Why are high ability individuals from poor backgrounds under-represented at university? *

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Abstract

We analyse data in which individuals from low socioeconomic status (SES) backgrounds have lower university participation rates than those from higher SES backgrounds. Our focus is on the role played by credit constraints in explaining these different participation rates. We propose a multistage model of education where university participation is contingent on ability to pay and high school academic performance, which depends on family SES and innate student ability. We find no evidence that credit constraints deter high achieving students from attending university in Australia, a country with an income contingent loan scheme for higher education tuition fees. We do, however, find that how students convert their earlier school performance into the scores on which university entrance is based is contingent on their SES. That is, for students of similar ability, those from higher SES backgrounds are more likely to obtain university entrance scores and achieve higher scores if they do. Hence, policy interventions that rectify the credit constraint problem that faces individuals at the time they make university entrance decisions are not sufficient to equalize university participation across social groups.
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1 Introduction

There is strong international evidence that students of lower socioeconomic status (SES) are less likely to attend university than students of higher SES. This evidence can be found in Heckman (2000) and Carneiro and Heckman (2002) for the United States, Greenaway and Haynes (2003), Galindo–Rueda *et al.* (2004) and Dearden *et al.* (2004) for the UK, Chapman and Ryan (2005) for Australia and Finnie and Laporte (2003) for Canada, while Blossfeld and Shavit (1993) provide a collection of studies with evidence on a further 13 countries. While all of these studies have varying approaches, an underlying message is that students of lower SES are much less likely to attend university than otherwise similar students of higher SES.

The natural response to the question of why these low SES students have low university participation rates is that their low SES must leave them credit constrained, unable to afford a university education. In fact, across the world, these credit constraints have been the subject of numerous, diverse education policy responses, ranging from targeted scholarships to loan guarantees to income contingent loans to nationalised university systems without tuition fees. Across a wide range of institutional structures, similar patterns are observed, with the poor attending university in lower numbers than the relatively wealthy. Carneiro and Heckman (2002) address this question directly by identifying what portion of the US college ready population faces credit constraints, finding that around 8% of potential students are credit constrained, suggesting that (i) existing post-secondary education funding policies seem to be effective and (ii) the low participation by low SES students cannot be explained by credit constraints alone.

In this paper, we address a similar question to that of Carneiro and Heckman (2002). We identify the role of credit constraints in determining university participation in Australia. This is of wide interest because Australia was the first economy to initiate an income contingent loan scheme for university tuition, called the Higher Education Contribution Scheme (HECS), in the late 1980's; see Chapman (1997). This scheme has been the foundation of numerous income contingent loan schemes around the world; see Chapman (2005). In the UK, student income support currently takes the form of an income contingent loan scheme while the soon to be introduced framework of variable tuition fees will include a deferred payment scheme with income contingent repayments. The theoretical implication of HECS in Australia is that no student should face credit constraints when deciding to enter university, as students can, in effect, take out loans at zero real interest, deferring tuition payment. Students are not required to repay these loans until their income is sufficiently high. If HECS does eliminate credit constraints effectively, then we are forced to seek alternative explanations for the low university participation by low SES students.

In order to analyse this question, we propose a model of multistage education to explain the low participation of low SES households in university education. The key to our model is that university attendance does not depend soley on the student's ability to meet its costs. It also depends on educational outcomes in earlier stages, for example primary and secondary school. Even without credit constraints, such a framework can predict lower university participation by students of low SES. This arises from differential within family effects which depend on family SES and which have likely persisted throughout childhood. We also incorporate a role for the student's innate ability. Thus university participation depends on ability to pay and schooling outcomes which in turn depend on SES/family background and innate student ability.

In the data we analyse here, we partition the population into three groups that reflect the social background and access to financial resources of young Australians. This provides groupings of Australian students that are more or less likely to be credit constrained when making university attendance education decisions. Almost 70 per cent of the group with the highest social background attended university within the first two years after they completed school. Less than 20 per cent of the low SES group attended university. Yet we find that none of this difference reflects the impact of credit constraints among the low SES group. Principally, differences in university attendance rates reflect differences in the way early school academic performance was translated into later school performance and differences in the early school academic performance levels between groups. In our analysis, we are able to highlight the differences in the experiences of students from different social background groupings using simple diagrams, drawing on the approach taken in Barsky *et al.* (2002). However, we also present regression estimates that account for some of the 'selection' processes that we expect to have influenced the observed data. These regression estimates suggest that the diagrams we present capture the key elements that determine which individuals go to university.

The next Section sketches the theoretical framework that lies behind our empirical approach, which is described in Section 3. The data are described in Section 4 and our results in Section 5. Concluding remarks are made in Section 6.

2 Theoretical Foundations

In order to identify factors that influence university participation, we propose a theoretical framework of student progress through school to university. The key aspects of our framework are that participation in university education depends on two broad factors. First, we assume the student or the student's family needs to be able to pay the costs of university education. That is, in order to participate, the household must not be credit constrained at the time of the entrance decision. Education financing policies such as scholarships targeted to disadvantaged students, income contingent loan schemes and fully public provision of university education suggest that policy makers are concerned by the credit constraint issue. The second factor that we incorporate into our framework is that a student must satisfy some merit based entrance requirement in order to gain entry to university. This could be thought of as a technology constraint, where universities require a minimum level of achievement to ensure that students have the ability to cope with the program offered.[1]

[1] While we do not model a market for university places, a merit based entrance requirement can also be thought of as one dimension of a rationing policy for a capacity constrained university facing excess demand. This dimension will be particularly important in cases where universities have little control over tuition fees charged, for example in a centralised public university system where tuition is relatively uniform across many institutions, such as has been the case in Australia and the UK.

In terms of a reduced form structure, we propose a model where university participation by a student from household i denoted by a dummy variable, u_i, is a function of household income when the university entrance decision is made, w_i^u, and the student's achievement or human capital at the end of schooling, h_i:

$$u_i = f\left(w_i^u, h_i\right) \tag{1}$$

where $u_i = 1$ when the student participates in university and $u_i = 0$ otherwise.

While many studies treat ability measured at the entrance decision as exogenous, see for example De Fraja (2001), our approach is in the spirit of Carneiro *et al.* (2003) where we treat ability measured at the entrance decision as endogenous, the outcome of schooling and other household decisions about the student's education. The importance of such an approach is that it allows us to depart from the more conventional focus on short term credit constraints as the sole source of a student's inability to participate in university education. The objective is to analyse more rigorously the production of end of schooling human capital, h_i, which is used to determine entry to university. This is done in a relatively conventional way, using an education production function with a reduced form:

$$h_i = g\left(w_i^s, a_i, x_i\right) \tag{2}$$

where w_i^s denotes household income when schooling decisions are made, a_i denotes students' raw ability measured before final schooling outcomes and x_i is a vector of individual household factors, controlling for socioeconomic factors. One implication of this framework is that we can think of education as a multi-stage process, where participation in later stages is contingent on choices made in earlier stages, an intuitively appealing feature given that this seems to be the way that students progress through their schooling. For our purposes, such a structure is useful because it allows us to identify if short term factors, like credit constraints facing university candidates, are important in determining whether they can attend university. This can be posed against the alternative of whether factors that determine school outcomes are more important in determining university entrance.

3 Estimation Methodology

Assume that the population can be partitioned into three groups that reflect the extent to which they face a credit constraint in terms of their participation at university. The group indexed by n face no constraints; the group indexed by c are constrained and the group indexed by m are a middle group whose position is not known. That is, the population is partitioned into groups that reflect broadly their access to financial resources. The determination of these groups is described in the next section.

Denote the group, G, to which an individual belongs as $G \in \{c,\ m,\ n\}$ and their participation at university by u, as before. Then in terms of the framework outlined in the previous section, we might view this outcome as determined in the following (parametric) way:

$$u_i = f_G(\delta_G h_i) = \ f_G(\delta_G \pi_G a_i). \tag{3}$$

where δ_G is a parameter that varies between groups and reflects the impact of credit constraints on whether individuals with the same level of human capital at the end of their schooling attend university. Further for presentational purposes, we assume that the human capital of individuals at the end of their schooling is their starting level of ability multiplied by a group–specific parameter, π_G. That is, we allow differential access to financial resources to affect both the way ability is converted into end of schooling human capital and differences in the propensity to attend university, given that human capital.

Consequently, differences in observed university participation rates between groups then reflect three factors: differences in their starting distributions of ability; differences between the groups in the way they convert that ability into human capital at the end of their schooling (captured by differences in π_G); and differences between groups in their preparedness to pay to attend university, given their human capital at the end of their schooling (captured by differences in δ_G). Differences in the δ_G parameters between the groups indicate the extent to which credit constraints influence university enrolment patterns.

