong, van Soest and Villagomez 2004), or the dynamics of unionisation (Vella and Verbeek 1999). Intentions to study at university and actual enrolment are modelled in a similar fashion—except that they are binary choices and actual enrolment is one-off. In addition, we also include terms in the model that allow us to test whether those students who are more or less likely to combine study and work are also intrinsically more or less likely to progress to university.[5]

[4] The threshold of 15 hours per week is ad hoc, but equates to an average of three hours per day in each school week.
[5] This is achieved by allowing the terms capturing unobserved factors in study-work decisions and educational choices to be correlated.

The data used in our analysis are drawn from the 1998 LSAY cohort (Y98 cohort), in which a nationally representative sample of about 14,000 Year 9 students in 1998 is tracked annually for up to 12 years. The longitudinal nature of LSAY allows an analysis of the dynamics of students' choices. As our focus is on study-work choice and on higher education attainment, we use the first five waves of the sample----until a year after the students leave secondary school.[6] One drawback of the survey is its high attrition rate over time (see NCVER , 2009). Not taking it into account in the estimation would potentially lead to inconsistent results. We explicitly model such attrition in the estimation.

The remainder of the paper is organised as follows. In Section 2, we describe the data and provide some descriptive analysis. In Section 3 we develop a dynamic model of study-work choice and university enrolment to identify the factors that influence students' decisions. Models are estimated for female and male students separately. The results are discussed in Section 4. In Section 5, we conduct a series of simulations to illustrate the transition of study-work choices, intended and actual university enrolment. Section 6 concludes the paper.

[6] In this analysis, those who secured a position in universities but deferred their actual enrolments (e.g. those who take a 'gap year') are included. However, decisions to enrol in universities at later stages by some students are ignored.

2. The data

The 1998 longitudinal survey tracks a large cohort of Australian students entering Year 9 in 1998 over the course of their school careers. The survey collects detailed information on students' education and training choices and employment outcomes, and covers a wide range of school and post-school topics, including: student achievement, student aspirations, school retention, social background and development, attitudes to school, work experiences and post-school career intentions. Given that our focus is on the dynamics of study-work and the relationship between these study-work choices and intended and actual enrolment in higher education, we use the first five waves of the LSAY sample covering the period from Year 9 enrolment of the 1998 cohort to a year beyond their exit from secondary school.

Of the 14,117 Year 9 students surveyed in 1998, we removed 7 students who were recorded as being in Year 10; 1,185 students who had a disability condition (and thus were less able to work); 213 students who moved home or interstate; 209 students with missing size of residential location; 50 students in rural ACT and Northern Territory; 353 students in apprenticeship or trainee programs in the third and fourth waves of LSAY (Year 11 and 12, respectively); 498 students whose birth years were missing or too large/small to be true; 561 students whose working status could not be identified, and another 337 students with missing information on test scores, self-evaluation of performance, gender, and language spoken. This left a final sample for analysis of 37,884 observations on 10,704 individual students.

Study and work choices

In each wave, students are asked about whether they did paid work and if yes, the number of hours per week. From this question, we create the study-work variables which are defined earlier. In Figure 1, we plot the proportion of students in each study-work state from Year 9 to Year 12.[7] It shows that in Year 9, the majority of students (about 79 percent) did not combine study and work. Of those who did, most students worked fewer than 15 hours per week. But as they progressed over the school years, the proportion of study-only students decreased to about 44 percent in Year 12, while more of the working students worked intensively. The proportion of students engaging in some work increased to about 37 percent. In addition, the proportion of students working 15 hours or more also increased from less than 3 percent in Year 9 to about 19 percent in Year 12. The patterns are somewhat different between boys and girls---boys worked (and intensively) more often than girls (see the left panels in tables 7A and 7B).

[7] Some Year 11 and 12 students may enrol into vocational courses, which is part of the Australian secondary educational system. These students involve more paid work than other students. We excluded those who were in apprenticeship or trainee programs. There might still be some students in vocational courses in the sample. Unfortunately, we do not have the information to distinguish these students.

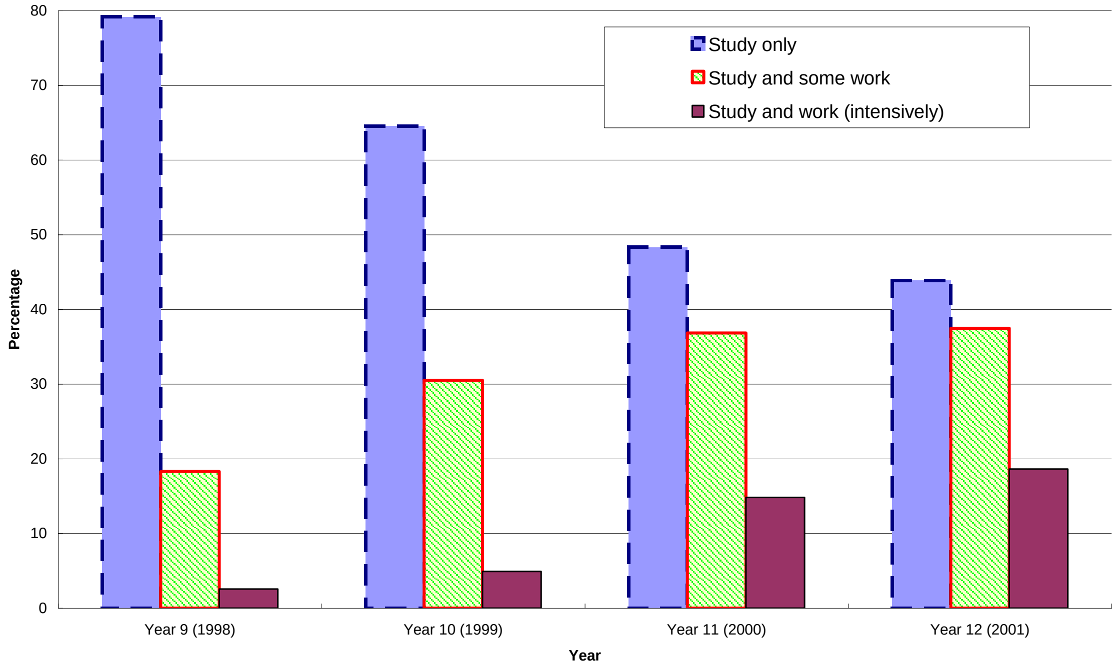


Figure 1 Patterns of combining study and work

Table 1 describes the transition patterns across different study-work status over five years from Year 9 to Year 12. The first point to note is that the mobility between different study-work status is quite substantial. Around 20 percent of the students went from study only in Year 9 to working in Year 10. And 24 percent of the students went from study only in Year 10 to working in Year 11. Fewer students reduced than increased their work effort over the course of these two years. Around 7 percent of the Year 9 students reduced work effort when moving into Year 10, with 10 percent of the Year 10 students working fewer hours (or not working at all) as they move to Year 11.

Table 1 Transition patterns of study and work (%)

Year t-1	**Year t**			
		Year 10		
t-1 = Year 9	No work	Some work (<15 hours)	Work intensively (>14 hours)	Total in *t-1*
No work	59.25	17.12	2.79	**79.16**
Some work (<15 hours)	5.51	11.35	1.42	**18.29**
Work intensively (>14 hours)	0.70	1.17	0.68	**2.55**
Total in *t* (Year 10)	**65.46**	**29.64**	**4.90**	**100.00**
		Year 11		
t-1 = Year 10	No work	Some work (<15 hours)	Work intensively (>14 hours)	Total in *t-1*
No work	41.07	17.14	6.36	**64.57**
Some work (<15 hours)	6.89	18.09	5.53	**30.51**
Work intensively (>14 hours)	0.90	1.84	2.18	**4.92**
Total in *t* (Year 11)	**48.86**	**37.07**	**14.07**	**100.00**
		Year 12		
t-1 = Year 11	No work	Some work (<15 hours)	Work intensively (>14 hours)	Total in *t-1*
No work	34.70	8.78	4.83	**48.32**
Some work (<15 hours)	7.16	24.94	4.76	**36.85**
Work intensively (>14 hours)	2.03	3.77	9.03	**14.83**
Total in *t* (Year 12)	**43.89**	**37.49**	**18.62**	**100.00**

Notes: Based upon individuals observed in two consecutive waves.
Source: Authors' calculation based upon LSAY 1998.

The picture is somewhat different during the last years in school. Although more Year 12 students were likely to combine school with work (56 percent) than in earlier years, a greater proportion (13 percent) either reduced working or stopped doing so altogether. Although about 28 percent[8] of the study-only students in Year 11 started working in Year 12, around 18 percent of the working students in Year 11 stopped working in Year 12. The factors that drive the choice of study-work are explored in further detail in the next section.

Intended and actual enrolment in university

The key educational choices and outcomes we focus on are, first, the intention to progress to higher education, and, second, whether students actually enrolled in a higher education institution (or received an offer) a year after Year 12. Table 2 summarises the post-school education choices of those Year 9 (Wave 1) students. Specifically, we look at the proportion of the students who obtained a university place (either enrolled or in receipt of an offer) in the year after their graduation from school out of those who expressed their desire to enrol in a university course when they were in Year 9. We present the statistics for all students and by their study-work status. The first panel of Table 2 shows that 56 percent of the Year 9

[8] Non-working Year 11 students who began work in Year 12, comprise of the sum of 8.78 percent and 4.83 percent as a proportion of the total student population who did 'No work' in Year 11 - 48.32 percent. Of those students working in Year 11, 7.16 percent and 2.03 percent stopped work in Year 12, which is 18 percent of the total Non-working student population (51.68 percent) in Year 12.

students intended to study in a university, around 70 percent of whom succeeded in securing a university place (equating to 39 percent of all students). On the other hand, less than 27 percent (or 11.72 out of 43.96 percent) of those Year 9 students who said they didn't want to study in a university were observed subsequently to enrol or secure an offer after Year 12. These overall patterns are repeated as they progress beyond Year 9. This shows that the intention to enrol is a good (but by no means perfect) predictor of the actual enrolment outcome, with some students quite uncertain about their post-school educational choices and others not able to make the desired transition to university education.

It also reveals some interesting differences in the patterns of enrolment across gender: girls are more likely than boys to aspire to higher education, and more likely to be offered a university place. Around 62 percent of the girls in Year 9 expressed their desire for a place in higher education, compared with less than 50 percent of the boys. After Year 12, 56 percent of the girls secured a university place, compared with only 46 percent of the boys.

In the second to fourth panels, we compare the patterns of intention and enrolments in universities by students' study-work status in Year 9. It can be seen that among the students who worked intensively, the proportions of those wanting or enrolling in universities are both lower than those who worked less in Year 9.

Panels 2 to 4 present the patterns by students' study-work status in Year 9.

