The Impact of HECS Debt on Australian Students' Tertiary Academic Performance

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Abstract

The Australian literature suggests that students' academic success in tertiary education is principally influenced by their university entrance score. Personal, secondary school and university characteristics have more minor impacts on tertiary outcomes. Little research has been undertaken into the relationship between students' marks and the financing arrangements for their tertiary education. This paper investigates the links between the achievements of university students and the debts incurred under the Higher Education Contribution Scheme (HECS). It finds that students who accumulate a HECS debt have lower marks in first year than students who pay their HECS liabilities up-front. Students who defer their HECS also have a lower probability of continuing their studies beyond first year. These effects are statistically significant, although they are smaller than the effects of gender, school type and the Tertiary Entrance Ranking (TER). However, the means of financing their university study does not appear to affect students' marks beyond the first year. The implications of these findings for future research are explored, with particular reference to Tinto's (1975) interactionalist theory of higher education outcomes. The possibility that HECS is a proxy for family background is also explored.

* *Paul Miller acknowledges financial assistance from the Australian Research Council and the Department of Education, Science and Training. The authors wish to acknowledge the assistance of the University of Western Australia with data provision. Opinions expressed in this paper are those of the authors and should not be attributed to the funding agencies or the University of Western Australia.*

Introduction

The Higher Education Contribution Scheme (HECS) was introduced in Australia in 1987. Given that it was an income–contingent scheme, it was generally felt that it would have few adverse effects. However, HECS was implemented without an associated evaluation program that might enable on-going formal assessment.

There have been various ad hoc studies of the possible effects of HECS, with many reporting that the scheme significantly reduced application rates to university (see Edwards, 1989; Robertson *et al.*, 1990; Savvas *et al.*, 1994; Andrews, 1997). For example, the analysis by Andrews (1997) found that Year 12 applications to university fell by 14 percent when HECS was introduced. Similarly, Robertson *et al.* (1990) found that approximately 8 percent of Victorian and West Australian Year 12 students stated that HECS was a very important reason for them not applying to university. Moreover, many studies show that the adverse impacts of HECS are concentrated on mature-age students. Andrews (1997), for example, found that the number of mature-age applicants fell by 10 percent after the 1997 changes to HECS were implemented. Likewise, Aungles *et al.* (2002) reported that 17,000 fewer mature-age students applied for university places following the 1997 changes to HECS.[1]

More positive perspectives on the potential impact of HECS have been provided by Andrews (1999) and Chapman and Ryan (2005). Andrews (1999) uses a range of methodologies, including descriptive materials, attitudinal surveys and multivariate analyses, in a further examination of the impact of HECS on the participation rate of individuals from low socioeconomic status in higher education. HECS is suggested as a minor influence in this regard.[2] Chapman and Ryan (2005) examine longitudinal data collected by the Australian Council for Educational Research to inform on the participation in higher education of 18 year olds in the first year they could potentially attending university, in 1988, 1993 and 1999. They report that HECS did not discourage university participation in general, or among individuals from low wealth groups. Unfortunately, given its focus on direct entry students, their study cannot address the reactions of the mature-age group who have provided a focus for much of the past research.

This paper examines a further possible effect of HECS, namely its impact on students' academic performance. It is known that around 75 percent of the total HECS liability of students in any given year is

deferred, to be paid through the income tax system, with the balance of the total liability being paid up-front to the institution. Students who defer their HECS, and hence accumulate debt, may behave differently at university from those who pay their HECS (or have their HECS paid for them) up-front. A number of overseas studies (*for example* Stratton *et al.*, 1994; Reynolds and Weagley, 2003) have shown that the arrangements for funding university study can impact on students' grades, and their probability of completing their degree, though the mechanisms through which these impacts work are not clear. There are several possibilities in this regard.

First, the presence of the HECS debt may make these students more appreciative of the value of their education, and hence induce greater effort. This may be associated with superior academic performance. In this context, Freebairn *et al.* (1987, p.109) suggested that charging fees for tertiary study in Australia would result in a better motivated student body. Similarly, Marlowe *et al.* (2002) argue that students in receipt of financial aid in the US may be more highly motivated than other students. Even though HECS is income contingent, it has been recognised as a cost (*for example* Andrews, 1999) and thus has the potential to have an impact along the lines discussed by Freebairn *et al.* (1987).

Second, in order to pay up-front, students may engage in market work to the detriment of their studies.[3] While this suggestion is intuitively appealing, it has been contested in the overseas literature. Marlowe *et al.* (2002), for example, report a positive relationship between market work time and students' grades. This impact is argued to arise because work experience promotes goal orientation, and enhances a student's human capital, which is a key factor in the education production function.

Alternatively, deferring HECS may be associated with sets of circumstances (*for example* general financial needs) and social background factors (*for example* limited home education resources, lower goal commitment) that impact negatively on tertiary outcomes (see Birch and Miller, 2006b). In this situation, where students have a propensity to pay up-front to feel 'debt-free', a HECS debt would simply compound the effects of an existing set of circumstances. The interactionalist model of Tinto (1975), for instance, draws attention to the importance of family background to a student's goal and institutional commitment and academic outcomes.