Now imagine that we possess a measure of the human capital of individuals at the end of their schooling, which we denote by y_i and an earlier measure of their school performance, which we denote by p_i and refer to as early school performance. We assume that early school performance, p_i, is exogenous and that this performance has a bounded support, $p_i \in \left[\underline{p}, \overline{p}\right]$, and that $g_p(p|G)$ is the distribution of these early school performance measures, conditional on membership of group G.[2] We further assume that y_i and p_i are related by some function that varies between groups such that $y_i = \lambda_G(p_i)$, $y_i \in \left[\underline{y}, \overline{y}\right]$ and define $g_y(y|G)$ to be the distribution of human capital at the end of schooling, conditional on membership of group G. However, the measure of performance at the end of their schooling (y_i) is only available for a subset of individuals, those who complete all of the requirements for an award of a school completion certificate and earn what is known as an Equivalent National Tertiary Entrance Rank or ENTER score, which is a rank of relative performance (described in more detail in the next section). In order to be considered for a university place, we assume that a student must possess such an ENTER score.[3] While all students possess some human capital at the end of schooling, this human capital is effectively unobserved for the purposes of university entrance if the student has not earned an ENTER score. We thus have y_i as being observed only if underlying final school performance $y_i^* > \phi$, where the $*$ superscript denotes the household's optimal choice and ϕ is some threshold value, denoting some minimum requirement in order for an ENTER score to be awarded. Our interest is on the probability individuals from group G attend university($u_i = 1$), which we write as $Prob[u|G]$. This is given by:

[2] We do not denote early school performance as a_i (innate ability above) because early school performance is expected to reflect not only innate ability but household and schooling influences.

[3] Admission to university on the basis of ENTER scores is the dominant mode for those completing school in Australia. Other criteria are used for mature aged entrants.

$$
\begin{aligned}
Prob[u|G] &= Prob[u|G,\ y^* > \phi] \ \times \ Prob(y^* > \phi|G) + Prob[u|G,\ y^* \leq \phi] \ \times \ Prob(y^* \leq \phi|G) \\
&= Prob[u|G,\ y^* > \phi] \ \times \ Prob(y^* > \phi|G) \\
&= \int_{\phi}^{\overline{y}} Prob[u|G,\ y]\ g_y(y|G)\ dy \times \ \int_{\underline{p}}^{\overline{p}} Prob(y^* > \phi|G,\ p)\ g_p(p|G)\ dp \\
&= \int_{\phi}^{\overline{y}} Prob[u|G,\ y]\ g_y(\widetilde{\lambda_G}(p)|G)[\frac{dy}{dp}]\ dp \times \ \int_{\underline{p}}^{\overline{p}} Prob(y^* > \phi|G,\ p)\ g_p(p|G)\ dp \\
&= \int_{\lambda_G^{-1}(\phi)}^{\lambda_G^{-1}(\overline{y})} \widetilde{\delta_G}(y)\ \widetilde{\psi_G}(p)[g_y(\widetilde{\lambda_G}(p)|G)\ dp] \times \ \int_{\underline{p}}^{\overline{p}} \widetilde{\theta_G}(p)\ [g_p(p|G)\ dp]. \qquad (4)
\end{aligned}
$$

Based on equation (4), there are five factors that determine the probability that members of group G attend university. The first is a parameter which reflects the likelihood of attending university conditional on the individual's end of schooling human capital (ENTER score), $\widetilde{\delta_G}(y)$. The second is a parameter that reflects how earlier school achievement is translated into end of schooling human capital (ENTER scores) for that group, $\widetilde{\psi_G}(p) = \frac{dy}{dp}$. The third is the distribution of end of school human capital (enter score) in group G, $g_y(\widetilde{\lambda_G}\,(p)\,|G)$. The remaining two factors determine the proportion of students from group G who achieve final school performance $y^* > \phi$, those that earn a school completion certificate and an ENTER score. This comprises the fourth factor which reflects the likelihood individuals in the group obtain an end of schooling human capital score($y^* > \phi$), given their earlier school achievement level, $\widetilde{\theta_G}(p) = Prob(y^* > \phi|G, p)$, while the last factor is the exogenous starting distribution of school achievement in group G, $g_p(p|G)$.

In the sections that follow we represent graphically how the functions $\widetilde{\delta_G}(y) \times y$, $\widetilde{\psi_G}(p) \times p$ and $\widetilde{\theta_G}(p) \times p$ differ between the groups $G \in \{c,\ m,\ n\}$, along with the starting distribution of school achievement for each group, $g_p(p|G)$. These figures are based on conditional means that we estimate non-parametrically.[4] This approach draws on that undertaken in Barsky *et al.* (2002).

Equation (4) has a ready parametric regression counterpart as:

$$
\begin{aligned}
Prob[u|G] &= Prob[u|G, y^* > \phi] \;\times\; Prob\,(y^* > \phi|G) \\
&= F_{1G}\,(y_i\beta_G) \;\times\; F_{2G}\,(p_i\gamma_G) \\
&= F_{1G}\,((p_i\eta_G)\,\beta_G) \;\times\; F_{2G}\,(p_i\gamma_G) \qquad (5)
\end{aligned}
$$

where F_{1G} and F_{2G} are CDFs and where y and p might also include higher order terms, and are supplemented with other background variables in the actual regressions. The parameters on the y and p variables (including the higher order terms) would provide estimates of $\widetilde{\delta_G}(y)$, $\widetilde{\psi_G}(p)$ and $\widetilde{\theta_G}(p)$. A common assumption for the CDFs is that they follow the standard normal distribution. This is simply a bivariate probit selection problem, where the first element of equation (5) is estimated conditional on the second part being equal to unity. It is of interest to obtain estimates of both $\widetilde{\psi_G}(p)$, which measures the conversion of early school performance into later performance and $\widetilde{\delta_G}(y)$, the credit constraint effect, from the first part of equation (5). This can be done by treating those without end of schooling human capital scores as a sample selection problem, with the relationship estimated over those with scores taking this selection into account. Estimates of $\widetilde{\delta_G}(y)$can be obtained from the probit university attendance equation $\Phi(y_i\beta_G)$ estimated over those for whom we observe end of schooling human capital (an ENTER score), while estimates of $\widetilde{\psi_G}(p)$ can be obtained from the parameters of the regression of y_i on p_i, where the selection of those obtaining scores is taken into account in both equations.

Specifically, we estimate the following equations:

[4]We use the *lowess* program in *STATA* to generate these estimates of the parameters.

$$y_i^* = \alpha_{10} \ + \kappa_1 \ p_i \ + \tau_1 \ G_i^* + \varphi_1(p_i \times G_i^*) + X_i'\beta_1 + Z_{1i}'\mu_{11} + Z_{2i}'\mu_{12} + \ e_{1i}. \tag{6}$$

$$y_i = \alpha_{20} \ + \kappa_2 \ p_i \ + \tau_2 \ G_i^* + \varphi_2(p_i \times G_i^*) + X_i'\beta_2 + Z_{1i}'\mu_{21} + \ e_{2i}, \qquad \forall \ i \ s.t. \ y_i^* > \phi. \tag{7}$$

$$u_i^* = \alpha_{30} \ + \kappa_3 \ y_i \ + \tau_3 \ G_i^* + \varphi_3(y_i \times G_i^*) + X_i'\beta_3 + Z_{2i}'\mu_{32} + \ e_{3i}, \qquad \forall \ i \ s.t. \ y_i^* > \phi. \tag{8}$$

where u_i^* is the 'underlying' university participation variable whose realisation u_i is observed with $u_i = 1$ iff $u_i^* > 1$, G_i^* are group indicator variables, the Xs reflect demographic characteristics, the Z's are 'instruments' discussed below, the Greek letters are parameters or parameter vectors and the e's are random errors. Tests of the significance of the τ's indicate whether the group effects matter in the positioning of the relationship between achievement or the ENTER scores and the dependent variables, while tests of the φ's indicate whether the slopes of these relationships vary between the groups.

As already indicated, estimation of equation (7) makes use of 'selection' term derived from estimation of equation (6) to account for any correlation between the error terms of the two equations. Similarly, equations (6) and (8) are estimated jointly via bivariate probit to take account of the correlation between the error terms of those two equations. Tests for selection bias arising from non-randomness in decision to obtain an ENTER score (equation 6) involve tests of the estimated correlation coefficient between the errors of the equations. It is also possible that the errors of equations (7) and (8) might be correlated, in which case the variable y_i is endogenous in equation (8). We test for this below and describe how the results change when this variable is treated as endogenous. Regression results that reflect the framework of equations (6) – (8) are presented in the results section below.