Table 2 University study intentions and enrolment outcomes (%)

Intention to enrol at university in Year 9	Enrolled in or offered enrolment in university post-Year 12								
	All (obs: 5,949)			Boys (obs: 2,851)			Girls (obs: 3,098)		
	No	Yes	Total	No	Yes	Total	No	Yes	Total
All									
No	32.24	11.72	43.96	38.06	12.35	50.40	26.89	11.14	38.02
Yes	16.78	39.27	56.04	16.31	33.29	49.60	17.20	44.77	61.98
Total	49.02	50.98	100.00	54.37	45.63	100.00	44.09	55.91	100.00
By study-work type									
	Work intensively (obs: 146, of which 77 boys and 69 girls)								
No	45.89	6.85	52.74	54.55	9.09	63.64	36.23	4.35	40.58
Yes	17.12	30.14	47.26	15.58	20.78	36.36	18.84	40.58	59.42
Total	63.01	36.99	100.00	70.13	29.87	100.00	55.07	44.93	100.00
	Some work (obs: 1,128, of which 576 boys and 552 girls)								
No	32.54	12.85	45.39	41.67	13.72	55.38	23.01	11.96	34.96
Yes	18.17	36.44	54.61	17.19	27.43	44.62	19.20	45.83	65.04
Total	50.71	49.29	100.00	58.85	41.15	100.00	42.21	57.79	100.00
	No Work (obs: 4,675, of which 2,198 boys and 2,477girls)								
No	31.74	11.59	43.34	36.53	12.10	48.64	27.49	11.14	38.64
Yes	16.43	40.24	56.66	16.11	35.26	51.36	16.71	44.65	61.36
Total	48.17	51.83	100.00	52.64	47.36	100.00	44.21	55.79	100.00

Notes to all tables: Based upon individuals observed in two consecutive years and excluding observations with missing hours.
Source: Authors' calculation based upon LSAY 1998.

Characteristics of students, their families and **s**chools

LSAY includes information on each student's individual and family background, the attributes of the school in which they study, their ranking scores in a test during their first interview,[9] and a self-assessment of their own ability, performance and attitude. In addition we believe that the school and local environments, especially the behaviour and attitudes of fellow students, will influence their own education and work choices. Using the school identifiers, supplemented by information on students' residence and school type, we are able to construct a range of variables that reflect the school environment, including the proportions of students: who intend to study in a university; who combine study and work; who perform better than average in the test; or who have positive reflections on their own school experience. These variables are constructed by taking the school average of the values reported by all students but excluding the respondent. [10]

Descriptive statistics for the data used in this analysis is presented in Table 3. Included in Table 3 are variables describing students' own circumstances and the characteristics of their families. We use their own and parents' birth places, language and years since arriving in Australia to proxy their cultural and ethnic background. We also use students' test scores and their self-assessed measures of ability, and year and state dummies to control for local labour market and institutional conditions. Measures of self-assessment are used together with the actual test scores as proxies for students' ability because they may capture additional information about confidence, attitude and potential that can't be reflected by a single ability index. Family background (as measured by parents' background) is also likely to affect study-work and higher education choices. While most students were born in Australia or other English-speaking countries (about 93 percent), many have quite different backgrounds. For example, about 14 percent of the students have both parents born in non-English speaking countries and about 10 percent of the students speak a language other than English at home.

Table 3 also shows that, overall, students are somewhat different by study-work status in Year 9. For example, the students who worked intensively are more likely to be boys and have lower test scores. Those students are also more likely to be in public schools (70 percent) and in schools with average lower scores.

[9] Students were asked to complete two tests on literacy and numeracy when they were first contacted in 1998. From their answers in these two tests, a standardised (to mean zero and standard deviation of 1) measure of achievement in literacy and numeracy were produced. In the data, however, only a categorical variable (quartiles of achievement) of this measure is available. For more details, see NCVER (2009).

[10] For a small number of students who changed school during Years 11 or 12, the identifiers for their new school are not available. This prevents the construction of specific school environment variables for them. In such cases we use as proxies the average value of each environment indicator in the student's local area, as well as a direct indicator to control for the change of school.

Table 3 Sample statistics

Variables	Mean			
	All	No work	Some work	Work intensively
Boys	.503	.493	.535	.573
Born in Australia/NZ and other English-speaking countries	.928	.919	.963	.935
Born in non-English European/Latin American countries	.016	.018	.009	.023
Born in other countries	.056	.063	.028	.042
Residence: metropolitan	.606	.608	.596	.599
Residence: regional	.220	.217	.236	.207
Residence: rural or remote	.174	.175	.169	.194
Indigenous	.028	.029	.019	.036
Arrived in Australia during high school	.018	.021	.005	.000
Arrived in Australia during primary school	.044	.049	.026	.039
Arrived in Australia before primary school	.032	.033	.026	.032
Test score in Year 9 above average	.513	.512	.535	.398
Self-assessment in Year 9: English above average	.465	.463	.480	.421
Self-assessment in Year 9: maths above average	.465	.464	.481	.392
Language at home: English	.904	.894	.948	.900
Language at home: European	.034	.035	.026	.039
Language at home: Asian	.040	.047	.011	.039
Language at home: Arab	.011	.013	.007	.013
Language at home: other	.007	.003	.004	.007
NSW	.251	.244	.266	.327
Vic.	.212	.205	.244	.197
Qld	.214	.227	.158	.207
SA	.088	.091	.082	.052
WA	.117	.120	.110	.087
Tas.	.053	.053	.057	.045
NT	.029	.027	.031	.055
ACT	.036	.032	.053	.029
Neither father nor mother born in English speaking countries	.143	.158	.077	.129
Father finish Year 12 and with a post-school qualification	.440	.438	.452	.440
Mother finish Year 12 and with a post-school qualification	.427	.418	.464	.447
Proportions of students in school in Year 9 (excluding self):				
who are working	.231 (.09)	.226(.09)	.248(.09)	.243(.09)
with test scores above average	.503 (.19)	.501(.19)	.516(.19)	.462(.28)
who intend to study in a university	.497 (.19)	.497(.19)	.501(.18)	.453(.27)
whose father finished Year 12 and with qualification	.469 (.18)	.442(.16)	.482(.17)	.467(.18)
whose mother finished Year 12 and with qualification	.449 (.16)	.424(.14)	.468(.16)	.446(.16)
who finish homework	.282 (.12)	.268(.12)	.282(.12)	.283(.12)
who believe their school friends are eager to learn	.611 (.13)	.596(.13)	.610(.13)	.612(.13)
who believe their school friends work hard	.629 (.14)	.606(.13)	.631(.13)	.629(.14)
who believe their school friends are well behaved	.563 (.16)	.522(.15)	.564(.16)	.564(.16)
who believe their teachers are qualified	.691 (.15)	.663(.15)	.699(.15)	.690(.15)
School type in Year 9: government	.623	.629	.583	.712
School type in Year 9: Catholic	.227	.222	.253	.191
School type in Year 9: independent	.150	.149	.164	.097
Obs.	10,704	8,459	1,936	309

Source: Authors' calculation based upon LSAY 1998. Study-work status is in 1998.

School environments vary considerably from one school to the next (as shown by the standard deviations on each school environment indicator in Table 3). We illustrate this by showing estimated distributions of the proportion of the working students in schools (Figure 2) and the proportion of students with above-average test scores in each school (in Figure 3) in Year 9. Although around 23 percent of the students combine school and work in an average school, the distribution of the working-student proportion in each school covers a fairly broad range. Figure 3 tells a similar story for average performance of students in each school. One element of variation is likely to be the type of school: around 62 percent of the students were in government schools, 23 percent in Catholic schools and the remainder in independent schools (Table 3).

Figure 2 Estimated distribution of schools by proportion of students working (Year 9)

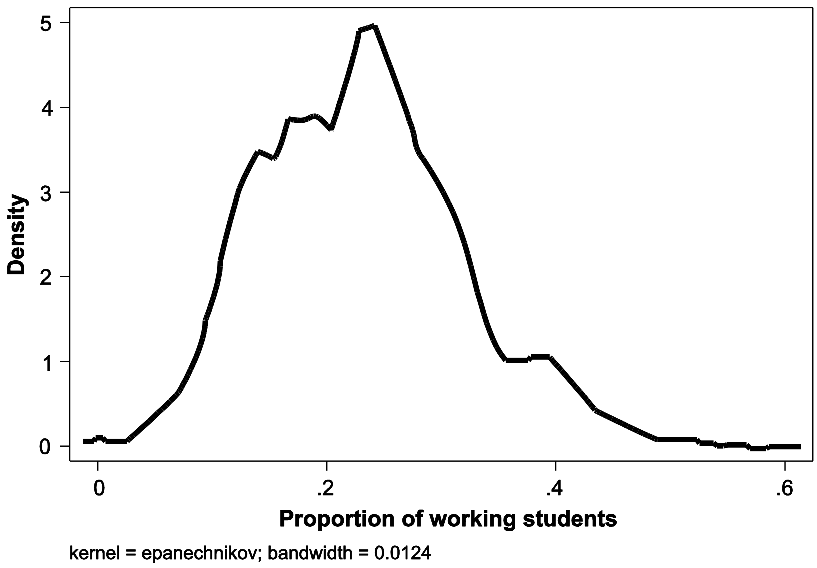
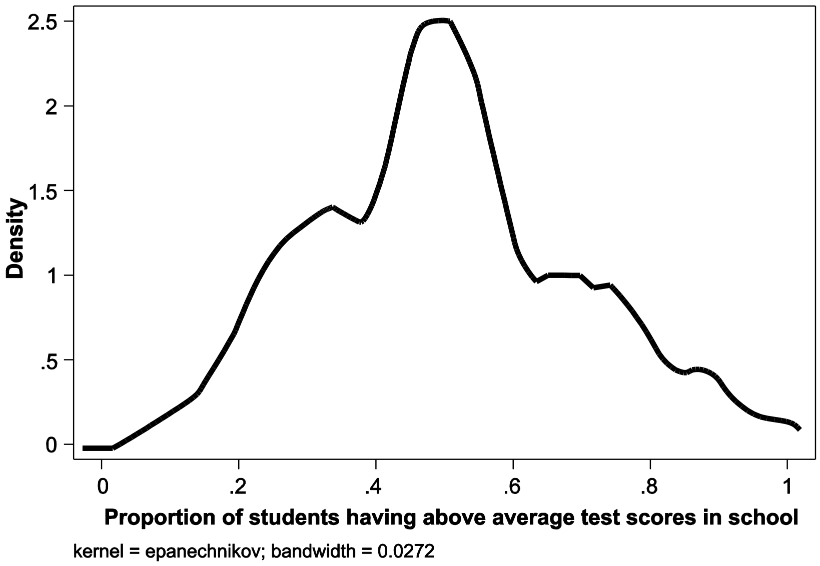


Figure 3 Estimated distribution of schools by proportion of above-average-test-score students (Year 9)



3. The model

Our model consists of four equations in three parts: the study-work choice equation; the equations of intention and actual enrolment in higher education; and the attrition equation.

Study-work choices of students in secondary schools

We assume that a secondary school student *i* in each year *t* (= 1998, 1999, 2000, and 2001) chooses from three states of study-work:

$$y_{it} = \begin{cases} 1.\text{ Study only;} \\ 2.\text{ Study and some work } (< 15 \text{ hours per week}); \\ 3.\text{ Study and work intensively } (\geq 15 \text{ hours per week}). \end{cases} \quad (1)$$

To explain the study-work choices, we specify a dynamic multinomial logit panel data equation with random effects. This is similar to the first-order Markov model proposed in Heckman (1981b). In this model, the inclusion of the lagged choice dummies and the random effects makes it possible to distinguish between the structural state dependence and unobserved heterogeneity. The unobserved individual effects are assumed to be multivariate normal (which are also correlated with those in equations of intention and enrolment to higher education) and independent of the observed characteristics.