The empirical analyses conducted below provide information on the magnitude of the effect on students' tertiary performance associated with HECS. Through exploring variations in this effect across groups distinguished by their Tertiary Entrance Rank (TER) and year of study, insights into the relative importance of the three channels of influence outlined above can be canvassed, and these insights should provide a direction for future research.

The structure of the paper is as follows. Section II provides a brief introduction to the studies that examine student academic performance at university in Australia. It then extends the discussion to cover overseas studies that link academic performance to aspects of student indebtedness. Section III describes the data used in the analysis, while Section IV presents and discusses the empirical findings. A summary and conclusion are contained in Section V.

Accounting for academic performance at university

There have been many studies that have examined aspects of academic performance at university in Australia, and the majority of these are reviewed in Birch and Miller (2005). The findings from studies that were published during the 1980s and 1990s have been largely confirmed by more recent research, and hence the comments here focus on three quite recent studies: Win and Miller (2005), Birch and Miller (2005) and Dobson and Skuja (2005).[4] Win and Miller (2005) examined the determinants of first-year academic performance at the University of Western Australia, Birch and Miller (2005) conducted a similar examination for a large, comprehensive Australian university, and Dobson and Skuja (2005) had a focus on first-year student performance at Monash University.

These studies are based on variants of the following conceptual framework:

$$\text{Academic Performance} = F(\text{Entrance Score Characteristics, School Characteristics and Student Characteristics}). \quad (1)$$

There are three entrance score characteristics that have been examined. The first of these is the tertiary entrance rank (or equivalent) used for selecting students for entrance into university. Each of the studies reveals a strong, positive relationship between TER and

university performance, though the relationship is stronger in the Win and Miller (2005) research than in the other studies. However, Dobson and Skuja (2005, p.55) argue that the predictive capability of university entrance scores appears to diminish as the discipline area moves away from the subjects taught to students at secondary school. The approach by Dobson and Skuja (2005) is in line with studies for the UK, such as Sear (1983), which report that the link between university degree results and high school performance is stronger in science subjects than in the arts and social studies.

The second entrance characteristic examined is whether the student actually had a TER below the official cut-off score for the institution, and so would have been granted admission to the institution on the basis of special consideration for certain adversities when sitting the TER.[5] Students in this category appear to do particularly well at university, especially in the data set analysed by Birch and Miller (2005).

The third entrance characteristic incorporated into the formal statistical analyses undertaken is the role of student preferences for course of study. Students who do not get allocated a course that is one of their first two preferences have an academic performance that is below that of their counterparts who get offered their first or second preference (Birch and Miller, 2005).

The studies reviewed have also attempted to ascertain whether students who completed their schooling at a Government school have an academic performance at university that differs from that of students who completed their schooling at either Catholic schools or other Independent schools. Each of the studies has reported that students who completed their schooling at a Government school have higher weighted average first-year marks at university than students who completed their schooling in the other school sectors. Dobson and Skuja (2005), for example, show that there was a differential of around five marks at the end of first year between students from non-selective Government schools and their counterparts from Independent schools, and that this differential persisted across the range of university entrance marks examined.

In terms of the reasons for these effects, the studies have introduced a range of statistical controls, including whether the school was coeducational, an all-boys school or an all-girls school, whether the school was in a rural area, the size of the school, and various aggregate characteristics of the student body (*for example* proportion of the Year 12

class doing four or more subjects contributing to their TER score, proportion classified as high achievers). The analyses show that students from coeducational schools do better at university than students from single-sexed schools, students from rural schools do not perform as well at university as their counterparts from metropolitan schools, and that attendance at a small school appears to be associated with a minor advantage in terms of first-year university academic performance. Mixed findings are reported for the impact of aggregate characteristics of the student body. However, even in the presence of controls for these factors (including TER), students from Government schools are reported to do better at university than other students.

Limited details on students are collected by universities. Hence the main student characteristic included in the studies has been gender. It is reported in each of the three recent studies that females do better during the first year of university than males. Win and Miller (2005, p.9) argue that the female mark advantage at university is '...about two points, it is highly significant, and is one of the few individual-level or school-level variables that has a consistent effect on first-year academic performance'. Dobson and Skuja (2005) show that the female mark advantage is a characteristic of most school-type/entrance score band combinations at Monash University.

A number of US studies have expanded the set of factors included in equation (1) to include variables on the arrangements for financing university study. These include the availability of merit-based scholarships, needs-based scholarships, and loans. Given that HECS is a universal scheme, the findings from analyses of merit-based scholarships will not have great relevance to the analyses presented below. However, as the propensity to defer HECS, and hence to accumulate debt, appears to be related to family circumstances (Birch and Miller, 2006b), the analyses of needs-based scholarships may be relevant. Accordingly, these analyses, together with those of education loans schemes, are summarised in Table 1.