4 Data

This paper utilizes data from two Longitudinal Surveys of Australian Youth (LSAY) cohorts to assess the size of the group who might attend university but face credit constraints. These are the Longitudinal Surveys of Australian Youth Year 9 cohorts of 1995 (LSAY 95) and 1998 (LSAY 98).

These cohorts are drawn from two-stage cluster samples of Australian school children. In the first stage, schools were randomly selected. In the second stage, intact classes of Year 9 students from those schools were randomly selected. The samples were stratified by school sector (government, Catholic or independent private schools). Population means in this paper are estimated with weighted data to account for this stratification.[5] In the first survey year, when students were in Year 9, they completed literacy and numeracy tests at their schools, along with a short questionnaire to elicit background information. Participants were surveyed in subsequent years by mail and/or telephone questionnaires. In their fifth and subsequent contact years in both surveys, subjects were asked whether they had received the relevant certificate from their jurisdiction to indicate they had completed Year 12, whether they had obtained an ENTER score and whether they were studying at university. A student is awarded an ENTER score if they complete a pre-university entrance program in their final (twelfth) year of schooling. The ENTER score is based on their achievement in statewide examinations and other assessment tasks and reflects the percentile rank of the student's performance within their cohort.[6] The second (LSAY 98) cohort was also asked whether they had applied for admission to a university course and whether they had been offered a place.

The analysis comparing university enrolment among individuals with similar ENTER scores was conducted for both the LSAY 95 and LSAY 98 cohorts. These groups could first

[5] The weights also attempt to take account of survey attrition.

[6] The name given to the university entrance rank score differs between Australian jurisdictions, as do their scales, the requirements for obtaining them and the proportion who undertake Year 12 studies who obtain an entrance rank. An ENTER score is a generic name for these entrance ranks that is calibrated to a common, Australian-wide scale that ranges from 30 to 99.95

have attended university in 1999 and 2002, respectively. Since the results are so similar for the two cohorts, only those for the latter cohort are presented in detail.

The achievement scale used in this paper is the average of their literacy and numeracy performance in Year 9, as represented in separate scales developed by Rothman (2002).[7] The individual scales were constructed to have a mean of 50 and standard deviation of 10 and the average scale has a standard deviation of 8.5.

Definition of the 'groups' facing differing levels of credit constraint

For the purposes of this paper, the group treated as *least likely* to face credit constraints are students who in Year 9:

1. were in the top socio-economic status quartile, based on their parent's occupation;[8]
2. attended a school in the top socio-economic status quartile of schools, based on the average of parents' occupation in schools; and
3. attended a non-government school.

The last criterion is used to ensure that only individuals whose families had already demonstrated a preparedness to pay for at least part of their child's education were included in this group. The first two criteria are designed to pick out those students with the highest social backgrounds at the schools where such students are most concentrated. This group constitutes 7 % of the weighted sample of LSAY 98 data.

By contrast, the group treated as *most likely* to face credit constraints are students who in Year 9 were in the lowest socio-economic status quartile who attended schools in the lowest average socio-economic status quartile of schools. This group constitutes almost 10

[7]Where only one of the literacy and numeracy scales is available, it was used as the achievement score. This affected about 2.4 per cent or 180 observations of the 7532 used in the regression equations.

[8]The ANU 3 scale (Jones 1989) is used for the 1995 cohort and the ANU 4 scale (Jones and McMillan 2001) for the 1998 cohort. Both scales are status-based occupational prestige measures, where the scales lie between 0 and 100. The relevant 'parent' is the student's father unless information about his occupation is missing. In those circumstances, information on the occupation of the student's mother is used.

% of the weighted sample of LSAY 98 data. The *potentially constrained* group are all other Year 9 students.[9]

The size of these various groups and some summary statistics for them are presented in Table 1. Consistent with the Australian and international evidence cited earlier, members of the high status social background group had the highest university participation rate and the highest average ENTER score. In turn, the middle group had a lower average ENTER score and university participation rate, while the low SES group had the lowest average ENTER score and university participation rate.

Evidence on how well these criteria have partitioned Year 9 students according to other indicators of wealth and social background is presented in Table 2 for the 1995 cohort. The other indicators include a wealth scale, based on household possessions,[10] two social status indexes constructed by the Australian Bureau of Statistics (ABS), whether students or their parents received government student income support in their last year of school and indicators derived from neighbourhood–based income rankings in taxation data.[11] The two ABS social status indexes provide an indication of the average social backgrounds of the neighbourhoods in which the Year 9 students lived in 1995.[12] The rankings based on

[9]Variations in these definitions were used to test how sensitive the results reported below were to the specific SES variable and the group selection criteria used here. Partitioning school students according to alternative SES measures, such as the ABS neighbourhood-based SES measures or those based on average taxable incomes within postcodes, along with a composite measure that included elements of all SES measures, with the weights based on parameters from a regression equation explaining students' future expected occupations, did not change the qualitative features of the results. Variations in the criteria used included removing the private school requirement from the first criteria, basing the groups solely on individual SES and using three groups rather than quartiles for the individual and school SES classifications. Among these variations, only the last change had any discernible impact on the regression estimates, with slightly smaller estimated differences between the groups.

[10]The wealth scale is based on responses individuals gave regarding the presence in their household of a: computer; CD player; piano; swimming pool; dishwasher; telephone; mobile phone; colour television; video camera; and microwave oven.

[11]The government student income support program in Australia is called AUSTUDY. It provides means tested income support to disadvantaged students in the later years of high school and through university.

[12]The ABS social status indexes are based on 1991 Census Collection Districts (CDs). One scale reflects the education and occupational characteristics of the individuals living in the CDs, with the weights derived from principal component analysis of these characteristics. The second scale is based on a broader set of SES measures, including the proportions with low family income, unemployment, single parent families and those living in public housing.

taxation data are rankings of the suburbs in which individuals lived in 1995.[13]

It is clear from Table 2 that members of the *least likely* group come from very privileged backgrounds. The typical student in that group has a higher value for the wealth scale than 70 percent of individuals in the cohort. Approximately half are in the top deciles of the two ABS indexes and three quarters in the top quartiles. They live, predominantly, in concentrations with other high SES and high income people. All of the indicators demonstrate clearly that members of the *least likely* group come from more privileged backgrounds than the *potentially constrained* group, who in turn have (or live near others with) substantially higher social backgrounds than members of the *most likely* constrained group. Comparable data for the wealth variable and the ABS SES indexes are not available for the LSAY 98 cohort. However, the taxation–based indexes for the LSAY 98 cohort show the same patterns evident in Table 2.

5 Results

Differences in the distribution of earlier school achievement between groups

We first estimate the distributions of early school performance conditional on the credit constraint grouping G, given by $g_p(p|G)$ with $G \in \{c,\ m,\ n\}$, in terms of the earlier discussion. The empirical density functions of the group *most likely* to face credit constraints, the *potentially constrained* group and the most advantaged group are shown in Figure 1, with that of the most advantaged group well to the right of the other two distributions. Members of the group *most likely* to face credit constraints had the lowest levels of school achievement when measured in Year 9. These empirical density functions tell us that there are marked differences between average early school student performance (at about age 14 years) on the basis of potential credit constraints faced and SES. These differences are consistent with Carneiro and Heckman (2003) who argue that differences in cognitive performance are de-

[13]The taxation-based indexes are derived from averages for postcodes over the three financial years 2000-01 to 2002-03. The scales are based on a ranking of suburbs, with the figures in Table 2 representing the average ranking for each group.

termined early in a child's life, perhaps as early as eight years of age. We now analyse the data to identify if any of the other factors identified earlier affect end of school performance, ENTER scores and university participation.

Differences in the proportion who obtain an ENTER score between groups

Members of the group *most likely* to face credit constraints were also the least likely to obtain an end of schooling ENTER score. Table 1 shows the proportion of this group earning an ENTER score was 44 per cent, below that of the *potentially constrained* group (58 per cent) and that of the most advantaged, *least likely*, group (87 per cent). These differences between the groups reflected two phenomena also reported in Table 1 — different Year 12 completion rates and differences in obtaining ENTER scores conditional on completion of Year 12.