To each of the three alternatives *j (j = 1, …, 3)* in year *t>1*, attaches a value of utility which is determined by

$$U_{it}^{j} = \sum_{s=2}^{J} (\eta_s^j D_{t-1}^s + \lambda_{1s}^j x_{it}^1 D_{t-1}^s + \lambda_{2s}^j x_{it}^2 D_{t-1}^s) + \beta_j X_{it} + \alpha_i^j + \varepsilon_{it}^j \quad (2)$$

where each D_{t-1}^s represents an indicator of the lagged study-work choices at time *t*-1 for working some hours (*s* = 2) and for working intensively (*s* = 3) (study-only is omitted as the reference state). The variables X_{it} denote a range of factors thought to influence the study-work choices, including individual characteristics, family background variables, past test scores, and the characteristics, attitudes and work patterns of the fellow students in the school. A number of scenarios serve to illustrate the influence of peers in students' choice. For example, peer pressure that increases the likelihood of a student working may be greater in schools with a greater proportion of students combining study and work. Likewise, students in schools where a high proportion of their fellow students have the same intention may be more likely to pursue higher education. Admittedly, the coefficients of these variables could not be interpreted as peer effect itself because identification without further information is difficult. However, inclusion of these variables in the model could still illustrate the influence of fellow students. To allow for potential differentiated effects of the lagged study-work choice among students from different type of schools, we also include interaction terms of school types (labelled as x^1 and x^2 in Equation (2)) and D_{t-1}^s's. Any 'unobserved heterogeneity' in the study-work choices is captured by a series of random individual effects α_i^j in the multinomial choice model. Finally, we add a set of idiosyncratic error terms ε_{it}^j to capture any remaining state-specific variation in each time period t. These errors are assumed to follow a Type I extreme value distribution, and are distributed identically and independently from all observed characteristics and unobserved heterogeneity terms. β_j, λ^j, and η_s^j are parameters to be estimated. For identification purposes each of the parameters α_i^1, β_1 and η^1 are normalised to 0.

The student is assumed to choose the alternative which gives her the highest utility, so that (conditional on the random effect) the probability of her choosing alternative *j* is given by a multinomial function:

$$P_t^s = P\{y_{it} = j \mid \alpha_i\} = \frac{\exp(\sum_{s=2}^{J}(\eta_s^j D_{t-1}^s + \lambda_{1s}^j x_{it}^1 D_{t-1}^s + \lambda_{2s}^j x_{it}^2 D_{t-1}^s) + \beta_j X_{it} + \alpha_i^j)}{\sum_{k=1}^{J}\exp(\sum_{s=2}^{J}(\eta_s^k D_{t-1}^s + \lambda_{1s}^j x_{it}^1 D_{t-1}^s + \lambda_{2s}^j x_{it}^2 D_{t-1}^s) + \beta_k X_{it} + \alpha_i^k)} \quad (3)$$

This specification defines a dynamic process and allows us to distinguish between the effect of the lagged dependent variables (D_{t-1}^s) and the unobserved characteristics (α_i).

Intended and enrolment in higher education

We examine the yearly self-reported intentions of school students to enrol in higher education and their actual enrolment, to better understand the most important drivers and influences of educational choices and outcomes. One particular purpose of our approach is to capture the dynamic aspects of educational choice and the relationship with study-work choices. This link is established by the inclusion of previous study-work choices in the intention/enrolment equations on the ground that previous study-work decisions may affect preferences for tertiary education by both altering students' human capital in the labour market and impacting upon their achievements and educational outcomes.

Intention for universities is modelled as a dynamic logit model:
Let Ted_{it}^* be the latent value of receiving tertiary education in each period, and given by

$$Ted_{it}^* = \varsigma Z_{it} + \sum_{s=2}^{J}(\rho_s^j D_{t-1}^s + \pi_{1s}^j x_{it}^1 D_{t-1}^s + \pi_{2s}^j x_{it}^2 D_{t-1}^s) + \theta_i + \varphi_{it} \quad (4)$$

where Z_{it} is a vector of explanatory variables in wave *t* and θ_i is the random effect. Also included are a number of variables describing learning environment such as proportion of students who finish their homework, who believe their mates working hard, who think their teachers were qualified, etc. These variables are not included in the study-work equation, and help to identify the equation. Study-work choices in the previous period D^s_{t-1}*'s* enter the equation in that they may affect the return to tertiary education. Again, we include interaction terms between lagged study-work status and school type dummies to allow for differentiated effects of these variables. φ_{it} is an i.i.d. error term with logistic distribution. ς , π and ρ are parameters to estimate. Thus the probability for student *i* in year *t* intending for a university is given by

$$P_t^v = \Pr\{Ted_{it} = 1 \mid \theta_i\} = P\{\varsigma Z_{it} + \sum_{s=2}^{J}(\rho_s D_{t-1}^s + \pi_{1s}^j x_{it}^1 D_{t-1}^s + \pi_{2s}^j x_{it}^2 D_{t-1}^s) + \theta_i\} \quad (5)$$

The probability of actual enrolment in universities in the year after they leave school (wave 5) is similarly but separately specified with a logit model

$$P^e = \Pr\{Univ_i = 1 \mid \theta_i^e\} = P\{\varsigma^e Z_{i4} + \sum_{s=2}^{J} \rho_s^e D_3^s + \theta_i^e\}, \tag{6}$$

where ς^e, ρ^e, and $\theta^e{}_i$ are similarly defined as for (5) but are distinct parameters and random effects respectively.

Specification of the random effect terms

The random effects could reflect unobserved heterogeneity such as students' unobserved ability, motivation, unobserved family and school environment, and so on. These are so called nuisance parameters, but need to be controlled for.

The random effects, α_i^2, α_i^3 in Equation (2) and θ_i in Equation (4) are assumed to follow a multivariate normal distribution (which is a linear combination of three independent *N(0,1)* variables):

$$\Delta_i \equiv \begin{pmatrix} \alpha_i^2 \\ \alpha_i^3 \\ \theta_i \end{pmatrix} = A \times \omega_i \tag{7}$$

where ω_i is a vector of three independent standard normal variables, and A is a 3 by 3 lower triangular parameter matrix to be estimated.

The random effect in the enrolment equation (6) is specified as $\theta^e{}_i = m\theta_i$, where m is a parameter to be estimated.

Marginal effects

The signs of the parameters in each equation indicate the directions of the effects of the associated variables on the probability of the explained outcomes. However, given the non-linear structure of the model, the magnitude of the effects (which varies across individuals) cannot be inferred directly from the parameters. The effects of the explanatory variables are usually summarised by marginal effects on the explained probability for some benchmark individuals (such as sample mean). For example, the marginal effect of an explanatory variable on the probability of university enrolment is the change in the probability for one unit change in that explanatory variable if it is continuous (for example, proportion of the working students), or for the change from 0 to 1 if it is a dummy variable (for example, Indigenous dummy).

Initial conditions

The issue of initial condition arises because the lagged dependent variables D_{t-1}^s's appear as explanatory variables of the model. We deal this problem in the same manner as in Heckman (1981a). For the first wave ($t = 1$), we specify static equations of study-work and intention towards universities, respectively. The two static equations have different parameters and are without D_{t-1}^s's. As discussed in Gong, van Soest and Villagomez (2004), these equations can be seen as linear approximations to the reduced form with the lagged study-work choices replaced by their expectations according to the dynamic model for periods earlier than $t = 1$. This treatment may lead to inconsistent estimates when the length of the panel is short and if the approximation is poor. However, a number of studies, including Heckman (1981a), Hyslop (1999), and Chay and Hyslop (2000), show that empirically the bias induced by this procedure is quite small. For more discussions of alternative treatment of the initial condition problem, also see Wooldridge (2000, 2002).

To be specific, the 'utility' of study and work in the initial period, U_{i1}^{j} ($j=1, 2, 3$), is specified as

$$U_{i1}^{j} = \beta_j^0 X_{it} + \alpha_i^{0j} + \varepsilon_{i1}^{j} \tag{8}$$

where the variables and parameters are all similarly defined as in Equation (2). The probability for student *i* to choose alternative *j* in wave 1, given the random effects (and *X*'s) is given by

$$P_1^s = P\{y_{i1} = j \mid \alpha_i^0\} = \frac{\exp(\beta_j^0 X_{it} + \alpha_i^{0j})}{\sum_{k=1}^{J} \exp(\beta_k^0 X_{it} + \alpha_i^{0k})} \tag{9}$$

The probability of students' intention to universities in wave 1 is also specified similarly against its dynamic counterpart Equation (5),

$$P_1^v = \Pr\{Ted_{i1} = 1 \mid \theta_i^0\} = P\{\varsigma^0 Z_{it} + \theta_i^0\} \tag{10}$$

Random effects in the two reduced-form equations are assumed to be a linear function of their dynamic counterparts in the following way

$$\Delta_i^0 \equiv \begin{pmatrix} \alpha_i^2 \\ \alpha_i^3 \\ \theta_i \end{pmatrix} = C\Delta_i = B\omega_i \tag{11}$$

From the model specification we can see that model identification relies upon both panel and cross-sectional variations, the exclusion restrictions, the random effect assumptions, and the functional form assumptions. In particular, the assumption that the random effect is uncorrelated with the observed variables is crucial for the identification. If this assumption is violated the consistency would be lost. If it were in linear models, fixed effect models would be a better choice for this purpose. Unfortunately, such tools are not available for this multiple-equation, dynamic, and nonlinear model.

Sample attrition

As mentioned earlier, one issue with LSAY is its high attrition rate over time. For example, around one-third of the students interviewed in 1998 were not interviewed in 1999. By the fifth wave (2002, one year beyond Year 12), only 44 percent of the original cohort remained in the sample. For most LSAY waves, students exit the survey permanently once they leave. However, this wasn't the case for the third LSAY wave (2000, Year 11). For this wave, some students who were missing from the 1999 telephone interview returned mailed-out questionnaires. As a result, the proportion of original students remaining in the sample for that year was roughly the same as in 1999. As is well known, non-random attrition in panels can adversely affect the reliability of the analysis. As show in Table B8, the characteristics of students went missing in Year 12 are different. For example, they are more likely to be in public schools, boys, Indigenous, or not to be performing as well academically. It is a sign that attrition is not entirely random. We account for attrition by assuming the conditional probability of remaining in the panel sample in each year as a function of students' and their family characteristics and use this 'survival' probability to adjust the empirical estimates of study-work and enrolment choices (see Horst, Nijman and Verbeek 2001):

P_t^a , the probability of being observed in time *t (Ot = 1)* conditional on being observed in *t-1* is given by a logit function

$$P_t^a = \Pr\{O_{it} = 1 \mid O_{it-1} = 1\} = \Phi\{\varsigma^o M_{it-1} + \sum_{s=1}^{J} \mu_s^{o,j} D_{t-1}^s\} \qquad (12)$$

where M_{it-1} is a vector of explanatory variables at *t-1*.

The estimated effects of the variables on attrition probability in Table B6A show that some of the characteristics affect attrition probability significantly. For example, those in schools where more students choose to study-work are less likely to remain in the survey in later waves---if the proportion of study-work students in their school increases by 100 percent, the likelihood for a boy to remain in the sample would be decreased by about 7 percentage points, and that for a girl would be decreased by 17 percentage points. We also conducted a test on whether the estimated parameters of the model would be different with and without attrition is taken into account. The null hypothesis that the parameter estimates with and without attrition taken into account are the same is rejected.

Estimation

The equations are estimated jointly using simulated maximum likelihood. Joint estimation, together with the specification, helps to take account of the various selection issues. Given the random effects, the likelihood is a product of all choice probabilities (including the propensity for an observation to 'survive' in a particular wave):

$$L_i(\omega) = \prod_{t=1}^{4} (P_t^s P_t^v) P^e \prod_{t=2}^{5} P_t^a \qquad (13)$$

Since the random effects are not observed, the likelihood contribution for each student is given by the expected value of (13), after the random effects being 'integrated out':

$$L_i = \iiint L_i(\omega_i)\varphi(\omega_i) d\omega_{i1} d\omega_{i2} d\omega_{i3} \qquad (14)$$

where $\varphi(\omega_i)$ is the density function of ω. We use a smooth simulated maximum likelihood approach in which the three-dimensional integral is replaced with a simulated mean: for each individual, we take R (=30) draws from the error distribution (ω), and compute the average of the R likelihood values conditional on these draws. The integral in (14) is thus replaced by

$$L_i = \frac{1}{R} \sum_{q=1}^{R} L_i(\omega_i^q) \qquad (15)$$

The draws are taken from Halton sequences[11] using the procedure described in Train (2003). The estimator resulting from random independent draws is inconsistent for fixed *R*, but will be consistent as *R* tends to infinity with the number of observations of the sample.[12]

4. Estimation results

The model is estimated separately for boys and girls. As mentioned earlier, the parameters are hard to interpret due to the non-linearity of the model. We thus present the results in the form of marginal effects for the sample average (Tables 4-6). The original parameter estimates are presented in the Appendix.