It is apparent from the studies reviewed in Table 1 that there is not a consensus finding on the link between the funding of university study and students' academic performance. While most studies report that student loans and needs-based scholarships do not affect academic outcomes, there are studies that report that having a student loan has a negative effect (*for example* Reynolds and Weagley, 2003), as well as studies that report findings in the other direction (*for example* Stratton *et al.*, 1994). The reasons for these diverse relationships are not explored

in the various studies, though they are likely to be associated with the fact that, as outlined in Section I, loans can have both positive (through increasing motivation) and negative (being linked to market work which may be detrimental to study, and being associated with relatively unfavourable socioeconomic background) effects, and the relative strengths of these offsetting influences may vary across studies. The situation for Australia is canvassed in the sections that follow.

Table 1

Selected Studies That Examine the Impact of University Financing Arrangements on Tertiary Performance

Study/Year/Country	Dependent Variable	Measure of University Financing Arrangement	Main Findings
Stratton *et al.* (1994), 1981 to 1990, US.	-Students' grade point average at university.	-Whether received financial aid.	-Being in receipt of financial aid had a positive impact on students' grades.
Reynolds and Weagley (2003), 1995 to 1996, US.	-The probability of completing the degree.	-Whether received a need-based scholarship. -Whether had a student loan.	-Being in receipt of a need-based scholarship did not significantly influence the probability of completing a degree. -Having a student loan had a negative impact on the probability of completing a degree.
Wetzel *et al.* (1999), 1989 to 1992, US.	-Students' decision to continue at university in the following year.	-Amount owing on student loans.	-The amount owing on student loans did not significantly influence students' decisions to continue at university in the overall analyses, has a negative effect on the decisions of white students, and a weak positive effect on the decisions of black students.
Monks (2001), 1998, US.	-The probability of pursuing graduate study.	-Amount owing on student loans.	- The amount owing on student loans did not significantly influence students' chances of pursuing graduate study.
Marlowe *et al.* (2002), 2000, US.	-Students' grades at university.	-Whether had a student loan.	-Having a student loan did not significantly influence students' grades.

Data

The data for this analysis are from the Student Record System and HECS liability reports for the University of Western Australia (UWA). They relate to students who were in their first year at university in 2002. Within this broad category of students, the sample is restricted to students who incurred a HECS liability (*i.e.* domestic undergraduate students), who sat their university entrance exams in either 2000 or 2001, and for whom there are valid data on all variables considered in the statistical analysis.

These data are similar to those that have been used in study of the determinants of student outcomes by Win and Miller (2005) and Birch and Miller (2006a), the main difference being that they cover a later entrance cohort (2002 compared to 2001). Similar issues arise in relation to the use of such data as were present in the study of the 2001 entrance cohort by Win and Miller (2005) and Birch and Miller (2006a), specifically, are the data representative of all students at UWA, are the UWA data representative of the tertiary sector as a whole, and is the estimating equation well specified?

The data cover around one-half of all commencing students at UWA.[6] The main group omitted from consideration is the students who had a gap of more than one year between leaving school and commencing university (around one-quarter of all students). These are conventional gap-year students and mature-age students, for whom the University's student record system does not include information on either the type of high school attended (Government, Catholic or Independent) or (for mature-age students) the TER. As both the TER and type of high school attended have been shown to be key determinants of first-year university outcomes in the research reviewed in Section II, gap-year and mature-age students are omitted from the analysis.[7]

The other main groups that are not covered by the analysis are full-fee paying overseas students (who comprise around one-tenth of UWA first-year students, and for whom information on TER and school type is generally unavailable, and for whom HECS is not a relevant issue), and those who, for reasons such as withdrawal, deferred exams and delays in processing marks, had missing marks. Win and Miller (2005) argue that the latter group are broadly similar to the subgroup used in the statistical analyses reported below.[8]

The results reported by Win and Miller (2005) from the study of UWA data are, as discussed in Section II, remarkably similar to findings reported for Monash University (Dobson and Skuja, 2005) and for another large, comprehensive university in Australia (Birch and Miller, 2005) and also in the British literature (Smith and Naylor, 2005). This gives some confidence that the findings from statistical analysis of students at UWA will generalise to the tertiary sector as a whole, particularly as Monash University is described as a '...microcosm of the higher education sector in Australia' (Evans and Farley, 1998, p.2). Naturally, however, caution needs to be exercised in this regard, and research undertaken for a wider set of universities, in order to ensure that the findings are not institution-specific.

Finally, there is the issue of the specification employed. The model described in equation (1) is consistent with an education production function, and the variables included in it are standard in the empirical literature. There is, however, other information that has been considered in other recent studies of tertiary performance, namely the field of education variables of Dobson and Skuja (2005) and the degree type variables of Win and Miller (2005). Dobson and Skuja (2005) show that the correlation between university entrance scores and first-year marks varies by field of education. A difficulty with this variable, however, is that most students should be viewed as having multiple fields of education.[9] Win and Miller (2005) include degree type in their multivariate analysis, and report that this did not lead to any material changes to their results. The breadth of the typical first-year program at UWA indicates that the degree enrolled in is unlikely to provide additional independent information. Hence this variable is not considered here.