The proportions of individuals with an ENTER score, conditional on Year 9 achievement levels, are shown for the three groups in Figure 2. These are estimates of $\widetilde{\theta_G}(p) \times p = Prob(y^* > \phi | G,\ p)$. At very low levels of Year 9 achievement, the proportion who obtain an ENTER score is almost zero for all three groups. However, for all groups, these curves are increasing in early school achievement, implying that as early school achievement rises, the probability of earning an ENTER score also rises. An important feature of these curves is that for a given level of early school achievement, members of the group that is *least likely* to be credit constrained have the highest probability of earning an ENTER score, while members of the *potentially constrained* group in turn have a higher probability of earning an enter score than the *most likely* credit constrained group. These conditional probability orderings hold except at extreme early achievement measures, below 35 and above 65.[14]

The implication of this figure is that students from all groups choose not to attempt to enter university, but the incidence of this behaviour is highest among the group that may be constrained. We control for this potential self selection in the regression analysis below.

[14] A figure that also shows bootstrapped pointwise confidence bands at the 95 per cent level around the estimated proportions for the *most likely* and *least likely* constrained groups is available from the authors. It shows that the estimated proportions with ENTER scores in the *most likely* and *least likely* constrained groups are significantly different between achievement levels of approximately 40 and 65.

Differences in ENTER scores between groups among those with similar earlier school achievement

Among those who did obtain an ENTER score, members of the group *most likely* to face credit constraints typically obtained substantially lower ENTER scores than the members of the other groups. The average ENTER score was 60.3 among this group (as shown in Table 1), below that of the *potentially constrained* group (71.5) and that of the most advantaged group (83.4). These differences between the groups reflected two phenomena — differences in the early achievement distributions between the groups, already presented in Figure 1 and differences in the way achievement was translated into ENTER scores.

The average ENTER scores of individuals, conditional on their Year 9 achievement levels, are shown for the three groups in Figure 3. In terms of the framework provided earlier, the lines show $\widetilde{\psi_G}(p) \times p$, where p is early school achievement.[15]

While all groups in Figure 3 exhibit a positive relationship between early school achievement and ENTER scores, the critically important point to be gleaned from this figure is that the same level of early school achievement maps into very different average ENTER scores for each of the three groups. Students from the *least likely* constrained group are able to convert a given level of early school achievement into an ENTER score of at least 10 points higher than a student from the group *most likely* to face credit constraints with the same early school achievement. It is thus clear that there are substantial differences in the way the early school achievement of individuals is converted into ENTER scores between these groups based on their social background. Disadvantaged students are unable to capitalise on their ability (as reflected in early school achievement) in the same way as their more advantaged, high SES counterparts, in terms of ENTER scores.

[15] Once more, a figure that also shows bootstrapped pointwise confidence bands at the 95 per cent level around the estimated conditional means for the *most likely* and *least likely* constrained groups is available from the authors. It shows that the estimated conditional means for the *most likely* and *least likely* constrained groups are significantly different between achievement levels from just below 40 to nearly 70.

Differences in university participation between groups for those with similar ENTER scores

In this section we focus on whether those with similar ENTER scores in the different groups go to university at similar rates. We take this to be the measure of how well institutions in place in Australia redress the problems some individuals face from credit constraints.

The estimated university participation of individuals with different ENTER scores are shown for the three groups in Figure 4. In terms of the framework provided earlier, the curves in Figure 4 are estimates of $\widetilde{\delta_G}(y) \times y = Prob[u|G,\ y]$, the likelihood of going to university conditional on an individual's end of schooling human capital or ENTER score.

In Figure 4, the curves for the three groups lie almost on top of each other throughout most of the range of ENTER scores. Only at the very top of the range of ENTER scores does the proportion studying in the *most likely* constrained group depart from those of the other groups, but the apparent drop is based on a very small number of observations and the differences are not statistically significant. Therefore, we conclude that differences in the propensity to go to university, conditional on the ENTER score individuals obtain, play very little role in explaining differences in the proportion going to university between the groups analysed here. That is, conditional on achieving a given ENTER score, students from the *most likely* credit constrained, low SES group are equally likely to attend university as the *least likely* credit constrained, high SES group.[16]

The conclusion we draw from Figure 4 is that credit constraints do not play a major role in the determination of university participation in Australia under current institutional arrangements. The results were qualitatively unchanged when the data were partitioned using other SES measures. In the terms of the theoretical framework proposed in Section 2, the relatively low university participation by low SES students is not the result of the income/ability to pay term, (w_i^u), in equation (1). That is, current institutional arrangements,

[16] Marks and McMillan (2006) report similar results. They analysed university participation within ENTER score ranges and found that within these ranges, individuals whose parental occupational backgrounds were 'blue' collar were as likely to participate in university as those whose parental occupational backgrounds were professional.

notably the HECS program, rectify the borrowing problem for individuals. Instead, the determining factors operate through the end of high school human capital (ENTER scores), summarised by h_i in equation (1) and influenced by early credit constraints, socioeconomic factors and student's raw ability, as suggested in equation (2).

What are the magnitudes of the effects?

As argued in the previous subsections, differences in the university participation rates between groups stem principally from three sources: differences in earlier school achievement; in the way members of the groups convert their earlier achievement into high ENTER scores; and in their propensity to obtain an ENTER score. Differences in the group members' propensities to attend university, given their ENTER scores, play no role in explaining differing participation rates. In this subsection we estimate the relative contributions of the three factors that do seem important in explaining differences in the university participation rates of our three groupings. We can reformulate equation (4) slightly in terms of the mean values of early achievement as:

$$Prob[u|G] = \widehat{\delta}_G(\overline{y})\ \widehat{\psi}_G(\overline{p})\ \overline{p}^y_G \times\ \widehat{\theta}_G(\overline{p})\ \overline{p}_G = \widehat{\delta}_G(\overline{y})\ \widehat{\psi}_G(\overline{p})\ \widehat{\theta}_G(\overline{p}) \times\ [\overline{p}^y_G\ \overline{p}_G]. \qquad (9)$$

where $\overline{p}^y_G$ is the average early achievement score of those who obtain an ENTER score in group G and $\overline{p}_G$ is the average in the whole group and all of the parameters are evaluated at the relevant mean values of their arguments for their group.

Equation (9) can be used to decompose $Prob[u|j] - Prob[u|k]$, where $j, k \in G$, into differences in the value of the parameters for the groups $\{j, k\}$ and for the early achievement levels of the respective groups. As in other cases, the decomposition can be undertaken in a number of ways, so there is no unique outcome. However, across the range of possible decompositions of the differences between the groups *most likely* and *least likely* to face credit constraints, differences in the early achievement to ENTER transformation rate $\left(\widehat{\psi}_G(\overline{p})\right)$ accounted for 30 per cent of the almost 50 percentage point difference in university participation rates in the 1998 cohort. Differences in the propensity to obtain an ENTER score $\left(\widehat{\theta}_G(\overline{p})\right)$ accounted for a further 30 per cent of the difference, with differences in average achievement levels by group ($\overline{p}^y_G \times \overline{p}_G$) accounting the balance of 40 per cent of the difference in participation rates.

For the almost 35 percentage point difference between the *potentially constrained* and *least likely* to face credit constraints groups, the relative contributions were 35, 30 and 35 for the transformation $\left(\widehat{\psi}_G(\overline{p})\right)$, propensity to obtain a score $\left(\widehat{\theta}_G(\overline{p})\right)$ and average achievement effects ($\overline{p}^y_G \times \overline{p}_G$).

Regression estimates

Two sets of regression equations are estimated. A 'first' stage equation (equation (6)) is common to both — one that involves the probit estimation of the determinants of whether individuals obtain an ENTER score (it estimates $\widetilde{\theta_G}(p)$). The second stage equations involve the least squares regression of the determinants of the actual ENTER score individuals obtain (equation (7) — it estimates $\widetilde{\psi_G}(p)$) and a probit equation of whether individuals attend university (equation (8) — it estimates $\widetilde{\delta_G}(y)$). Both second stage equations take account of any self-selection effects from the decision by individuals to obtain an ENTER score.[17]

The identification strategies used to estimate these selection effects differ between the equations. Achievement is included in the 'has an ENTER' score probit, but not the university participation equation, since it does not play any role in the selection of individuals for university places, nor should it affect individuals' decision-making once they possess their ENTER score. For the actual ENTER score equation, state identifiers are excluded, since the ENTER score is a ranking of students within their cohort in each Australian jurisdiction, whether or not they do actually obtain an ENTER score, so there should be no mean state effects. There are jurisdiction effects on school completion and differences in what is

[17] In fact, the probit equations are estimated jointly as a bivariate probit equation, which means the parameters from the 'first' stage equation are not identical to those estimated when only it is estimated. A Heckman correction term based on the first stage regression is included in the equation that explains the determinants of ENTER scores.

required to obtain an ENTER score in jurisdictions, so there are significant effects in the 'has an ENTER' score probit. However, since the ENTER score is simply the percentile rank of students within their jurisdiction, it ignores any underlying difference in school performance between jurisdictions. Hence, these state identifiers can be excluded from the ENTER score equation.