Study-work decisions

Not surprisingly, socioeconomic and ethnic backgrounds are important for students' study-work choices. For example, parents' education appears to be an important factor. Compared with students whose fathers have finished Year 12 and with post-school qualifications, those with fathers receiving lower education tend to be more likely to work longer hours. This is true for both boys and girls, although the magnitudes are somewhat different. The effect on the likelihood of doing some work is different between boys and girls. For example, the likelihood of doing some work is 8 percent lower for boys whose fathers did not finish Year 12 and without a qualification, but that for similar girls are not significantly different. Students from Asian backgrounds are less likely to combine study with work relative to the reference student. Compared with government schools, students in Catholic or independent schools are less likely to engage in paid work. Looking at the intensity of working, students in Catholic schools are less likely to work long hours than those in other schools.

Students' actual test scores in 1998 and their self-assessed performance in mathematics and English are influential to the study-work choice. Students with above-average test scores and those who assess themselves to be above average in English or mathematics are less likely to engage in long hours of work. However, ability measures don't seem to show such a strong correlation with less intensive work.

As a general pattern, we find that students of low academic performance, with low social economic status, or in low performing schools are more likely to engage in more extensive work. But the same effects cannot be found for the likelihood of engaging in some work. In some cases the opposite effects are found. For example, a boy who performs better than average in English is about 3 percent more likely to engage in some work. Both boys and girls in schools where more students intended to enrol in universities are much more likely to engage in some work (17 percent and 13 percent, respectively).

[11] The 'quasi-random' Halton draws are designed to provide better coverage than independent draws. Simulation can also be more efficient in terms of reduced simulation errors for a given number of draws. See discussions in, for example, Bhat (2001), Train (2003), Sandor and Train (2004).

[12] Some individuals were missing from the 1999 wave but returned to the survey in the subsequent wave. To make full use of information, these individuals are included in the analysis, but their probability contributions in wave 2 are 'integrated out', by which we mean that the likelihood contribution after Wave 2 by each of such observation is calculated as the weighted average of those conditional on the alternatives in Wave 2.

The attitudes and behaviour of the fellow students play an important role in study-work choices, particularly the prevalence among the school cohort of combining work with study. Table 4 shows that if the proportion of the working students in a school increases by one percentage point, the likelihood of combining study with some work for a boy (girl) would increase by 0.67 (0.60) percentage points, and of working intensively by about 0.06 (0.08) percentage points. These results illustrate the importance of the school environment in shaping students' behaviour and performance. Although this may not be attributed solely to the peer effect, it does indicate the cross influence of the fellow students.

An important finding is the strong state dependence and persistence in study-work choices, in the sense that current study-work choices are significantly affected by previous work decisions (Table 4). These can be seen from the marginal effects of the lagged study-work choice (marked in bold in Table 4 and subsequent tables). For illustration, if a boy with an 'average' set of characteristics and circumstances worked intensively in a year, his probability of working intensively would increase by 4 percentage points a year later, and that of combining study and some work would increase by 23 percentage points. Doing some work while studying would also increase his chance of doing the same a year later by 42 percentage points, but wouldn't increase his chance of working intensively. We did not calculate the differentiated effects of the lagged dependent variables among school types, but from the estimates of the interaction terms (Tables B2, B3, and B4), we can see that the effects of the lagged dependent variables are not very different for most of the choices. The only exception is that the effects of the lagged dependent variables on the likelihood of doing some work are somewhat smaller for students in non-public schools than others, although the effects are at most significant at the 10 percent level.

Unobserved characteristics are important in explaining students' study-work choices and education preference/outcomes. Unobserved characteristics between the levels of employment in the study-work equations are shown to be positively correlated, and negatively correlated with those in the intention and enrolment equations. These results (presented in Table B7 of the appendix) suggest that students who combine study with some work are similar to those who work longer hours, but are different from those who study only, and those who intend to go to university.

Individual characteristics play quite different roles between boys and girls in their study-work choices. First, girls speak Asian languages are 21 percentage points less likely to combine study with some work than the reference female student. Asian boys' likelihood of working while at school is 16 percentage points lower than their comparison group. Secondly, results from Table 4 show that there are significant differences in the patterns of study-work according to father's education. Boys are seven percentage points less likely to combine study with work if their father has no educational qualifications, compared to those whose fathers received a qualifications and Year 12 certificate. The same effect is not shown so strongly for girls. This may be due to boys taking their fathers as role models. Thirdly, there is a stronger state dependence for girls working intensively while at school when compared with boys. This indicates that those girls who do work longer hours are more likely to continue to do so over the course of their school career than boys. State dependence is generally stronger for students who combine study with some work than those who worked intensively, but stronger for boys than girls.

These findings suggest that whether and how students engage in paid work depend upon a number of things. First, it is determined by their academic performance at school. Secondly, it is determined by their family environments. On the one hand, their preference toward school education and paid work is influenced by the preference and the example of their family members. On the other hand, students in poorer families may need to earn their own pocket money. Thirdly, the school environment including their peers' attitude and behaviour play very important roles in their choices. Again, these findings may not necessarily all be the peer effect, but they do illustrate influence among fellow students. Fourthly, the strong state-dependence means that study-work choice is highly path-dependent. The implication of this is that students' initial choices may be crucial for their choice and performance later on, thus proper guidance and advices at early stages would help them much more efficiently.

Table 4 Marginal effects on probabilities of study–work (dynamic) [13]

Variables	Boys		Girls	
	Some work	Intensively	Some work	Intensively
Indigenous	-.109* [-1.71]	.003 [0.33]	-.163** [-2.39]	-.012 [-0.56]
Born later than 1984	-.108 [-0.14]	.003 [0.03]	-.306 [-0.59]	-.017 [-0.10]
Regional Australia	-.011 [-0.45]	.000 [0.06]	.007 [0.38]	-.011 [-1.60]
Rural Australia	-.002 [-0.07]	-.004 [-1.25]	-.020 [-0.97]	-.007 [-1.04]
Catholic school	.049* [1.85]	-.001 [-0.17]	-.008 [-0.27]	-.017 [-1.07]
Independent school	-.025 [-0.74]	.014 [1.05]	-.047 [-1.44]	-.006 [-0.19]
Born: non-Eng. Europe/L. America	-.063 [-0.61]	-.005 [-0.43]	.071 [0.78]	-.046 [-1.15]
Born: other non-Eng. Countries	-.053 [-0.70]	-.007 [-0.59]	-.012 [-0.20]	.013 [0.60]
Parents born in non-Eng. Country	-.113** [-3.02]	-.010 [-1.54]	-.075 [-2.40]	-.025 [-1.83]
Father: no qual. or Year 12	-.076** [-2.29]	.006* [1.66]	.008 [0.30]	.015* [1.85]
Father: qual., no Year 12	-.016 [-0.69]	.013** [3.11]	.045** [2.27]	.020** [3.06]
Father: Year 12, no qual.	.004 [0.11]	.005 [0.97]	-.058* [-1.76]	.010 [0.97]
Father: educ. missing	-.047 [-0.64]	-.004 [-0.57]	-.053 [-1.14]	.005 [0.36]
Mother: no qual. or Year 12	-.024 [-0.76]	-.001 [-0.36]	.023 [0.96]	.003 [0.48]
Mother: qual., no Year 12	-.025 [-0.73]	.002 [0.58]	.038 [1.21]	.001 [0.07]
Mother: Year 12, no qual.	-.016 [-0.58]	-.002 [-0.50]	.036 [1.55]	.008 [-0.98]
Mother: educ. missing	.009 [0.12]	.015* [1.86]	.030 [0.54]	.013 [0.88]
Migrated after primary sch.	-.112 [-0.84]	.001 [0.06]	-.165 [-1.62]	.052 [1.54]
Migrated during primary sch.	-.004 [-0.06]	-.002 [-0.22]	-.060 [-1.01]	.005 [-0.26]
Migrated before school	.044 [0.62]	.002 [0.17]	-.082 [-1.45]	-.012 [-0.59]
LOTE: European	-.003 [-0.05]	.008 [0.95]	-.051 [-0.98]	.023 [1.28]
LOTE: Asian	-.156** [-2.26]	-.012 [-1.03]	-.210** [-3.30]	-.036 [-1.31]
LOTE: Arab	-.126 [-1.08]	.009 [0.57]	-.252 [-1.45]	.012 [0.22]
LOTE: other	-.262 [-0.86]	.025 [0.94]	-.037 [-0.22]	.025 [0.35]
Self-assessed: Eng. above average	.033* [1.80]	-.007** [-2.12]	.020 [1.33]	-.010* [-1.70]
Self-assessed: maths above average	-.006 [-0.33]	-.009** [-2.29]	.042** [2.73]	-.013** [-2.01]
Same school as in 1998	-.054* [-1.83]	-.005 [-1.46]	-.008 [-0.33]	-.006 [-0.82]
1998 test score above average	-.011 [-0.57]	-.011** [-3.10]	.020 [1.25]	-.013** [-2.45]
Proportion of students not working	-.669** [-9.18]	-.060** [-3.17]	-.596** [-8.17]	-.077** [-2.89]
Proportion of students above average test score	-.023 [-0.33]	.000 [0.05]	-.038 [-0.65]	-.012 [-0.59]
Proportion of students intending to go to university	.168** [2.56]	-.044** [-2.99]	.128** [2.30]	-.080** [-3.21]
Work intensively in previous year	.231** [4.66]	.042** [2.79]	.196** [4.33]	.094** [3.57]
Some work in previous year	.417** [13.48]	-.002 [-0.45]	.359** [14.51]	.020* [1.94]
State dummies		Yes		

Notes: * Significant at 10% level; ** Significant at 5% level; t-values are in the brackets. The reference group is study-only. LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

Enrolment intentions and outcomes

The results in Tables 5 and 6 suggest a clear association between students' enrolment intentions and their parents' educational background. Students in families where the father

[13] In this Table (and in Tables 5, 6, and B1-B6), the reference dummies include: non-Indigenous Australians; students born before 1985; students living in urban Australia; students in Government Schools; students born in English-speaking countries; parents born in English countries; father/mother with qualification and Year 12 certificates; non-migrants; speaking English at home; test scores/self-assessment not above averages; not in the same school as in 1998; and not working in the previous year.

has lower educational qualifications are less likely to express an intention for university and are less likely to enrol than those whose father has post-school qualifications. There are a variety of explanations for the relationship between parents' educational attainment and students' own choices. On the one hand, the need for students to either contribute to household income or supplement their own pocket money may be less in families with more highly educated (and usually wealthier) parents. Parental role model effects are also likely, with the students of more educated parents having different attitudes towards study and work, and a more positive disposition towards higher education.

Unsurprisingly, students' actual test scores in 1998 and their self-assessed performance in mathematics and English are strong predictors of their intention to progress to higher education, as well as actual enrolment. Students (boys and girls) with above-average scores or an above-average self-assessment of abilities in English and mathematics are more likely to enrol in university beyond Year 12.