The dependent variable for the first set of statistical analyses is first-year academic performance, measured by the weighted average first-year mark. This is computed as the mark obtained in each unit enrolled in after the dates specified for withdrawal from a unit without academic penalty, weighted by the relative contribution of the unit towards completion of the student's degree program. The same method is used to compute the mean student marks for later years of study.

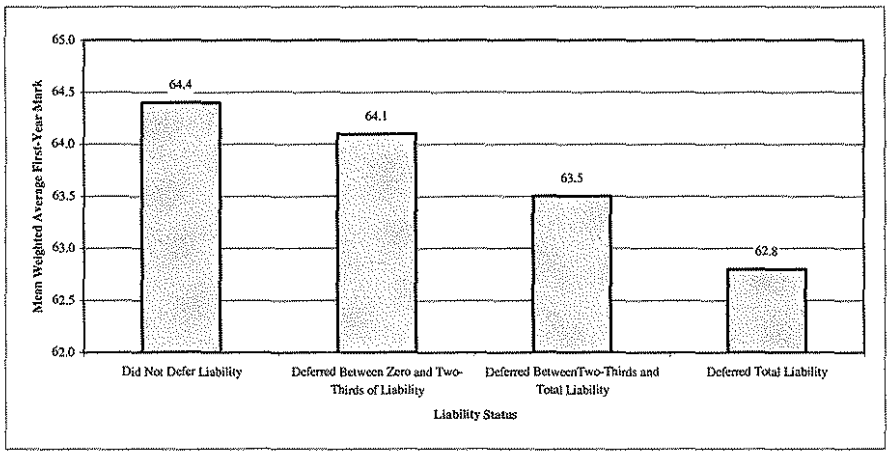
The data set contains information on both the student's HECS liability and their up-front payments to the institution. All up-front payments have been adjusted to take into account the discount (25 percent) offered in 2002 for such payments (see Birch and Miller, 2006b for historical details on HECS). Of the 2,055 students in the data set,

635 (or 31 percent) paid all their HECS liability up-front and 1,256 (or 61 percent) deferred the full liability. The remaining students (8 percent) paid varying amounts of HECS.

This distribution of the data impacts on the way the information on HECS debts might be incorporated into the analysis. In particular, rather than employing a continuous measure, such as the proportion of HECS deferred, the two end points in the distribution (0, 1) are distinguished by appropriately defined binary variables, and the intermediate data points are initially categorised into two groups, those deferring up to two-thirds of their HECS liability, and those deferring more than two-thirds, but not all, of their liability. This categorisation of the students paying some HECS up-front results in two groups of approximately the same size. Information on these groups is provided in Figure 1, which gives the mean weighted average first-year mark by HECS liability status.[10]

Figure 1 reveals that there is an inverse relationship between first-year academic performance and HECS liability status. At first glance, this relationship appears to be modest. Students who take out student loans for the entire cost of their university study have mean marks that are approximately two percentage points lower than the marks of students who do not take out loans to finance study. To put this in context, however, the gender differential in mean first-year marks in studies such as Win and Miller (2005) is only in the order of two percentage points, and the differences across the school systems less than four percentage points.

Figure 1
Mean Weighted Average First-Year Mark by Liability Status



The remaining variables that are entered into the estimating equation are described in Table 2.

Table 2
Description of the Variables in Models of the Determinants of Students' First-Year Marks

Variable	Description	Mean	Std Deviation
Students' Mark			
Mark	Continuous variable for the students' weighted average mark measured by a mark out of one hundred.	63.357	11.995
LnMark	Logistic form of *Mark*, computed as $Mark_i = \text{Log}\left(\frac{Mark_i}{(100.0 - Mark_i)}\right)$.	0.566	0.587
Gender			
Female	Female students.	0.529	0.499
Male	Omitted category.	0.471	0.499
Locality of Residence			
Noncity	Dummy variable for students who do not live in the capital city area.	0.096	0.295
City	Omitted category.	0.904	0.295
TER Score			
TER	Continuous variable for students' TER score.	92.436	5.294
Course Preference			
Third-Fourth	Dummy variable for students who were accepted into courses that they ranked as their third or fourth (out of a possible four choices) preference to university.	0.056	0.230
First-Second	Omitted category.	0.944	0.230
Course Load			
Part-time	Dummy variable for studying part-time (defined here as having a course load that is less than two-thirds of the course load set for full-time students).	0.087	0.281
Full-time	Omitted category.	0.913	0.281
HECS Liability Status			
Defer1-99	Dummy variable for students who deferred more than zero and less than one hundred percent of their HECS liability up-front (*i.e.* variable for students who finance their university study using student loans and using other means, such as, finance from their parents, savings and scholarships).	0.079	0.270
Defer100	Dummy variable for students who deferred all of their HECS liability up-front (*i.e.* variable for students who finance their entire university study using student loans).	0.611	0.487
NoDefer	Omitted category.	0.309	0.462
School Size			
Large	Dummy variable for students who attended a secondary school with more than two hundred students in their final year of study.	0.214	0.410
NonLarge	Omitted category.	0.786	0.410
School Type			
Catholic	Dummy variable for attending a Catholic secondary school.	0.254	0.435
Independent	Dummy variable for attending an Independent secondary school.	0.381	0.486
Government	Omitted category.	0.365	0.482
Coeducational Status			
Boy	Dummy variable for attending an all-boys secondary school.	0.174	0.379
Girl	Dummy variable for attending an all-girls secondary school.	0.199	0.399
Coed	Omitted category.	0.627	0.484
Proportion of Students Doing Four or More Subjects Contributing to the TER			
TER4	Continuous variable for the percentage of students who took four or more subjects at the secondary school that contributed to their TER score.	71.488	16.316
Proportion of Students Graduating High School			
Graduate	Continuous variable for the percentage of students who graduated from the secondary school.	95.383	7.026
Proportion of Students With High TER Scores			
HighTER	Continuous variable for the percentage of students with high TER scores upon the completion of secondary school for the secondary school.	42.844	15.160