The regression estimates provide a similar picture to the graphical presentation provided above. The outcome of various specification tests for three estimated equations appear in Table 3. The table contains the *p–values* of the specification tests. These tests include whether or not it is necessary to include terms that cover group membership in the equation and whether membership has an impact on the relationship between achievement and ENTER scores and ENTER scores and university participation. The resulting 'preferred' specifications for each of these equations are reported in Table 4 and descriptive statistics in Table 5.

Along with group membership, the regression equations include a fairly standard set of demographic characteristics as regressors — gender, parental education level, birthplace, region, state. The one exception is a variable measuring student 'self-confidence', which was derived from students' self–reported comparisons of their academic performance in Year 9 compared with other students in their classes. It is an important determinant of whether individuals obtain an ENTER score and the value achieved but the inclusion of the variable has little impact on the other parameter estimates.[18]

The key features of the specification test results are that group membership affects the probability individuals have an ENTER score and its magnitude, but not whether they

[18]This reflects the fact the variable is orthogonal to achievement by construction. The self-reported assessments of students will reflect their own achievement and the average of their peers. The mean response of students, conditional on their own achievement, was estimated separately for students by gender and for students in schools in each quartile the school performance distribution. The conditional mean was then subtracted from students' actual responses to obtain an estimate of their own assessment that is independent of their actual performance and that of their peers. We treat the resulting estimate as one of 'self–confidence' or self-efficacy. The unadjusted self-report is often named academic self-concept in the education literature. The estimated effect here is large. From Table 5 the variable has a mean value of 50.6 and standard deviation of 9.9, implying a one standard deviation increase in the self confidence measure will lead to a 3.7 point increase in ENTER score, close to 40% of the impact of a one standard deviation increase in achievement.

attend university. This supports the conclusion from Figure 4 that students from the *most likely* credit constrained group are no less likely to attend university than students from the *least likely* credit constrained group, given their ENTER score. University participation depends almost solely on the individual's actual ENTER score (see Table 4). Selection effects are important for the equation explaining the ENTER scores individuals obtain, with unobserved factors making individuals both more likely to obtain ENTER scores and achieve higher scores. Compared with Figure 3, the regression-based differences between the groups for those with similar early school achievement scores lie further apart than that apparent in the actual data. Selection effects associated with who gets an ENTER score do not appear to be important for whether or not they go to university, however, since the p-value of the selection effect was 0.37 in the university participation equation. The estimated correlation between the error terms of the two equations, ρ, was not significantly different from zero. This suggests that the estimated relationship between ENTER scores and university participation in the equation is unlikely to be affected much by the self-selection of individuals to actually obtain an ENTER score.

The qualitative features of the results appear to be very robust across alternative regression specifications. If the equations are estimated separately for males and females, the outcomes of the specification tests are identical to those reported in Table 3 for both genders. Estimation of the ENTER score equation by least squares or median regression ignoring those with missing scores, or treating the data as a truncation problem, provided qualitatively similar results to those in Table 4. In a similar vein, estimating a linear probability model for the university participation equation or allowing for the errors of that equation to be heteroskedastic, in that they were related to the ENTER scores of individuals, or treating the ENTER score as endogenous (see discussion in the next sub-section), did not change the qualitative features of the results — specifically the group effects were never significant.[19]

In light of this consistency in results, it is worth focussing on the results in Table 4

[19] One difference was that in the linear probability model for the university participation equation the quadratic ENTER score term was significant. Weighted regression results were also effectively the same as those using unweighted data.

in a little more detail – first on the results for the ENTER score equation, second for the university participation equation. In addition to earlier student achievement and social background group, other demographic characteristics had significant effects on the ENTER scores individuals obtained. Females obtained higher ENTER scores than males, those whose parents had university degrees obtained higher scores, as did those who attended metropolitan schools, were not from Indigenous backgrounds and were born overseas in non-English speaking countries. Further, those who considered their school performance to be above average relative to their peers in Year 9 also obtained higher ENTER scores.

In contrast, in the university participation probit equation these demographic characteristics are generally not significant. A host of other features that are related to the social background of individuals appear to play little role in the decision-making of individuals about their university participation, once their ENTER score has been determined. These factors include whether they are Indigenous, whether they attended metropolitan schools, the education levels of their parents or even their gender. These factors were all important in determining ENTER scores, but once their actual ENTER score is determined, it dominates other factors in determining whether individuals attend university. Only one factor is not dominated by this effect — whether individuals were born overseas in predominantly non-English speaking countries. This has a positive impact on university participation, whatever the individual's ENTER score. Other Australian studies using this same data have found similar strong effects for those from non-English speaking migrant backgrounds on such educational outcomes (see Marks *et al.* (2000) and Le and Miller (2005), for example).

Potentially confounding factors

In this subsection we address several factors that might induce reservations about our empirical results: the potential endogeneity of ENTER scores in the university participation equation; alternative mechanisms by which credit constraints may affect university participation; the merits of using an early measure of SES as the basis of studying credit constraints at the later time when university participation decisions are made; the role of intergenerational correlations in ability; the impact of sample attrition; unobserved motivational levels that differ between groups; and the role of school and school sector effects.

If the error terms of equations (7) and (8) are correlated then inclusion of the ENTER score variable in equation (8) will lead to inconsistent parameter estimates for that equation. We have no obviously compelling, individual variable that might serve as an instrument for the the ENTER variable in the university participation equation. However, if our general story, that individual characteristics have little role in the participation decision once ENTER scores have been determined is correct, we might exclude those variables from the university participation equation. When we estimate an instrumental variables probit equation for the university participation decision where we exclude the otherwise insignificant demographic characteristics from it, the magnitude of the ENTER score effect increases slightly, the group dummy variables remain insignificant and the exogeneity of the ENTER score variable is not rejected.[20] On the basis of this evidence, we do not conclude that any endogeneity of ENTER scores provides particular problems for the university participation equation.

An alternative mechanism whereby credit constraints may affect the university participation rate is that credit constrained potential university students may choose not to obtain an ENTER score in the belief that such an investment would be a waste of resources. If this were the case, we would expect to see students from the low SES group (those *most likely* to face credit constraints) with potentially high ENTER scores choosing not to obtain an ENTER score. However, as we see from the university participation equation, among those who obtain an ENTER score, those who attend university have higher ENTER scores than those who do not attend university. Using the ENTER score equation and the characteristics of individuals, it is also apparent that those who obtain an ENTER score but do not attend university have much stronger ENTER score–related characteristics than those who do not obtain ENTER scores, for each of the social background groups. Hence, their predicted ENTER scores, had they obtained them, were estimated to be lower on average

[20] An alternative is to exclude only the student self-confidence variable from the university participation equation, but the results of the exogeneity test were unchanged.

than the group who obtained ENTER scores but did not go to university. The implication is, had these students chosen to earn an ENTER score, they would likely not have gained entry into university anyway, the reason being their low academic performance rather than credit constraints. These students are likely facing some sort of resource constraint, but it is binding on them earlier in their academic career than the university entrance decision, limiting their academic performance and the potential to participate in university education.

The SES measures used in this study to partition the population are based on family background characteristics (parental education and occupation, neighbourhood characteristics and the like) at the time students were in Year 9. These may not be representative of the financial positions of families and students at the time decisions are made about entering university, leading to the type of results evident in Figure 4. Evidence in Table 2 indicates that the partitioning based on the early SES background remains informative about the later financial positions of families. Living assistance to university students, which is based on more contemporary family income measures, is heavily skewed towards those in the *most likely* constrained group. About 44% of that group at university received AUSTUDY , compared with 12% of the *least likely* group. Therefore, we conclude that there is enough about access to resources by families that is 'permanent' for our partitioning to remain relevant for study of the university participation decision.

A further possible objection to our interpretation of the results might be that group effects reflect intergenerational correlations in ability, since individuals are grouped based on criteria that predominantly reflect their parents' characteristics. We do not have an explanation for why parental ability might affect whether people have an ENTER score and its value, but have no direct effect on the decision to participate at university. Further, we would anticipate that parental ability would be principally reflected in the measures of individual school performance, achievement and ENTER scores, and in their own education measures included in the equations rather than the group indicators. Hence, our view is that these variables are more likely to pick up resource effects than any residual intergenerational ability effects.

Attrition from the cohort has the potential to cause problems for our analysis if it differs between groups and is associated with the likelihood of proceeding to university. For example, it is possible that those from the *most likely* constrained group who remain in the sample were always those most committed to attending university. Attrition does differ between groups in the sample and was greatest among the *most likely* constrained group (see the number of weighted and unweighted observations for the groups in Table 1). However, it does not appear to have had a substantial impact on our results. This statement is based on two sets of analyses.