Again, attitudes of fellow students are estimated to be important in education choices and outcomes---enrolment intentions and outcomes are positively influenced by the positive disposition towards higher education among the student cohort in a school. For the average male student, a one-percentage-point increase in the proportion of school peers intending to go to university would lead to an increase of 0.9 percentage points in his own intention to enrol in higher education. The chance of realising this ambition would also increase, by 0.45 percentage points. The effect appears to be stronger for girls than boys. Our estimates suggest that Year 9 girls are 1.2 percentage points more likely to express an intention for university for a one percentage point increase in the proportion of their school peers expressing the intention. Girls are also more likely to convert this intention to reality, with actual enrolment rising by 0.8 percentage points.

There is no evidence for that the intention for university is affected by study-work choice (as evidenced by the insignificant effects of the two study-work variables in the intention equation presented in Table 5). However, the propensity for actual enrolment in university does seem to be affected (Table 6). For the average male student, his chance of securing a position in a university would be reduced by about 11 percentage points if he works long hours in Year 12. For girls, this negative effect is almost doubled (21 percentage points). On the other hand, the likelihood of enrolling in a university is generally not negatively affected for students who combine study with only some work during Year 12. For boys, the effect is even significantly positive, although only at the 10 percent level. These findings are consistent with previous studies in the literature (see for example, Meyer and Wise 1982; Hotz et al. 2002; Vickers, Lamb and Hinkley 2003; Biddle 2007; Anlezark and Lim 2011).

Table 5 Marginal effects on probabilities of enrolment intention (dynamic)

Variables	Boys	Girls
Indigenous	-.126 [-1.33]	-.064 [-0.60]
Born later than 1984	.002 [0.00]	.521 [0.83]
Regional Australia	.031 [0.95]	.004 [0.12]
Rural Australia	.018 [0.52]	.076* [1.95]
Catholic school	.073** [2.06]	.073* [1.90]
Independent school	.008 [0.17]	.030 [0.60]
Born in non-English country in Europe/Latin America	-.104 [-0.74]	.200 [1.26]
Born in other non-English countries	.018 [0.17]	.028 [0.25]
Both parents born in a non-English country	.187** [3.20]	.300** [4.57]
Father's education: no qualification or Year 12	-.129** [-2.37]	-.150** [-2.92]
Father's education: qualification, no Year 12	-.136** [-3.32]	-.120** [-3.43]
Father's education: no qualification, but Year 12	.057 [1.14]	-.004 [-0.07]
Father's education: missing	-.122 [-1.19]	-.278** [-3.65]
Mother's education: no qualification or Year 12	-.066 [-1.37]	-.067 [-1.50]
Mother's education: qualification, no Year 12	-.159** [-2.78]	-.086 [-1.47]
Mother's education: no qualification, but Year 12	-.008 [-0.20]	.076* [1.85]
Mother's education: missing	-.215* [-1.81]	.019 [0.21]
Migrants: arrival high school or later	-.056 [-0.32]	-.008 [-0.04]
Migrants: arrival during primary school	.081 [0.88]	-.017 [-0.17]
Migrants: arrival before school	-.037 [-0.36]	.071 [0.68]
LOTE: European	-.009 [-0.10]	-.199 [-1.94]
LOTE: Asian	.309** [2.78]	.307** [2.55]
LOTE: Arab	.180 [1.20]	-.103 [-0.48]
LOTE: other	.089 [0.26]	.141 [0.51]
Self-assessment: English above average	.240** [5.80]	.294** [10.41]
Self-assessment: Math above average	.216** [5.97]	.220** [7.66]
Same school as in 1998	-.023 [-0.76]	.054 [1.53]
1998 test score above average	.333** [5.28]	.281** [8.88]
Proportion of students not working	.147* [1.87]	.004 [0.05]
Proportion of students above-average test score	-.050 [-0.53]	-.057 [-0.48]
Proportion of students intending to go to university	.861** [5.48]	1.204** [12.38]
Proportion of fathers with qual. and Year 12	.221 [1.59]	-.345** [-2.26]
Proportion of mothers with qual. and Year 12	.038 [0.27]	.332** [2.08]
Proportion of students finish homework	-.271** [-2.23]	-.104 [-0.85]
Proportion of students think mates eager to learn	.072 [0.54]	-.078 [-0.51]
Proportion of students think mates working hard	.097 [0.69]	-.005 [-0.03]
Proportion of students think mates well behaved	-.214* [-1.69]	-.039 [-0.29]
Proportion of students think teachers qualified	.139 [1.11]	-.171 [-1.40]
Work intensively in previous year	-.055 [-0.95]	-.037 [-0.70]
Some work in previous year	.049 [1.40]	-.016 [-0.54]
State dummies	Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the brackets.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

Table 6 Marginal effects on probabilities of actual enrolment

Variables	Boys	Girls
Indigenous	-.212* [-1.89]	-.240 [-1.20]
Born later than 1984	-.063 [-0.16]	.825 [0.18]
Regional Australia	.018 [0.52]	.023 [0.43]
Rural Australia	.084** [2.12]	.161** [2.67]
Catholic school	.023 [0.49]	.089 [1.26]
Independent school	.000 [0.01]	.122 [1.29]
Born in non-English country in Europe/Latin America	-.052 [-0.40]	-.138 [-0.62]
Born in other non-English countries	.114 [1.03]	-.092 [-0.60]
Both parents born in a non-English country	.139** [2.21]	.220** [2.36]
Father's education: no qualification or Year 12	-.145** [-2.14]	-.244** [-3.19]
Father's education: qualification, no Year 12	-.101** [-2.11]	-.129** [-2.46]
Father's education: no qualification, but Year 12	-.025 [-0.52]	-.134 [-1.49]
Father's education: missing	-.226* [-1.87]	-.262** [-2.16]
Mother's education: no qualification or Year 12	-.076 [-1.42]	-.093 [-1.41]
Mother's education: qualification, no Year 12	-.083 [-1.44]	-.087 [-1.00]
Mother's education: no qualification, but Year 12	.033 [0.93]	.086 [1.43]
Mother's education: missing	-.055 [-0.47]	-.072 [-0.49]
Migrants: arrival high school or later	.050 [0.23]	-.105 [-0.48]
Migrants: arrival during primary school	-.110 [-1.13]	.204 [1.38]
Migrants: arrival before school	-.185 [-1.64]	.161 [1.13]
LOTE: European	.004 [0.05]	-.156 [-0.96]
LOTE: Asian	.141 [1.41]	.176 [1.20]
LOTE: Arab	-.024 [-0.17]	-.465 [-1.52]
LOTE: other	.044 [0.26]	-.001 [0.00]
Self-assessment: English above average	.191** [3.48]	.311** [7.25]
Self-assessment: Math above average	.214** [3.59]	.364** [8.08]
Same school as in 1998	-.078** [-2.58]	.040 [0.76]
1998 test score above average	.301** [3.18]	.424** [8.33]
Proportion of students not working	.042 [0.41]	-.112 [-0.72]
Proportion of students above average test score	.114* [1.04]	.033 [0.17]
Proportion of students intending to go to university	.446** [2.75]	.839** [4.89]
Proportion of fathers having qual. and Year 12	.080 [0.50]	.159 [0.64]
Proportion of mothers having qual. and Year 12	.403* [1.94]	.392 [1.49]
Proportion of students finishing homework	-.006 [-0.05]	-.302 [-1.48]
Proportion of students think mates eager to learn	.274 [1.56]	.266 [1.05]
Proportion of students think mates working hard	.141 [0.89]	-.160 [-0.65]
Proportion of students think mates well behaved	-.280* [-1.80]	.056 [0.26]
Proportion of students think teachers qualified	.085 [0.64]	.094 [0.45]
Work intensively in previous year	-.108** [-2.16]	-.207** [-3.07]
Some work in previous year	.054*[1.66]	.026 [0.62]
State dummies	Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; t-values are in the brackets.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

5. Simulations

Using model estimates, the probabilities of study-work choices, educational intentions and outcomes can be simulated for given values of observed and unobserved characteristics. We use simulations to analyse the mobility pattern of study-work and university enrolment cross years, which are hard to see from the marginal effects presented above. We also use simulations to assess how well the model is able to reproduce the data. The simulations could also be used to analysis the effects of various policy settings. In this section, we present the simulation results of the average pattern of the whole sample.[14]

Simulated sample probabilities

Simulated probabilities produced by the model are calculated by aggregating the probabilities for all individuals in the sample with simulated values of the unobserved characteristics, and are compared with actual probabilities in the data. This is to assess the extent to which the model fits the data. Tables 7 present the results for study-work patterns, and Table 8 for intention and enrolment in university. In Tables 7, both stock probabilities for each wave and mobility across each pair of consecutive waves are produced. The two tables show that the model predictions of the stock probabilities are close to the actual data (with the differences for most of them less than one percentage point). The predicted cross-tabulation between the first two waves also follows the data reasonably well, but it exhibits larger discrepancy with the actual data for later waves. As discussed in Gong, van Soest and Villagomez (2004), this is normal and it would be unreasonable to expect a perfect fit for the whole period.

Results in Tables 7 show some interesting patterns. Firstly, the initial patterns of study-work in Year 9 are not too different between boys and girls---most students did not do any work, and a very small proportion worked many hours. But when they are in Year 12, over 50 percent of either boys or girls combine study and work. And, boys are substantially more likely (23 percent) than girls (17 percent) to work intensively, and less likely to combine study with some work (42 percent for the boys and 31 percent for the girls).

Secondly, the mobility is described by the conditional probability between states. The probabilities of remaining in the same states (bold) show how likely the students remain in the same study-work status between waves. In early years, most non-working students remain where they were when they move to the next grade. For example, about 74 (68) percent of non-working Year 9 boys (girls) were still not working when they are in Year 10. As they move to higher grades, the probability becomes 58 percent for the boys and 57 percent for the girls. At the same time, in the early years, the status of working intensively is a highly non-stable status---only 21 (22) percent of the intensively-working boys (girls) in Year 9 were in the same status when they were in Year 10. The same probability is more than doubled for the boys when they move to Year 11 and increased to about 49 percent when they move to Year 12. For the girls, the status of working intensively also becomes a more stable state, but not to the same extent.

[14] Due to the non-linearity of the model, the pattern is different for each individual student. To illustrate how individual heterogeneity may influence mobility pattern, one could simulate the patterns for each individual.

Thirdly, mobility out of the state of working intensively is different between years and between boys and girls. From Year 9 to 10, about 64 percent ($\approx .508/(.508+.284)$) of boys who came out of the state of intensively working went back to study-only. It dropped to 58 percent from Year 11 to 12. For the intensively-working girls, the patterns are different. Between Year 9 and 10, the probability of study-only conditional on leaving the state of working intensively (52 percent) is lower than that of the boys (64 percent). And only 45 percent of the intensively working girls in Year left their jobs completely a year later. These patterns show that once engaged in work, girls are less likely to leave completely.