Empirical Results

First-Year Tertiary Performance and HECS Liability Status

Table 3 contains estimates from four versions of the model. The first two columns of results are for a model that has the mean weighted first-year mark as the dependent variable. The two versions of the model reported on are distinguished by the more encompassing information on the school attended included in the second specification. The final two columns are for similar specifications as those in the first panel of this table. They are distinguished by the use of the logistic transformation of the student marks, as described in Table 2. This transformation is implemented in order to constrain predictions to be in the 0-100 range that the original dependent variable covers. Overall the models are reasonably strong predictors for academic success, at least in the context of similar cross-sectional studies. In each instance the adjusted r^2s are around 0.26 to 0.29. Each of the models estimated has a heteroscedastic error structure, as indicated by the result of a Breusch-Pagan test (see Breusch and Pagan, 1979), and hence the 't' statistics are computed using White's (1980) heteroscedasticity-consistent covariance matrix estimator.

As shown in column (*i*) of Table 3, female students have higher weighted average first-year marks than male students, in the order of two percentage points. This finding is consistent with those produced in previous Australian studies, such as Win and Miller (2005), Dancer and Fiebig (2004), Dobson and Sharma (1999) and Everett and Robins (1991). The slight mark advantage that female students have over their male counterparts has been attributed to: (i) differences in the cultural attitudes towards education among males and females (see Hewitt, 2003) and (ii) differences in the literacy and numeracy skills of boys and girls developed in primary school (see Nowicki, 2003).

The table shows that students' TER score has a strong positive impact on their weighted average first-year marks, with a one percentage point increase in students' TER rank being associated with around a one percentage point increase in their university marks. This result is on par with the studies reviewed in Table 1 in Birch and Miller (2005), where the mean estimated coefficient for the tertiary entrance score in studies using data from 1990 onwards is 0.75. It is also consistent with other studies using data for earlier time periods from the University of Western Australia, such as Win and Miller (2005) and Everett and Robins (1991).

Table 3
Estimated Determinants of Students' First-Year Tertiary Performance

	Dependent Variable = *Mark*				Dependent Variable = *LnMark*			
	Column (*i*)[a]		Column (*ii*)		Column (*iii*)		Column (*iv*)	
	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value
Constant	-24.057	5.42 ***	-27.723	5.04 ***	-3.492	16.38 ***	-3.704	14.52 ***
Gender								
Female	2.148	4.78 ***	1.806	3.40 ***	0.084	3.85 ***	0.075	3.03 ***
Locality								
Noncity	-0.410	0.49	-0885	1.06	-0.038	0.76	-0.059	1.17
TER Score								
TER	0.977	20.76 ***	1.017	21.41 ***	0.046	20.23 ***	0.047	20.97 ***
Course Preference								
Third-Fourth	-4.234	3.40 ***	-4.119	3.38 ***	-0.197	3.29 ***	-0.192	3.27 ***
Course Load								
Part-time	-8.979	6.63 ***	-8.791	6.55 ***	-0.435	5.77 ***	-0.426	5.70 ***
Liability Status								
Defer1-99	-0.456	0.56	-6.349	0.80	-0.026	0.70	-0.035	0.94
Defer100	-0.914	1.87 *	-1.127	2.30 **	-0.047	-1.98 **	-0.057	2.37 **
School Size								
Large	-1.664	2.59 ***	-0.871	1.21	-0.081	2.61 ***	-0.054	1.55
School Type								
Catholic	-1.755	2.94 ***	-1.220	1.80 *	-0.090	3.14 ***	-0.065	2.01 **
Independent	-4.181	6.65 ***	-1.289	1.52	-0.205	6.46 ***	-0.075	1.86 *
Coed. Status								
Boy	[b]		-1.723	2.03 **	[b]		-0.089	2.17 **
Girl	[b]		-0.263	0.29	[b]		-0.043	0.82
Four TER Subjects								
TER4	[b]		0.037	1.47	[b]		0.017	1.42
Graduating								
Graduate	[b]		0.028	0.73	[b]		0.014	0.15
High TER Scores								
HighTER	[b]		-0.134	4.12 ***	[b]		-0.06	3.32 ***
	Adjusted r^2 = 0.28 Mean *Mark* = 63.36 Sample Size = 2,055		Adjusted r^2 = 0.29 Mean *Mark* = 63.36 Sample Size = 2,055		Adjusted r^2 = 0.26 Mean *Mark* = 0.57 Sample Size = 2,055		Adjusted r^2 = 0.27 Mean *Mark* = 0.57 Sample Size = 2,055	