First we ran the equivalent of Heckman–selection effect tests on the ENTER score and university participation equations and found that the terms were not significant. Attrition and university participation were estimated jointly as a bivariate probit equation, with a *p–value* of 0.67 on the correlation between the errors.[21] The ENTER equation was estimated with a Heckman–selection correction term for attrition, as well as allowing for selection of whether students had an ENTER score. The attrition correction term had a *p–value* of 0.77 and its inclusion had little impact on the other estimated parameters.

The second way we tested whether attrition may have had an impact on the results was to test whether those lost from the sample had different attitudes towards university participation from those who remained in it for each of the groups. In the first year students were surveyed, they were asked what they intended to do in the year after they left school, including whether they intended to go to university. In a probit regression equation of whether students planned to attend university at that time, those who remained in the survey (and hence were included in our main analysis) from each group were not significantly more or less likely to say they intended to go to university than those lost from the survey from their group.[22] Comparing the *least likely*, *potentially* and *most likely* constrained groups, the differences between those lost to the survey and those who remained were not statistically

[21]The attrition equation included all of the background variables in Table 4, the participation equation only those that were significant in the results reported in Table 4.

[22]The regression equation included the same set of explanatory variables as the 'has an ENTER' score equation in Table 4, but with an indicator for members of each group who remained in the survey.

significant. Therefore, it appears that those lost to the survey did not differ in their attitudes towards university participation from those in their group who remained in the survey. Consequently, we do not believe that attrition has caused particular problems for the results we reported above.

Another possible problem for our results might arise if individuals in the three groups have different (average) underlying motivation levels to study at university which are not readily observed or taken into account in the analysis. Essentially, the differences apparent in Figures 2 and 3 may reflect the impact of motivation more than access to resources. When the analysis was repeated only for those individuals who indicated in Year 9 that they intended to go to university after leaving school, the diagrams changed very little. While the curves were marginally closer together, substantial gaps remained between the curves of the three groups in the equivalent of Figure 3. The curves of the *most likely* constrained and the middle group were closer together in the equivalent of Figure 2, but they remained well below that of the *least likely* constrained group. While we expect some interaction between SES and motivation, our analysis suggests that after controlling for motivation, differences between groups persist and that differences in motivation to attend university between groups appear to be only a very small part of the explanation of the differences in group outcomes.

The final issue is to what extent the results apparent in Figures 2 and 3 reflect differences in school performance between sectors or schools, since the sectoral composition differs so much between the groups (Table 1).[23] We do not rule out some role for such effects, though when they are incorporated in our results, they do not change them much. Allowing for individual school effects or school sector effects had no impact on the results for the university participation equation.[24] Where we included school sector variables in the other equations, they were significant in the 'has an ENTER' and ENTER score equations, and while the magnitude of the group effects fell somewhat, they remained significant and substantial. We

[23]Marks (2004) finds school sector effects on ENTER scores, in addition to SES and performance.

[24]The results were unchanged where we estimated it allowing for random effects in a probit equation, or for fixed effects in the linear probability model. The group indicator variables were never significant.

view school sector choice and the associated decisions about school tuition fee levels as one of the means by which high SES parents make investments in the education of their children, for which the payoffs include higher ENTER scores (and payoffs in other dimensions, such as wages – see Dearden *et al.* 2002, for example).[25] Equally, however, these school effects appear to play little role in the decision to attend university, once students' ENTER scores have been determined.

6 Conclusion

We have added to the growing literature on the role of credit constraints for potential university students by showing that Australian students making university entrance decisions do not appear to be short term credit constrained. The key point is that students who complete high school and earn an ENTER score are, given their ENTER score, equally likely to attend university whether we identify them as likely to be credit constrained or not. Instead we find empirical support for our proposed theoretical framework comprising multi-stage education where university participation depends on achievement in school, along with a student's ability to pay costs associated with university. In terms of our framework, it seems the Australian income contingent loan scheme for higher education charges (HECS) is an effective funding scheme and largely removes a student's or household's ability to pay for university tuition fees from the entry decision.

Our empirical analysis was based on a division of our sample into three groups; those *most likely* to face credit constraints when deciding on university participation, a *potentially constrained* group and the group *least likely* to be credit constrained. Given these groupings, we provide a decomposition of the probability of university participation into a number of determining factors, including measured early school performance, the transformation of this performance into university entrance scores (ENTER), the propensity to obtain an ENTER

[25] Studies for the United Kingdom and Australia suggest that the effects of private schools on subsequent academic performance at university, conditional on students' entrance scores is negative — see Smith and Naylor (2005) and Dobson and Skuja (2005), for example.

score and the role of credit constraints. The role of these factors was illustrated in a series of figures, with the the implications of the graphical analysis confirmed using regression analysis. In addition to the apparent absence of credit constrains facing university candidates, we find that ENTER score is the major factor determining university participation, irrespective of SES. Based on our analysis, we do however find that group membership (reflecting credit constraints) along with early school achievement are both important determinants of ENTER scores, thereby determining university participation. Our results were qualitatively unchanged when the data were partitioned according to different SES measures.

In our results section, we consider a range of factors that might have influenced our results and conclude that either their effect here has been minimal or that our results are robust to specification variations that aim to deal with these issues. Hence, the thrust of our story remains that the short term credit constraint issue has been dealt with by policy in Australia. However, there appear to be longer term factors that prevent low SES students from earning the type of ENTER scores required for university participation. These factors are tied to SES and early learning, manifesting themselves in lower average early school achievement for low SES students. Identifying and quantifying roles of these factors provides the basis for future research.

The work of Carneiro and Heckman (2003) suggests, based on US data, interventions should be targeted at students aged below 8 years. This is consistent with our finding that the different groups exhibit big differences in mean school achievement by their ninth year of school, Figure 1. We also show in Figure 3 that the gap between groups widens from year 9 to year 12. Given identical early school achievement, high SES students perform better through high school than low SES students, which suggests that there remains scope for policy targeting students at ages 14-15 years and later. Important policy questions involve the relative cost and effectiveness of remedial policies at such late ages compared with earlier interventions. What does seem clear, and consistent with our theoretical framework, is that policy needs to address the schooling decisions and outcomes of these students, targeting factors embodied in equation (2) at times well before the beginning of such student's twelfth (final) year of schooling. Policies such as targeted university scholarships are unlikely on their own to bring low SES students into the university system in greater numbers.

Current higher education changes in the UK are focused on the pricing of higher education and price differentiation between degrees and institutions.[26] These changes are being facilitated by expanding the existing income contingent loan scheme. Our findings suggest that equally talented and qualified students of differing SES and credit availability are likely to have equal access to university programs and that any lower participation by low SES students is likely related to factors operating much earlier in student's education and lives. Our results clearly endorse the focus on raising standards and achievement at all points of students' lives apparent in British Government statements that preceded decisions on the reforms to the higher education sector (for example, DfES 2003)

[26]While we have not studied tuition elasticities of demand for higher education, suggested to be relevant in this case by Kane (1994) and Ellwood and Kane (2000), Cameron and Heckman (1999) show that enrolment responses to tuition chages do not differ by family income, suggesting increases in tuition are unlikely to have differential effects on students of different SES.

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Table 1: Group sizes and summary statistics

	Groups			
	Non −	*Potentially constrained*	*Likely*	*Total*
LSAY 95				
Number of observations				
Unweighted	690	6191	666	7547
Weighted	582	5993	808	7383
Number of observations (weighted) with an ENTER score	494	3520	336	4350
Proportion with ENTER score (%)	84.9	58.8	41.6	59.0
Proportion with ENTER score if Year 12 (%)	90.4	74.4	61.3	74.7
Proportion female (%)	49.7	52.5	51.9	52.2
University participation rate (%)	66.3	36.6	21.2	37.3
Average ENTER score (if had one)	82.6	72.2	62.6	72.6
Year 12 participation rate (%)	93.9	79.0	67.9	79.0
Proportion at Government school	0.0	68.9	91.8	69.5
Proportion at Catholic school	39.7	20.8	8.2	20.9
Proportion at Independent school	60.3	10.3	0.0	13.1
LSAY 98				
Number of observations				
Unweighted	709	6259	524	7762
Weighted	548	6487	752	7761
Number of observations (weighted) with an ENTER score	479	3792	318	4932
Proportion with ENTER score (%)	87.3	58.4	44.0	59.1
Proportion with ENTER score if Year 12 (%)	94.1	73.9	63.7	74.8
Proportion female (%)	48.1	51.2	48.0	50.7
University participation rate (%)	66.5	33.5	18.8	34.4
Average ENTER score (if had one)	83.4	71.5	60.3	72.0
Year 12 participation rate (%)	92.8	79.0	69.1	79.0
Proportion at Government school	0.0	69.8	94.5	67.2
Proportion at Catholic school	41.8	20.0	5.5	20.1
Proportion at Independent school	58.2	10.2	0.0	12.6