Table 7A Simulated and actual average study and work probabilities (boys)

	Actual				**Simulated**			
		Mobility (t to t+1)				Mobility (t to t+1)		
	Stock(t)	*No work*	*Some*	*Intensive*	*Stock(t)*	*No work*	*Some*	*Intensive*
Year 9 to 10								
No work	.779	.781	.187	.033	.770 (.01)	**.741 (.01)**	.210 (.01)	.049 (.01)
Some	.191	.362	.572	.066	.200 (.01)	.452 (.03)	**.501 (.03)**	.047 (.01)
Intensive	.030	.340	.440	.220	.030 (.02)	.508 (.03)	.284 (.03)	**.208 (.03)**
Year 10 to 11								
No work	.678	.670	.217	.114	.672 (.01)	**.609 (.01)**	.231 (.01)	.159 (.01)
Some	.277	.256	.551	.193	.274 (.01)	.340 (.03)	**.514 (.03)**	.147 (.02)
Intensive	.046	.200	.288	.512	.054 (.01)	.325 (.03)	.227 (.03)	**.448 (.04)**
Year 11 to 12								
No work	.527	.722	.158	.120	.525 (.01)	**.587 (.02)**	.228 (.01)	.185 (.01)
Some	.311	.209	.635	.156	.308 (.01)	.324 (.02)	**.506 (.03)**	.169 (.02)
Intensive	.162	.123	.195	.682	.167 (.01)	.299 (.03)	.213 (.02)	**.488 (.04)**
Year 12	*1.00*	*.465*	*.313*	*.222*	*1.00*	*.463 (.01)*	*.307 (.02)*	*.231 (.01)*

Notes: Standard errors are in the parentheses.
Source: Authors' calculation based upon LSAY 1998.

Table 7B Simulated and actual average study and work probabilities (girls)

	Actual				**Simulated**			
		Mobility (t to t+1)				Mobility (t to t+1).		
	Stock(t)	*No work*	*Some*	*Intensive*	*Stock(t)*	*No work*	*Some*	*Intensive*
Year 9 to 10								
No work	.802	.721	.241	.038	.805 (.02)	**.681 (.01)**	.274 (.01)	.045 (.01)
Some	.176	.244	.667	.089	.172 (.01)	.367 (.03)	**.554 (.03)**	.079 (.02)
Intensive	.022	.193	.482	.325	.023 (.02)	.409 (.04)	.373 (.04)	**.219 (.03)**
Year 10 to 11								
No work	.618	.604	.312	.084	.620 (.01)	**.542 (.01)**	.344 (.01)	.113 (.01)
Some	.330	.204	.623	.172	.323 (.01)	.249 (.02)	**.586 (.03)**	.165 (.02)
Intensive	.052	.171	.439	.390	.057 (.01)	.259 (.03)	.353 (.04)	**.388 (.04)**
Year 11 to 12								
No work	.442	.715	.208	.078	.441 (.01)	**.573 (.02)**	.328 (.02)	.099 (.01)
Some	.422	.184	.705	.111	.412 (.01)	.277 (.02)	**.575 (.03)**	.148 (.02)
Intensive	.136	.152	.319	.529	.147 (.01)	.291 (.03)	.353 (.03)	**.355 (.04)**
Year 12	*1.00*	*.415*	*.433*	*.153*	*1.00*	*.413 (.01)*	*.422 (.02)*	*.166 (.01)*

Notes: Standard errors are in the parentheses.
Source: Authors' calculation based upon LSAY 1998.

Table 8 Simulated and actual average probabilities of intention to universities

	Intention to enrol in a university				Enrolment
	Year 9	Year 10	Year 11	Year 12	One year after Year 12
Boys					
Actual	.441	.435	.498	.485	.456
Simulated	.450 (.01)	.413 (.01)	.501 (.01)	.474 (.01)	.437 (.01)
Girls					
Actual	.575	.533	.604	.610	.559
Simulated	.577 (.01)	.518 (.01)	.609 (.01)	.596 (.01)	.543 (.01)

Notes: Standard errors are in the parentheses.
Source: Authors' calculation based upon LSAY 1998.

Conclusions

In this paper we have studied the mobility of study-work choice and its interaction with intended and actual enrolment in higher education of the secondary school students in Australia. Our main contribution is that, with a dynamic econometric model that controls for the unobserved characteristics of the students, we reveal the dynamic pathway of the study-work choices and educational outcome overtime. We find that the study-work choices and students' chance of enrolling in universities are determined to a large extent by the path they take. The findings imply that students' initial choice affects their subsequent school-work decisions and educational outcomes. We find that working long hours significantly negatively affects the probability of enrolling in universities while it has no significant effect on such intentions. This confirms the usual finding in the literature that working too much at school may have negative effects on educational outcomes. The insignificant effect of the study-work choices on students' intention for university shows that preference for tertiary education is not much affected by study-work activities but more by students' background and characteristics.

Whether and how much students engage in paid work depend upon their own background, their academic performance at school, and the environment including the family, the school, and the fellow students. We find that students who worked intensively were also more likely to be boys and from a lower socioeconomic background (using father's educational attainment as proxy). The behaviour and attitudes of fellow students appear very important for both study-work choices and educational choices. Students in schools where more students work are also more likely to do so. Those in schools where more students intend to go to universities are also more likely to do so and to enrol in university after Year 12.

With simulations, we analyse the mobility of students' study-work status. We find that students' study-work choices are quite mobile over time. They increasingly engage in working activities as they progress in secondary school, but most of them choose to combine modest work with study at some point. Engaging in working long hours seems to be a temporary state, in that many of them switch out of that state a period later.

These findings are hardly surprising, but they may have important implications for related policies and the literature. For example, since working too many hours during high school may harm the opportunity for further education, and because choice of study-work is highly path dependent, it might be reasonable to strengthen regulations of the timing and the number of hours that youth can work. Educational programs with a work component probably should be also carefully designed to avoid any detrimental side effect. The dynamic relationship between high school study-work and university attainment also implies that, including study-work in the Mincer equation may not be sufficient to reveal the ‘true’ return to education as educational outcomes and study-work are interactively determined.

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Appendix. Parameter estimates

Table B1 Parameter estimates: study and work (initial) equation

Variables	Boys		Girls	
	Intensive work	Some work	Intensive work	Some work
Constant	-0.866[-0.56]	0.668[1.16]	-0.271[-0.13]	-0.647[-1.19]
Indigenous	-0.142[-0.18]	-0.763*[-1.70]	-2.080[-0.09]	-0.438[-0.85]
Born later than 1984	-0.957[-0.01]	-2.370[-0.05]	-0.850[-0.01]	-0.636[-0.22]
Regional Australia	0.261[0.69]	0.148[1.06]	0.073[0.17]	0.029[0.21]
Rural Australia	0.279[0.73]	-0.199[-1.27]	-0.379[-0.70]	0.029[0.20]
Catholic school	-0.146[-0.41]	0.254*[1.91]	-0.153[-0.35]	-0.136[-0.96]
Independent school	0.106[0.21]	0.240[1.34]	-0.945[-1.14]	-0.238[-1.42]
Born in non-Eng. Europe/L. America	0.234[0.16]	-0.028[-0.04]	0.605[0.22]	-0.770[-0.91]
Born in other non-Eng. countries	-0.624[-0.31]	-0.089[-0.17]	0.494[0.34]	-0.372[-0.79]
Both parents born in non-Eng. country	-0.909[-0.72]	-0.714**[-2.76]	-0.277[-0.26]	-0.716**[-2.64]
Father educ: no qual. or Yr 12	0.284[0.47]	0.182[0.92]	-0.570[-1.04]	-0.005[-0.02]
Father educ: qual., no Yr 12	0.007[0.02]	0.168[1.22]	-0.131[-0.32]	0.123[0.96]
Father educ: no qual., but Yr 12	-0.595[-0.76]	-0.219[-0.94]	-0.766[-0.79]	-0.008[-0.03]
Father educ: missing	1.155[1.49]	0.070[0.17]	-0.134[-0.11]	-0.116[-0.31]
Mother educ: no qual. or Yr 12	1.248*[1.79]	0.034[0.17]	-0.659[-1.51]	0.122[0.69]
Mother educ: qual., no Yr 12	1.181[1.48]	-0.102[-0.47]	-0.673[-0.75]	-0.322[-1.32]
Mother educ: no qual., but Yr 12	1.227*[1.84]	0.063[0.35]	-0.315[-0.63]	0.023[0.14]
Mother educ: missing	-0.270[-0.21]	-0.027[-0.06]	-1.884[-1.00]	-0.052[-0.11]
Migrated high sch. or later	-1.885[-0.03]	-2.821[-0.11]	-2.137[-0.07]	0.034[0.03]
Migrated during prim. sch.	-0.288[-0.22]	-0.187[-0.40]	-1.247[-0.72]	0.110[0.25]
Migrated before school	0.188[0.14]	0.409[0.91]	0.393[0.33]	0.263[0.68]
LOTE: European	1.605[1.42]	0.137[0.36]	0.070[0.04]	0.384[0.86]
LOTE: Asian	1.419[1.10]	-1.357**[-2.05]	0.714[0.45]	-0.326[-0.66]
LOTE: Arab	1.126[0.44]	-0.166[-0.23]	-0.954[-0.04]	-2.117[-0.08]
LOTE: other	-1.054[-0.03]	-0.726[-0.25]	-1.069[-0.03]	0.972[0.90]
Self-assessed: Eng. above avg.	0.116[0.36]	0.039[0.35]	0.123[0.35]	0.068[0.60]
Self-assessed: math above avg.	-0.456[-1.32]	0.168[1.45]	0.121[0.34]	0.093[0.80]
1998 test score above avg.	-0.695*[-1.86]	-0.225*[-1.86]	-0.458[-1.22]	0.077[0.64]
Prop. of students not working	-4.002**[-2.43]	-2.699**[-3.95]	-2.256[-1.00]	-1.711**[-2.73]
Prop. of students above avg. test score	0.173[0.12]	-0.008[-0.02]	0.420[0.31]	0.297[0.66]
Prop. of student intend to go to university	-1.042[-0.71]	-0.245[-0.50]	-1.970[-1.41]	0.463[0.93]
State dummies			Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the parentheses.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY1998.

Table B2 Parameter estimates: enrolment intention (initial) equation

Variables	Boys	Girls
Constant	-3.917**[-5.68]	-1.844**[-2.90]
Indigenous	-0.879**[-2.04]	-0.281[-0.65]
Born later than 1984	0.698[0.20]	0.458[0.21]
Regional Australia	-0.139[-0.92]	-0.092[-0.65]
Rural Australia	-0.097[-0.61]	0.139[0.87]
Catholic school	0.098[0.68]	0.248[1.63]
Independent school	-0.183[-0.93]	0.298[1.45]
Born in non-Eng. Europe/L. America	-0.039[-0.06]	0.390[0.53]
Born in other non-Eng. countries	0.514[1.02]	0.759[1.61]
Both parents born in non-Eng. country	0.966**[4.36]	0.678**[2.60]
Father educ: no qual. or Yr 12	-0.642**[-3.31]	-0.297[-1.43]
Father educ: qual., no Yr 12	-0.548**[-3.87]	-0.383**[-2.76]
Father educ: no qual., but Yr 12	0.247[1.14]	0.065[0.26]
Father educ: missing	-0.057[-0.14]	-0.690**[-2.23]
Mother educ: no qual. or Yr 12	0.050[0.26]	-0.097[-0.54]
Mother edu: qual., no Yr 12	-0.404*[-1.95]	0.069[0.29]
Mother educ: no qual., but Yr 12	0.088[0.51]	0.206[1.20]
Mother educ: missing	-1.180**[-2.63]	0.281[0.74]
Migrants: arrival high school or later	-0.728[-1.10]	0.287[0.41]
Migrants: arrival during primary school	-0.308[-0.69]	0.121[0.28]
Migrants: arrival before school	0.022[0.05]	0.437[1.08]
LOTE: European	-0.108[-0.30]	-0.752*[-1.70]
LOTE: Asian	-0.236[-0.52]	-0.231[-0.51]
LOTE: Arab	0.418[0.65]	0.842[0.99]
LOTE: other	0.265[0.26]	-0.625[-0.74]
Self-assessment: English above average	0.879**[7.86]	0.977**[7.96]
Self-assessment: math above average	0.670**[5.85]	0.921**[7.37]
1998 test score above average	1.009**[8.26]	0.000[0.00]
Prop. of students not working	0.381[0.55]	0.933**[7.46]
Prop. of students above avg. test score	0.494[1.03]	-0.534[-0.83]
Prop. of students intending to go to university	2.054**[3.92]	2.095**[3.89]
Prop. of sch. fathers having qual. and Yr 12	1.764**[2.87]	1.139**[2.13]
Prop. of sch. mothers having qual. and Yr 12	-0.352[-0.55]	-0.581[-0.91]
Prop. of sch. students finish homework	-0.309[-0.62]	0.209[0.31]
Prop. of sch. students think mates eager to learn	0.000[0.00]	0.422[0.83]
Prop. of sch. students think mates work hard	0.943[1.49]	0.003[0.00]
Prop. of sch. students think mates well behaved	-1.054*[-1.67]	0.769[1.19]
Prop. of sch. students think teachers qualified	0.161[0.31]	-0.659[-1.20]
State dummies	Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the parentheses.
LOTE = language other than English.