Notes: [a] The absolute 't'-values are presented. The symbol *** represents significant at the 1 percent level, the symbol ** represents significant at the 5 percent level and the symbol * represents significant at the 10 percent level. [b] The variable was not entered in the estimating equation.

Similar to the findings reported in Birch and Miller (2005) and McClelland and Kruger (1993), students who were accepted into courses that were their bottom two preferences for university have marks that are four percentage points lower than the marks of students accepted in their top or second preference. This finding is likely to be linked to the levels of motivation for study by students accepted into courses which they did not rank as their main preference.

Table 3 also shows that there are differences in the academic performance of students studying part-time and students studying on a full-time basis, with part-time students having lower weighted average first-years marks. The differential in first-year academic performance between these groups is almost nine percentage points. Similar patterns have been reported in the United Kingdom (see Smith and Naylor, 2001) and in Canada (see Montmarquette *et al.*, 2001), and may highlight the difficulties associated with combining tertiary study with other activities, such as being employed or raising a family.

Three secondary school characteristics were entered in the model to examine how prior learning environments influence outcomes at university. Comparable with the results in Birch and Miller (2005), Win and Miller (2005) and Smith and Naylor (2005), students who attended secondary schools with a larger number of students in their final year have marks that are two percentage points lower than the marks of students who attended schools with a smaller student body. Students who went to Catholic secondary schools or Independent secondary schools have marks that are two and four percentage points lower, respectively, than the marks of their counterparts who went to Government schools.

The lower tertiary academic performance of students from Catholic and Independent schools has been attributed to the 'inflated' TER scores achieved by these students (see Win and Miller, 2005). It has been suggested that as the level of resources (both school and private) devoted to students sitting the TER at non-Government schools is considerably greater than that at Government schools, students from Catholic and Independent schools will have lower marks at university than students from Government schools when holding their TER constant (see Birch and Miller, 2005; Win and Miller, 2005).[11]

Finally, column (*i*) in Table 3 suggests that there is a difference, albeit minor, between the marks of students who paid their HECS liability up-front and students who deferred all their HECS liability. Hence, students who deferred all of their HECS liability have marks that

are one percentage point lower than the marks of students who did not accumulate a HECS debt. Students who paid part of their HECS liability have marks that are similar to those of their counterparts who paid all their HECS liability up-front. In other words, students who take out loans to finance their university study have marks that are only slightly lower than the marks of students who finance their university study by other means. This finding is consistent with the study by Reynolds and Weagley (2003) which indicates that, in the United States, having a student loan has a negative impact on the likelihood of graduating.

Column (*ii*) of Table 3 presents the empirical results for the model estimated with additional secondary school variables. The inclusion of variables controlling for the coeducation status of the school (*Boy* and *Girl*) and peer effects (*TER4*, *Graduate* and *HighTER*) does not have a major impact on the main findings of the model. Hence, the estimated coefficient for students' TER score following the inclusion of these variables is still around unity. Furthermore, the only additional variable to have a significant and sizable impact on students' marks is the variable for attending an all-boys school.[12] Students who went to this type of school have weighted average marks that are 1.7 percentage points lower than the average marks of students who attended a coeducational school.

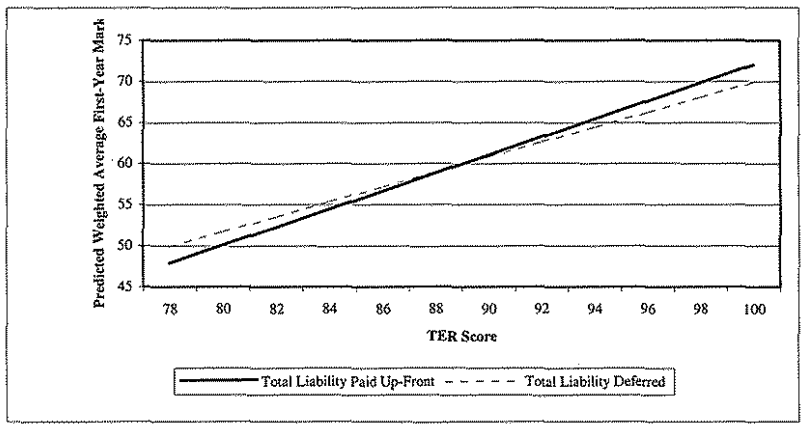
Columns (*iii*) and (*iv*) of Table 3 present the results of the model estimated with students' weighted average marks in logistic form. Most of the findings from this specification of average marks resemble those presented in the first two columns of Table 3. Hence, using the logistic form of students' marks, the marginal effects[13] of the variables *Female*, *Third-Fourth* and *Defer100* are -1.95, -4.57 and -1.10, respectively. They are 2.15, -4.23 and -0.91 using the untransformed measure of marks. As such, it is possible to suggest that the functional form used for the dependent variable (students' marks) does not have much impact on the empirical results.