Table 2: Wealth and social background indicators for the population groups in the 1995 Year 9 cohort

	Groups		
	Non −	*Potentially constrained*	*Likely*
LSAY 95			
Average wealth ranking (scale's range 0 – 100)	70.9	50.5	37.6
ABS education/occupation SES index			
Proportion in top quartile(%)	75.2	26.4	5.3
Proportion in top decile(%)	45.3	9.8	1.6
Proportion in bottom quartile(%)	3.8	19.8	38.8
ABS SES disadvantage index			
Proportion in top quartile(%)	72.9	35.7	14.1
Proportion in top decile(%)	50.1	15.9	3.9
Proportion in bottom quartile(%)	5.4	16.6	32.4
Proportion who received AUSTUDY/Youth Allowance in Year 12 (%)	8.9	21.2	28.0
Proportion who received AUSTUDY/Youth Allowance at university (%)	12.6	33.3	44.8
Average taxation postcode-based rankings			
Individual taxable income (range 0 – 100)	80.2	56.2	43.4
Individual non-labour income (range 0 – 100)	73.6	49.5	32.3
Proportion in postcode receiving Federal government benefits (range 0 – 100)	26.1	47.7	62.3

Table 3: Regression specification test outcomes — *p-values*

	Regression equations		
	Has ENTER Probit	*ENTER score regression*	*University Participation Probit*
Non-linear achievement	0.520	0.598	
Non-linear ENTER			0.092
Parallel shift of achievement/ENTER curve (τs = 0)			
Joint effects$^{(a)}$	0.000	0.000	0.353
Non constrained group	0.000	0.000	0.460
Potentially constrained group	0.000	0.000	0.189
Slope change in achievement/ENTER curve (φs = 0)			
Joint effects$^{(a)}$	0.463	0.000	0.378
Non constrained group	0.638	0.019	0.505
Potentially constrained group	0.596	0.722	0.237
Selection effect with the 'Has ENTER' probit		0.000	0.371

(a) Based on Wald tests of the joint significance of the group effects.

Table 4: Regression results

	Has ENTER probit		*ENTER score regression*		*University participation probit*	
	Coeff.	*Std.Err.*	*Coeff.*	*Std.Err.*	*Coeff.*	*Std.Err.*
ENTER score					0.051***	0.002
Achievement	0.085***	0.003	1.204***	0.038		
Achievement by non-constrained			−0.364***	0.072		
Non-constrained group	0.794***	0.109	30.267***	4.495		
Potentially constrained group	0.305***	0.077	5.750***	1.027		
Male	−0.310***	0.039	−4.169***	0.491	−0.056	0.047
Student overseas born- English speaking country	0.143	0.102	−0.507	1.298	−0.107	0.141
Student overseas born- non-English speaking country	0.391***	0.093	3.942***	0.768	0.271***	0.082
Father has degree	0.285***	0.053	3.764***	0.484	0.006	0.048
Mother has degree	0.344***	0.052	2.514***	0.468	0.070	0.053
Indigenous	−0.394***	0.137	−6.253***	1.917	0.210	0.193
Metropolitan	0.243***	0.051	3.579***	0.578	−0.007	0.047
NSW	−0.377***	0.076			0.291***	0.068
VIC	0.110*	0.067			0.196***	0.065
SA	−0.343***	0.107			0.072	0.090
WA	−0.830***	0.091			0.175*	0.091
TAS	−0.712***	0.095			0.971***	0.156
NT	−0.533***	0.168			0.345*	0.204
ACT	−0.631***	0.109			0.177	0.140
Self-confidence	0.030***	0.002	0.376***	0.024		
Constant	−5.611***	0.195	−19.245***	2.641	−3.641***	0.161
ρ			0.169	0.039	0.073	0.081
σ			13.2	0.201		
λ			2.2	0.519		
Number of observations			7532		7532	
Censored observations			2816		2816	
Uncensored observations			4716		4716	

Table 5: Descriptive statistics

	Mean	*Stddev.*
University Participation	0.394	0.49
Proportion with an ENTER score	0.621	0.49
ENTER score (if had one)	75.5	16.7
Achievement	51.8	8.3
Non-constrained group	0.088	0.28
Potentially constrained group	0.834	0.37
Male	0.472	0.50
Student overseas born- English speaking country	0.025	0.15
Student overseas born- non-English speaking country	0.062	0.24
Father has degree	0.243	0.43
Mother has degree	0.225	0.42
Indigenous	0.021	0.14
Metropolitan	0.549	0.50
NSW	0.236	0.42
VIC	0.207	0.41
SA	0.092	0.29
WA	0.117	0.32
TAS	0.058	0.23
NT	0.028	0.17
ACT	0.043	0.20
Self-confidence	50.6	9.9