Source: 'Authors' calculation based upon LSAY 1998.

Table B3 Parameter estimates: study and work (dynamic) equation

Variables	Boys		Girls	
	Intensive	Some	Intensive	Some
Constant	0.326[0.93]	0.271[1.01]	-0.006[-0.02]	0.612**[2.63]
Indigenous	-0.126[-0.38]	-0.443*[-1.70]	-0.683[-1.55]	-0.763**[-2.53]
Born later than 1984	-0.092[-0.02]	-0.437[-0.14]	-1.184[-0.48]	-1.419[-0.75]
Regional Australia	-0.016[-0.13]	-0.044[-0.45]	-0.189[-1.54]	0.003[0.03]
Rural Australia	-0.174[-1.27]	-0.016[-0.16]	-0.192[-1.48]	-0.107[-1.19]
Catholic school	-0.009[-0.06]	0.184*[1.76]	-0.294*[-1.66]	0.020[0.20]
Independent school	0.192[0.90]	-0.075[-0.55]	-0.587**[-2.44]	-0.251**[-2.10]
Born: non-Eng. Europe/L. America	-0.351[-0.63]	-0.271[-0.64]	-0.710[-0.99]	0.191[0.49]
Born: other non-Eng. countries	-0.407[-0.80]	-0.235[-0.75]	0.229[0.53]	-0.017[-0.07]
Parents born in non-Eng. country	-0.626**[-2.60]	-0.483**[-3.15]	-0.692**[-2.79]	-0.406**[-2.96]
Father educ: no qual. or Yr 12	0.099[0.56]	-0.299**[-2.18]	0.325*[1.88]	0.080[0.66]
Father educ: qual., no Yr 12	0.479**[3.59]	-0.040[-0.41]	0.518**[4.20]	0.257**[3.10]
Father educ: no qual., but Yr 12	0.194[0.90]	0.025[0.17]	0.044[0.20]	-0.232[-1.56]
Father educ: missing	-0.263[-0.78]	-0.200[-0.67]	-0.054[-0.20]	-0.223[-1.10]
Mother educ: no qual. or Yr 12	-0.105[-0.62]	-0.100[-0.77]	0.129[0.87]	0.113[1.06]
Mother edu: qual., no Yr 12	0.047[0.24]	-0.097[-0.69]	0.118[0.59]	0.173[1.25]
Mother educ: no qual., but Yr 12	-0.108[-0.69]	-0.071[-0.60]	-0.056[-0.38]	0.139[1.37]
Mother educ: missing	0.608*[1.68]	0.068[0.21]	0.346[1.09]	0.170[0.70]
Migrated high school or later	-0.177[-0.15]	-0.459[-0.82]	0.577[0.91]	-0.595[-1.32]
Migrated during primary school	-0.089[-0.23]	-0.021[-0.07]	-0.266[-0.68]	-0.282[-1.08]
Migrated before school	0.169[0.34]	0.186[0.63]	-0.472[-1.13]	-0.403[-1.59]
LOTE: European	0.324[0.90]	0.005[0.02]	0.307[0.89]	-0.166[-0.72]
LOTE: Asian	-0.804*[-1.76]	-0.665**[-2.34]	-1.298**[-2.68]	-1.042**[-4.04]
LOTE: Arab	0.116[0.17]	-0.498[-1.04]	-0.460[-0.55]	-1.096[-1.60]
LOTE: other	0.450[0.46]	-1.025[-0.83]	0.383[0.31]	-0.099[-0.14]
Self-assessed Eng. above avg.	-0.225**[-2.11]	0.119[1.58]	-0.140[-1.34]	0.063[0.94]
Self-assessed Math above avg.	-0.373**[-3.41]	-0.044[-0.57]	-0.135[-1.27]	0.155**[2.26]
Same school as in 1998	-0.316*[-1.86]	-0.233*[-1.92]	-0.139[-0.85]	-0.053[-0.48]
1998 test score above avg.	-0.462**[-4.05]	-0.069[-0.86]	-0.203**[-1.98]	0.053[0.75]
Prop. of students not working	-3.842**[-9.70]	-2.876**[-9.93]	-3.164**[-8.15]	-2.884**[-11.0]
Prop. of students above avg. score	-0.030[-0.08]	-0.092[-0.32]	-0.336[-0.84]	-0.201[-0.78]
Prop. of student intend for univ.	-1.453**[-3.90]	0.597**[2.21]	-1.224**[-3.44]	0.354[1.45]
Lagged-Work intensively	2.171**[9.46]	1.036**[5.00]	2.510**(12.58)	1.208** (7.21)
Lagged Some work	0.803**[4.89]	1.709**[13.22]	1.340**(10.61)	1.606**(15.96)
Catholic school × Lagged-Work intensively	-0.198[-0.54]	0.226[0.62]	0.658[1.45]	0.500[1.15]
Independent school × Lagged-some work	0.306[0.65]	0.628[1.35]	0.172[0.35]	-0.012[-0.02]
Catholic school × Lagged-Work intensively	-0.124[-0.50]	-0.289*[-1.73]	0.001[-0.00]	-0.023[-0.15]
Independent school × Lagged-some work	-0.061[-0.20]	-0.095[-0.49]	0.258[-0.76]	-0.336*[-1.86]
State dummies			Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the parentheses.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

Table B4 Parameter estimates: enrolment intention (dynamic) equation

Variables	Boys	Female
Constant	-5.896**[-10.8]	-2.872**[-6.39]
Indigenous	-0.630[-1.36]	-0.257[-0.60]
Born later than 1984	0.011[0.00]	2.102[0.83]
Regional Australia	0.157[0.94]	0.017[0.12]
Rural Australia	0.088[0.51]	0.307*[1.94]
Catholic school	0.367**[2.16]	0.294*[1.90]
Independent school	0.039[0.17]	0.119[0.60]
Born in non-Eng. Europe/L. America	-0.520[-0.74]	0.808[1.26]
Born in other non-Eng. countries	0.088[0.17]	0.114[0.24]
Both parents born in non-Eng. country	0.937**[3.55]	1.210**[4.59]
Father educ: no qual. or Yr 12	-0.645**[-2.92]	-0.606**[-3.01]
Father educ: qual., no Yr 12	-0.680**[-4.39]	-0.485**[-3.52]
Father educ: no qual., but Yr 12	0.287[1.12]	-0.017[-0.07]
Father educ: missing	-0.614[-1.22]	-1.123**[-3.70]
Mother educ: no qual. or Yr 12	-0.330[-1.52]	-0.270[-1.52]
Mother educ: qual., no Yr 12	-0.795**[-3.50]	-0.347[-1.48]
Mother educ: no qual., but Yr 12	-0.040[-0.20]	0.306*[1.81]
Mother educ: missing	-1.078**[-1.97]	0.078[0.21]
Migrants: arrival high school or later	-0.279[-0.32]	-0.034[-0.04]
Migrants: arrival during primary school	0.408[0.88]	-0.067[-0.17]
Migrants: arrival before school	-0.187[-0.36]	0.288[0.67]
LOTE: European	-0.043[-0.10]	-0.804*[-1.94]
LOTE: Asian	1.550**[3.06]	1.239**[2.55]
LOTE: Arab	0.903[1.21]	-0.417[-0.48]
LOTE: other	0.448[0.26]	0.570[0.51]
Self-assessed: English above average	1.202**[9.36]	1.188**[10.34]
Self-assessed: math above average	1.082**[8.30]	0.889**[7.53]
Same school as in 1998	-0.114[-0.72]	0.218[1.56]
1998 test score above average	1.671**[12.18]	1.133**[9.53]
Prop. of students not working work	0.738**[1.97]	0.016[0.05]
Prop. of students above avg. test score	-0.253[-0.53]	-0.228[-0.48]
Prop. of students intend to go to university	4.319**[11.53]	4.857**[13.56]
Prop. of students' father having qual. and Yr 12	1.108[1.61]	-1.390**[-2.27]
Prop. of students' mother having qual. and Yr 12	0.192[0.27]	1.338**[2.09]
Prop. of students finish homework	-1.359**[-2.34]	-0.419[-0.85]
Prop. of students think mates eager to learn	0.360[0.54]	0.000[0.00]
Prop. of students think mates work hard	0.486[0.70]	-0.316[-0.51]
Prop. of students think mates well behaved	-1.072*[-1.76]	-0.021[-0.03]
Prop. of students think teachers qualified	0.698[1.14]	-0.156[-0.29]
Work intensively in previous year	-0.274[-0.96]	-0.150[-0.70]
Some work in previous year	0.247[1.55]	-0.064[-0.54]
Catholic school × Lagged-Work intensively	0.101[0.22]	-0.041[-0.09]
Independent school × Lagged-some work	0.109[0.21]	-0.082[-0.12]
Catholic school × Lagged-Work intensively	0.168[-0.75]	-0.061[-0.32]
Independent school × Lagged-some work	0.205[-0.81]	0.349[1.36]
State dummies	Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the parentheses.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY1998.

Table B5 Parameter estimates: enrolment equation

Variables	Boys	Girls
Constant	-7.911**[-9.83]	-4.937**[-6.83]
Indigenous	-1.418**[-2.32]	-0.969[-1.20]
Born later than 1984	-0.422[-0.16]	3.333[0.18]
Regional Australia	0.121[0.52]	0.093[0.43]
Rural Australia	0.562**[2.31]	0.652**[2.64]
Catholic school	0.319[1.47]	0.422*[1.92]
Independent school	0.208[0.68]	0.146[0.50]
Born in non-Eng. Europe/L. America	-0.348[-0.40]	-0.559[-0.62]
Born in other non-Eng. countries	0.763[1.09]	-0.373[-0.60]
Both parents born in non-Eng. country	0.933**[2.66]	0.886**[2.36]
Father educ: no qual. or Yr 12	-0.970**[-3.24]	-0.986**[-3.36]
Father educ: qual., no Yr 12	-0.673**[-3.06]	-0.520**[-2.54]
Father educ: no qual., but Yr 12	-0.171[-0.53]	-0.541[-1.50]
Father educ: missing	-1.514**[-2.26]	-1.059**[-2.20]
Mother educ: no qual. or Yr 12	-0.512*[-1.77]	-0.374[-1.45]
Mother educ: qual., no Yr 12	-0.555*[-1.76]	-0.350[-1.02]
Mother educ: no qual., but Yr 12	0.219[0.86]	0.347[1.39]
Mother educ: missing	-0.369[-0.48]	-0.291[-0.49]
Migrants: arrival high school or later	0.337[0.23]	-0.424[-0.48]
Migrants: arrival during primary sch.	-0.734[-1.20]	0.825[1.38]
Migrants: arrival before school	-1.239*[-1.86]	0.652[1.13]
LOTE: European	0.029[0.05]	-0.628[-0.97]
LOTE: Asian	0.945[1.54]	0.709[1.20]
LOTE: Arab	-0.158[-0.17]	-1.876[-1.53]
LOTE: other	0.295[0.26]	-0.005[-0.00]
Self-assessed: English above average	1.282**[7.13]	1.257**[7.19]
Self-assessed: math above average	1.433**[7.67]	1.471**[8.04]
Same school as in 1998	-0.520**[-2.34	0.162[0.77]
1998 test score above average	2.018**[9.92]	1.712**[9.15]
Proportion of students not working	0.278[0.43]	-0.453[-0.71]
Prop. of students above average test score	0.766[1.04]	0.134[0.17]
Prop. of students intend to go to university	2.987**[4.20]	3.390**[5.02]
Prop. of students' father having qual. and Yr 12	0.537[0.50]	0.641[0.63]
Prop. of students' mother having qual. and Yr 12	2.699**[2.47]	1.582[1.50]
Prop. of students finish homework	-0.043[-0.05]	-1.221[-1.48]
Prop. of students think mates eager to learn	1.834*[1.67]	1.072[1.04]
Prop. of students think mates work hard	0.947[0.93]	-0.644[-0.65]
Prop. of students think mates well behaved	-1.876**[-2.05]	0.224[0.26]
Prop. of students think teachers qualified	0.569[0.65]	0.378[0.45]
Work intensively in previous year	-0.724**[-2.62]	-0.835**[-3.08]
Some work in previous year	0.361**[2.15]	0.104[0.63]
State dummies	Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the parentheses.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