The small size of the negative effect of having a deferred HECS debt on first-year performance raises the question of whether there are, as discussed above, offsetting impacts such that the underlying structural influences are masked. This is explored further using a variant to the model based on the approach of Dobson and Skuja (2005). They show that the impacts of some determinants of tertiary performance vary with university entrance scores. Hence, the 'All HECS Deferred' variable was interacted with the TER variable. As noted above, HECS debt may be an indicator of motivation, and as argued by Freebairn *et al.* (1987,

p.109), 'motivation and ability (as measured by matriculation score) are substitutable over a substantial range in most tertiary studies'. It is expected that this range would include low, but not high, TERs. From this perspective, it is reasonable to expect the impact of HECS debt on academic performance to be less negative, or even positive, among students with TERs around an institutions' official cut-off score compared to the negative impact recorded in Table 3. Results from the models that include this interaction term are presented in Table 4.

The inclusion of this interaction term has little impact on any of the variables other than the TER term and the variable recording whether the student deferred all their HECS liability. The results suggest that the change in marks associated with deferring all HECS liabilities varies by students' TER scores. This is illustrated in Figure 2.

Figure 2
Predicted Weighted Average First-Year Marks by HECS Liability Status



As illustrated in Figure 2, students who defer all their HECS liability, and whose TER score is below 88, have marks that are higher than the corresponding marks for students who pay their total HECS liability up-front. The difference in the academic achievements is most pronounced among students whose TER score is around the official cut-off score for entrance into the University of Western Australia. For example, the predicted first-year marks for students with a TER score of 80 is 51.7 for students who defer their HECS and 50.0 for students who pay their HECS up-front. This pattern of effects is consistent with the notion that a HECS debt is associated with higher levels of motivation.

Table 4

Estimated Determinants of Students' First-Year Tertiary Performance With Interaction Term

	Dependent Variable = *Mark*				Dependent Variable = *LnMark*			
	Column (*i*)[a]		Column (*ii*)		Column (*iii*)		Column (*iv*)	
	Coeff	't' Value	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value
Constant	-36.893	4.93 ***	-41.451	5.03 ***	-4.151	11.20 ***	-4.398	10.98 ***
Gender								
Female	2.122	4.73 ***	1.750	3.30 ***	0.083	3.79 ***	0.072	2.93 ***
Locality								
Noncity	-0.419	0.50	-0.901	1.09	-0.038	0.77	-0.060	1.19
TER Score								
TER	1.115	14.04 ***	1.164	14.70 ***	0.053	13.39 ***	0.055	14.02 ***
Course Preference								
Third-Fourth	-4.257	3.44 ***	-4.143	3.42 ***	-0.198	3.34 ***	-0.193	3.31 ***
Course Load								
Part-time	-9.056	6.70 ***	-8.871	6.63 ***	-0.439	5.83 ***	-0.430	5.76 ***
Liability Status								
Defer1-99	-0.349	0.43	-0.523	0.66	-0.021	0.55	-0.029	0.78
Defer100	219.283	2.11 **	20461	2.25 **	0.990	2.21 **	1.033	2.30 **
Interaction Term								
*TER*Defer 100*	-0.218	2.24 **	-0.233	2.41 **	-0.011	2.34 **	-0.011	2.47 **
School Size								
Large	-1.663	2.60 ***	-0.842	1.18	-0.080	2.61 ***	-0.052	1.52
School Type								
Catholic	-1.714	2.89 ***	-1.190	1.76 *	-0.088	3.08 ***	-0.064	1.97 **
Independent	-4.134	6.58 ***	-1.223	1.45	-0.202	6.40 ***	-0.072	1.79 *
Coed. Status								
Boy	[b]		-1.717	2.03 **	[b]		-0.089	2.16 **
Girl	[b]		-0.168	0.19	[b]		-0.038	0.73
Four TER Subjects								
TER4	[b]		0.039	1.54	[b]		0.002	1.50
Graduating								
Graduate	[b]		0.025	0.74	[b]		0.014	0.94
High TER Scores								
HighTER	[b]		-0.138	4.27 ***	[b]		-0.006	3.46 ***
	Adjusted r^2 = 0.28		Adjusted r^2 = 0.29		Adjusted r^2 = 0.26		Adjusted r^2 = 0.27	
	Mean *Grade* = 63.36		Mean *Grade* = 63.36		Mean *Grade* = 0.57		Mean *Grade* = 0.57	
	Sample Size = 2,055		Sample Size = 2,055		Sample Size = 2,055		Sample Size = 2,055	

For notes to Table, see Table 3.