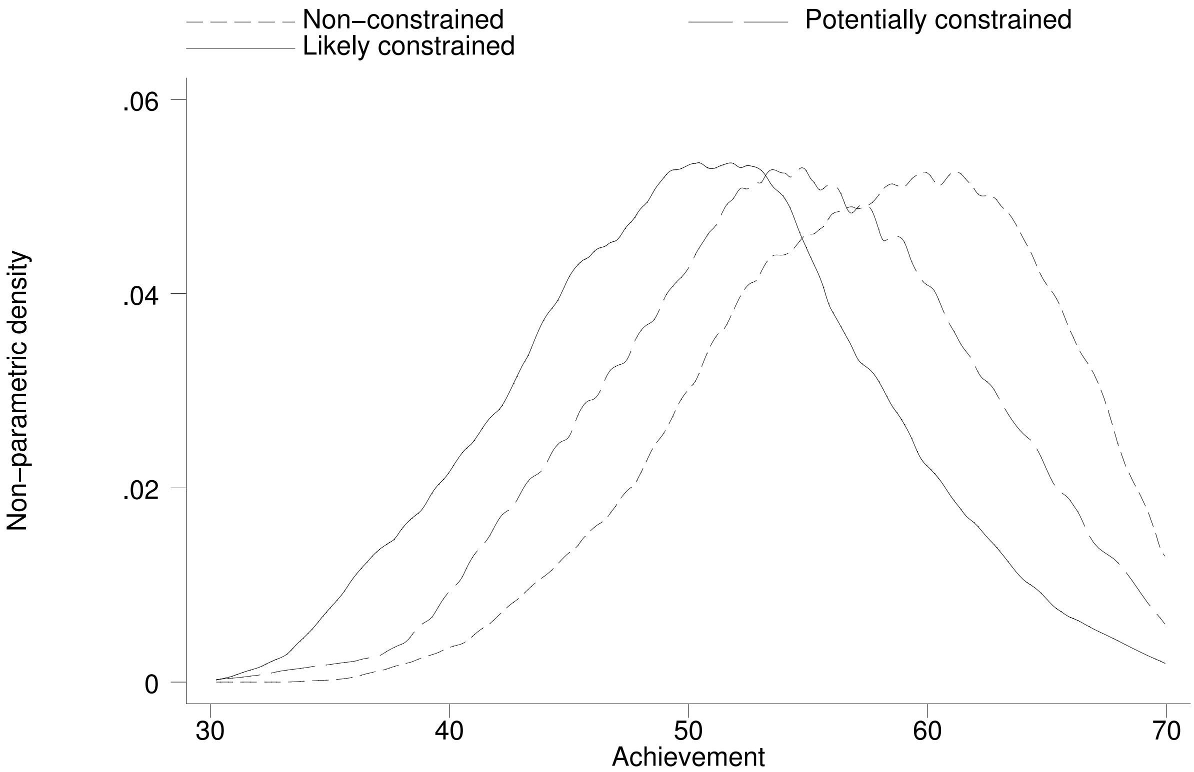

Figure 1: PDFs of Year 9 achievement score by group — 1998 cohort

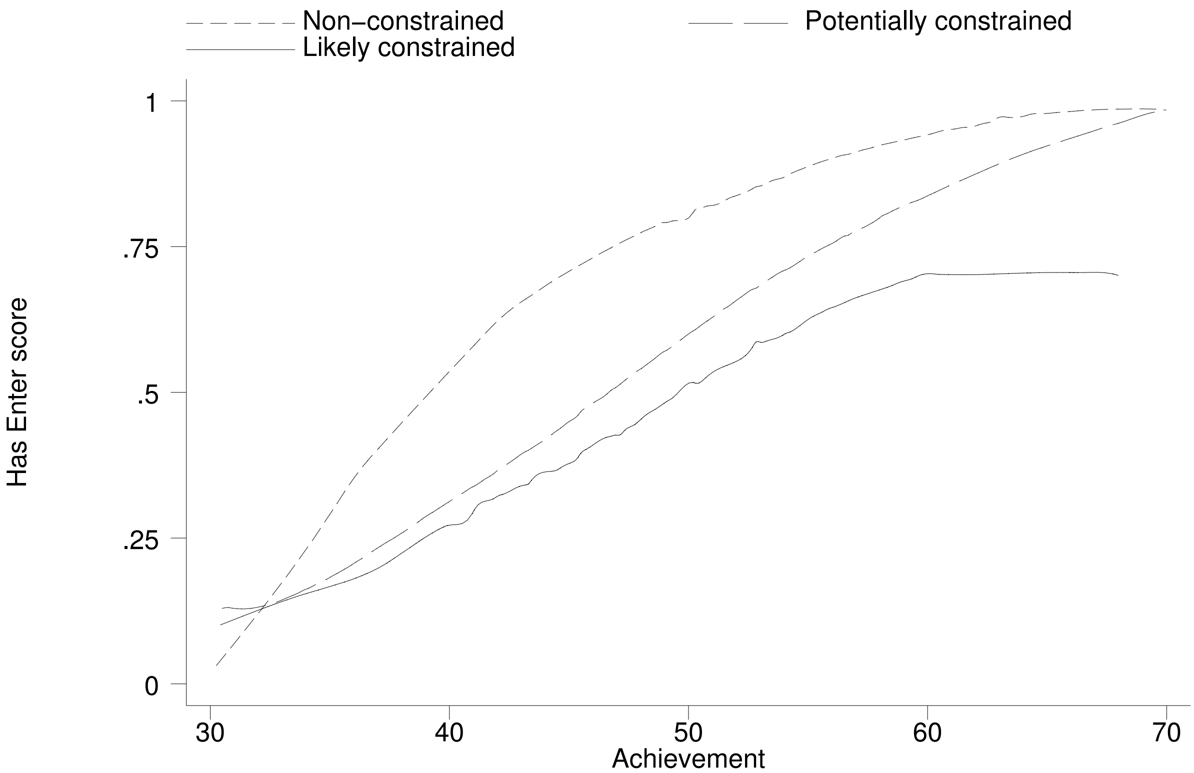

Figure 2: Probability of having an ENTER score by Year 9 test performance by group — 1998 cohort

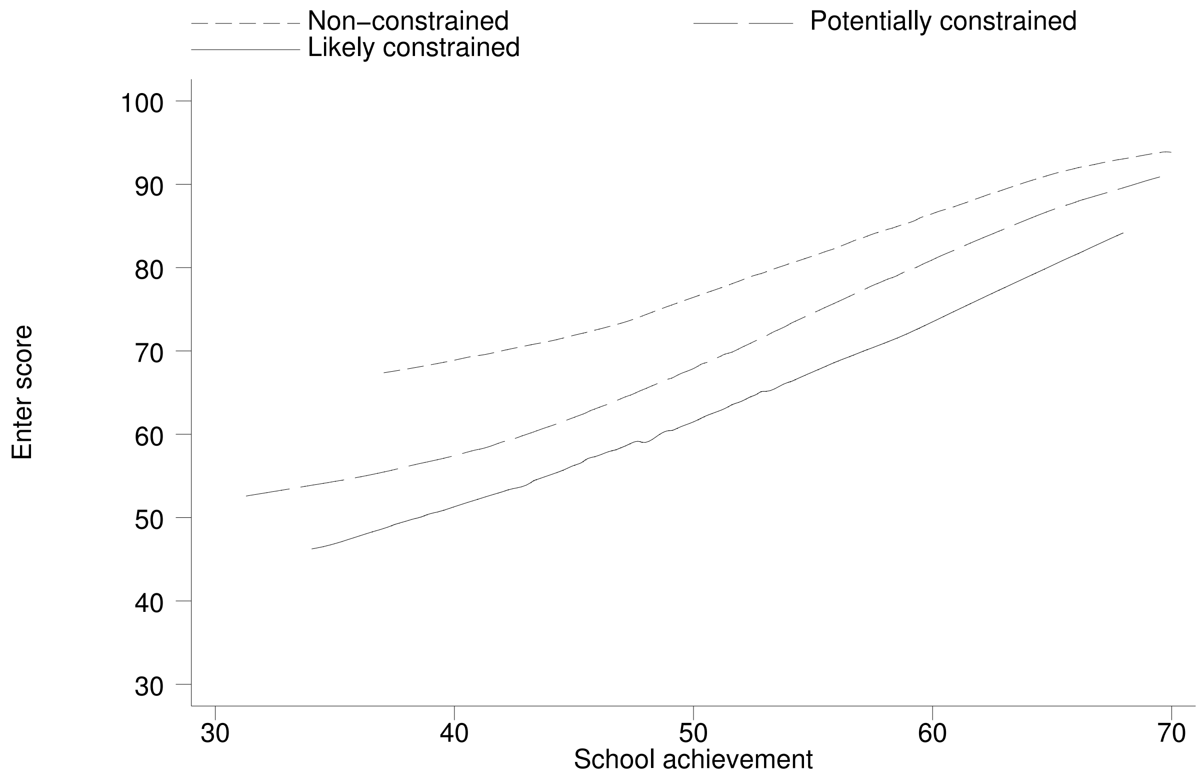

Figure 3: Translation of performance in Year 9 tests to ENTER scores by group — 1998 cohort

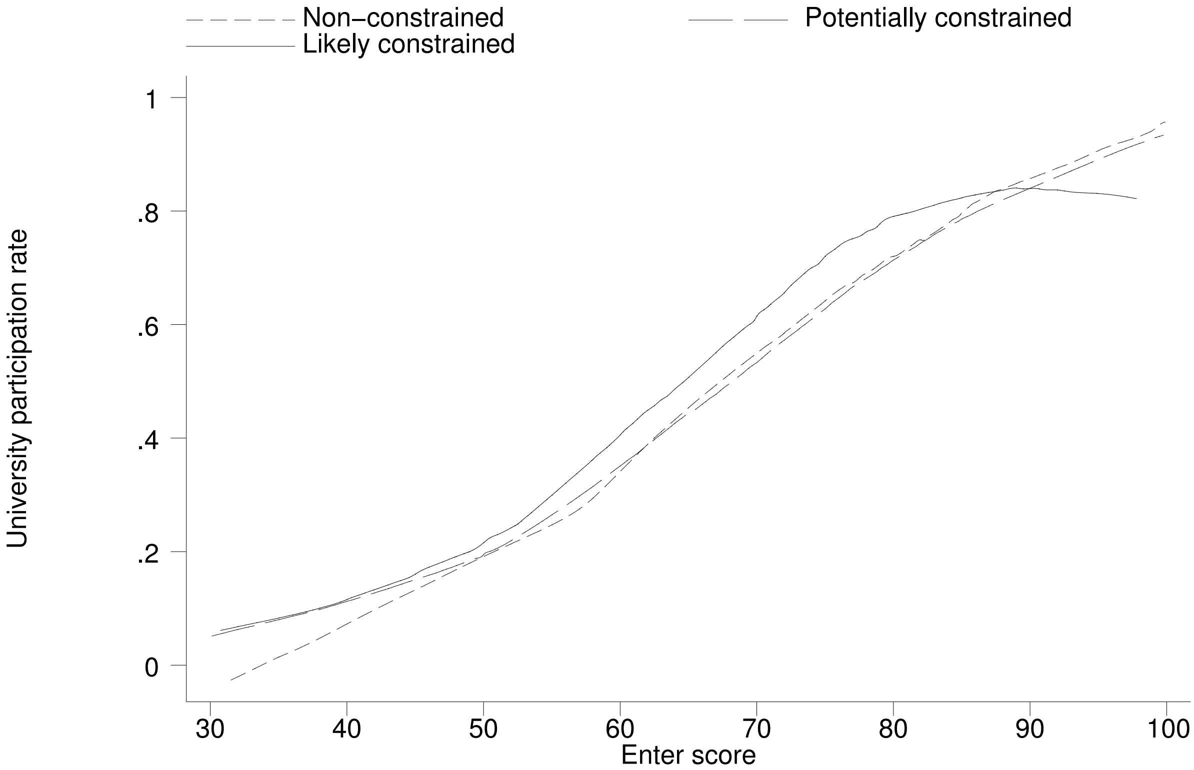

Figure 4: Probability of university participation by ENTER score — 1998 cohort