Table B6 Attrition equation

Variables	Boys	Girls
Constant	-0.062[-0.13]	1.500**[3.22]
Indigenous	-0.092[-0.24]	0.169[0.35]
Born later than 1984	1.306[0.02]	-0.614[-0.67]
Regional Australia	0.405**[2.44]	-0.021[-0.13]
Rural Australia	0.134[0.81]	-0.032[-0.18]
Catholic school	-0.033[-0.19]	0.364**[2.19]
Independent school	-0.399[-1.51]	-0.142[-0.63]
Born in non-Eng. Europe/L. America	1.240[1.46]	0.507[0.72]
Born in other non-Eng. countries	-0.485[-1.05]	0.613[1.44]
Both parents born in non-Eng. country	-0.175[-0.67]	0.393[1.25]
Father educ: no qual. or Yr 12	-0.010[-0.04]	-0.351[-1.60]
Father educ: qual., no Yr 12	-0.024[-0.15]	-0.241[-1.59]
Father educ: no qual., but Yr 12	-0.011[-0.04]	-0.237[-0.86]
Father educ: missing	-0.273[-0.67]	-0.448[-1.21]
Mother educ: no qual. or Yr 12	-0.108[-0.54]	-0.103[-0.50]
Mother educ: qual., no Yr 12	0.155[0.63]	-0.051[-0.20]
Mother educ: no qual., but Yr 12	0.140[0.70]	-0.168[-0.90]
Mother educ: missing	0.533[1.11]	-0.204[-0.47]
Migrants: arrival high school or later	-0.889[-1.43]	-1.479**[-2.73]
Migrants: arrival during primary school	-0.083[-0.21]	-1.367**[-4.27]
Migrants: arrival before school	-0.251[-0.48]	-0.404[-0.99]
LOTE: European	-0.220[-0.60]	-0.235[-0.44]
LOTE: Asian	0.382[0.79]	-0.494[-1.11]
LOTE: Arab	0.120[0.19]	0.244[0.21]
LOTE: other	-0.453[-0.52]	-0.325[-0.39]
Self-assessed: English above average	0.175[1.35]	-0.043[-0.34]
Self-assessed: math above average	0.238*[1.87]	0.178[1.38]
Same school as in 1998	-0.467**[-2.58]	-0.297*[-1.70]
1998 test score above average	0.172[1.23]	0.363**[2.80]
Proportion of students not working	4.865**[10.38]	4.981**[11.41]
Proportion of students above avg. test score	0.742[1.38]	-0.449[-0.79]
Proportion of student intend to go to univ.	-0.948**[-2.27]	-1.400**[-3.07]
Proportion of students' fathers having qual. and Yr 12	-0.888[-1.24]	-0.775[-1.10]
Proportion of students' mothers having qual. and Yr 12	1.363[1.62]	1.041[1.41]
Proportion of students finish homework	-0.170[-0.26]	-0.292[-0.51]
Proportion of students think mates eager to learn	-0.546[-0.72]	-1.041[-1.42]
Proportion of students think mates work hard	1.454*[1.91]	1.136[1.63]
Proportion of students think mates well behaved	-0.537[-0.82]	-0.562[-0.86]
Proportion of students think teachers qualified	0.445[0.70]	0.947[1.62]
Intend to go to university in previous year	.655**[4.32]	.477**[3.38]
Likelihood ratio test that the slopes are jointly 0	Reject	Reject
State dummies	Yes	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the brackets. Likelihood ratio tests show that parameters are jointly significant for both equations.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

Table B6A Marginal effects on probabilities of remaining in the sample

Variables	Male	Female
Indigenous	-.001[-0.24]	.006[0.35]
Born later than 1984	.020[0.02]	-.021[-0.64]
Regional Australia	.006*[1.68]	-.001[-0.13]
Rural Australia	.002[0.76]	-.001[-0.18]
Catholic school	.000[-0.19]	.013[1.41]
Independent school	-.006*[-1.66]	-.005[-0.70]
Born in non-Eng. Europe/Latin America	.019[1.18]	.018[0.69]
Born in other non-Eng. countries	-.007[-0.93]	.021[1.15]
Both parents born in non-Eng. country	-.003[-0.65]	.014[1.08]
Father educ: no qual. or Yr 12	.000[-0.04]	-.012[-1.27]
Father educ: qual., no Yr 12	.000[-0.15]	-.008[-1.22]
Father educ: no qual., but Yr 12	.000[-0.04]	-.008[-0.78]
Father educ: missing	-.004[-0.63]	-.016[-1.03]
Mother educ: no qual. or Yr 12	-.002[-0.52]	-.004[-0.49]
Mother edu: qual., no Yr 12	.002[0.61]	-.002[-0.20]
Mother educ: no qual., but Yr 12	.002[0.66]	-.006[-0.85]
Mother educ: missing	.008[0.99]	-.007[-0.47]
Migrants: arrival high school or later	-.013[-1.17]	-.051[-1.65]
Migrants: arrival during primary school	-.001[-0.21]	-.047*[-1.89]
Migrants: arrival before school	-.004[-0.47]	-.014[-0.89]
LOTE: European	-.003[-0.57]	-.008[-0.44]
LOTE: Asian	.006[0.74]	-.017[-0.99]
LOTE: Arab	.002[0.19]	.008[0.21]
LOTE: other	-.007[-0.50]	-.011[-0.39]
Self-assessed: English above average	.003[1.07]	-.001[-0.34]
Self-assessed: math above average	.004[1.34]	.006[1.15]
Same school as in 1998	-.007[-1.45]	-.010[-1.14]
1998 test score above average	.003[1.10]	.013*[1.78]
Proportion of students not working	.073**[2.20]	.173**[2.26]
Proportion of students above average test score	.011[1.11]	-.016[-0.76]
Proportion of student intending to go to university	-.014[-1.48]	-.049*[-1.78]
Proportion of fathers having qual. and Year 12	-.013[-1.10]	-.027[-1.00]
Proportion of mothers having qual. and Year 12	.021[1.40]	.036[1.28]
Proportion of students finish homework	-.003[-0.26]	-.010[-0.48]
Proportion of students think mates eager to learn	-.008[-0.65]	-.036[-1.07]
Proportion of students think mates working hard	.022[1.51]	.039[1.42]
Proportion of students think mates well behaved	-.008[-0.78]	-.020[-0.85]
Proportion of students think teachers qualified	.007[0.72]	.033*[1.64]
Intend to go to university in previous year	.010**[1.96]	.017**[1.97]
State dummies	No	

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the brackets.
LOTE = language other than English.

Source: Authors' calculation based upon LSAY 1998.

Table B7 Parameter estimates: variance and co-variances estimates of the random effects

	Boys				Girls			
	In initial equations (Δ^0)		In dynamic equations (Δ)		In initial equations (Δ^0)		In dynamic equations (Δ)	
σ_3^2	1.989	[4.63]**	1.002**	[2.09]	1.263	[3.71]**	0.855	[1.37]
σ_{23}	1.243**	[5.04]	0.856**	[3.45]	0.889**	[4.28]	0.584**	[2.36]
σ_2^2	0.943**	[4.35]	0.751**	[3.79]	0.795**	[4.17]	0.482**	[2.94]
$\sigma_{3\theta}$	-1.496**	[-8.07]	-0.580**	[-3.65]	-0.932**	[-6.76]	-0.428**	[-2.43]
$\sigma_{2\theta}$	-0.058	[-0.47]	-0.356**	[-3.50]	0.198**	[1.98]	0.062	[0.58]
σ_θ^2	5.770**	[12.66]	1.396**	[6.10]	5.023**	[13.68]	1.846**	[4.23]
σ_e^2		1.200**	[4.05)			2.149**	[3.47]	
Likelihood:		-6 212			Likelihood:	-6 940		
Number of obs:		18 340 (of 5 380 individuals)			Number of obs:	19 444 (of 5 324 individuals)		

Notes: * Significant at 10% level; ** Significant at 5% level; *t*-values are in the brackets.

Source: Authors' calculation based upon LSAY 1998.

Table B8 Comparison of samples with and without attrition

Variables	Mean	
	All	Those missing in Grade 12
Boys	.503	.540
Born in Australia/NZ and other English-speaking countries	.928	.916
Born in non-English European/Latin American countries	.016	.019
Born in other countries	.056	.065
Residence: metropolitan	.606	.628
Residence: regional	.220	.212
Residence: rural or remote	.174	.160
Indigenous	.028	.043
Arrived in Australia during high school	.018	.031
Arrived in Australia during primary school	.044	.046
Arrived in Australia before primary school	.032	.036
Test score in Year 9 above average	.513	.421
Self-assessment in Year 9: English above average	.465	.399
Self-assessment in Year 9: maths above average	.465	.417
Language at home: English	.904	.886
Language at home: European	.034	.036
Language at home: Asian	.040	.046
Language: Arabic	.011	.018
Language at home: other	.007	.007
NSW	.251	.253
Vic.	.212	.213
Qld	.214	.224
SA	.088	.084
WA	.117	.114
Tas.	.053	.047
NT	.029	.034
ACT	.036	.031
Neither father nor mother born in English speaking countries	.143	.164
Father finish Year 12 and with qualification	.440	.405
Mother finish Year 12 and with qualification	.427	.398
Proportions of students in school in 1998 (excluding self):		
who are working	.231 (.09)	.224(.09)
with test scores above average	.503 (.19)	.474(.19)
who intend to study in a university	.497 (.19)	.478(.19)
whose father finished Year 12 and with qualification	.469 (.18)	.455(.18)
whose mother finished Year 12 and with qualification	.449 (.16)	.433(.16)
who finish homework	.282 (.12)	.279(.12)
who believe their school friends are eager to learn	.611 (.13)	.603(.13)
who believe their school friends work hard	.629 (.14)	.620(.14)
who believe their school friends are well behaved	.563 (.16)	.551(.16)
who believe their teachers are qualified	.691 (.15)	.682(.16)
School type in Year 9: government	.623	.673
School type in Year 9: Catholic	.227	.188
School type in Year 9: independent	.150	.139
Obs.	10,704	3,996

Source: Authors' calculation based upon LSAY 1998. Study-work status is in 1998.