However, a HECS debt continues to have a negative impact on first-year marks among students with a TER score above 88. Given the specification adopted, this impact is more pronounced among students at the top end of the TER distribution. Thus, the difference in the predicted first-year marks of students who paid all their HECS up-front and those who deferred all their HECS is 1.8 percentage points (in favour of those who pay up-front) for students with a TER score of 98. This negative effect could be a reflection of the less favourable socioeconomic background of students who defer their HECS (see Birch and Miller, 2006b), which Tinto's (1975) model suggests could be associated with poorer academic performance, and which is not offset by higher levels of motivation as is the case among students with low TERs. If this is the case, then under Tinto's (1975) longitudinal process of interactions, the effect would be expected to dissipate over time, as students integrate into the academic and social environment of the institution. This matter can be addressed through study of the change in the relationship between a HECS debt and academic performance among second- and third-year students.

Student Retention and HECS Liability Status

In Australia, many students leave university prior to completing their course of study. Moreover, the proportion of non-completers does not appear to have changed over the past three decades. For example, in 1967 it was estimated that approximately 42 percent of students who had enrolled in university six years earlier had not completed their degree (see Jackson, 1999). By 1997, the proportion of students not completing their university study after five years of commencing study was still 39 percent (see Martin *et al.*, 2001; Urban *et al.*, 1999; Jackson, 1999). While some students who do not complete university at the first attempt may return to study, it has been suggested that only half are likely to complete their course the second time around (see Martin *et al.*, 2001).

An obvious reason for student withdrawal is prior academic performance. This might be considered a 'push' factor. But there are many other factors that might impact on this decision, including 'pull' factors (*for example* attractive job offers), home environment considerations, attitudinal factors and the like. While the reason for student withdrawal is often recorded on the student's academic record, the information is incomplete, and cannot be used to categorise students

into push and pull groups in the current study. Accordingly, the analyses which follow focus on a dichotomous retention/withdrawal variable.

Due to the restrictions on the institutional data collected, the following examination of the likelihood that students will continue beyond the first year of study needs to focus on the same set of variables used to explain first-year marks above. The potential role of the range of other factors will be assessed indirectly in the context of application of a Heckman (1979) selection correction model.

The probability that students will continue their study into the second year is given as:

$$\text{Prob}(\textit{Continue}) = F(\textit{Female, Noncity, TER, Third-Fourth, Part-time, Defer100, Large, Catholic, Independent, Boy, Girl, TER4, Graduate, HighTER}) \quad (2)$$

where *Continue* is a dichotomous variable taking the value of one where the student studies in 2003, having been enrolled in 2002, and the value of zero for students who were not enrolled (at the University of Western Australia) in 2003. The other variables included in the model are as defined above.

Note that the students' academic results in their first year are not included among the right-hand-side variables, as students are often excluded from university on the basis of poor academic performance, and the academic results variable therefore would introduce into the behavioural relationship aspects of the administrative rules governing academic progression. In addition, given the results above, only one HECS variable (defers the full HECS liability, *Defer100*) is used.

Equation 2 is estimated using a probit model, with the estimates serving as a selection equation for the study of students' academic performance in the second year. The equation is estimated with and without the inclusion of variables for the coeducational status of the school (*Boy* and *Girl*) and peer effects (*TER4*, *Graduate* and *HighTER*). The results are reported in Table 5.

Table 5

Estimated Determinants of Students' Retention at University

	Dependent Variable = *Continue*			
	Column (*i*)[a]		Column (*ii*)	
	Coeff.	't' Value	Coeff.	't' Value
Constant	1.969	2.98 ***	-2.321	2.74 ***
Gender				
Female	<-0.001	0.01	-0.095	0.97
Locality				
Noncity	-0.169	1.37	-0.200	1.60
TER Score				
TER	0.036	5.12 ***	0.039	5.40 ***
Course Preference				
Third-Fourth	-0.206	1.39	-0.184	1.23
Course Load				
Part-time	-1.16	11.09 ***	-1.154	10.94 ***
Liability Status				
Defer100	-0.160	2.00 **	-0.172	2.13 **
School Size				
Large	0.154	1.36	0.184	1.42
School Type				
Catholic	0.031	0.30	0.096	0.78
Independent	0.065	0.64	0.294	1.84 *
Coed. Status				
Boy	[b]		-0.288	1.98 **
Girl	[b]		-0.040	0.26
Four TER Subjects				
TER4	[b]		0.002	0.38
Graduating				
Graduate	[b]		0.003	0.58
High TER Scores				
HighTER	[b]		-0.007	1.31
	McFadden r^2 = 0.12		McFadden r^2 = 0.13	
	Prediction Success Rate = 87.79		Prediction Success Rate = 87.79	
	Mean *Continue* = 0.874		Mean *Continue* = 0.874	
	Sample Size = 2,055		Sample Size = 2,055	

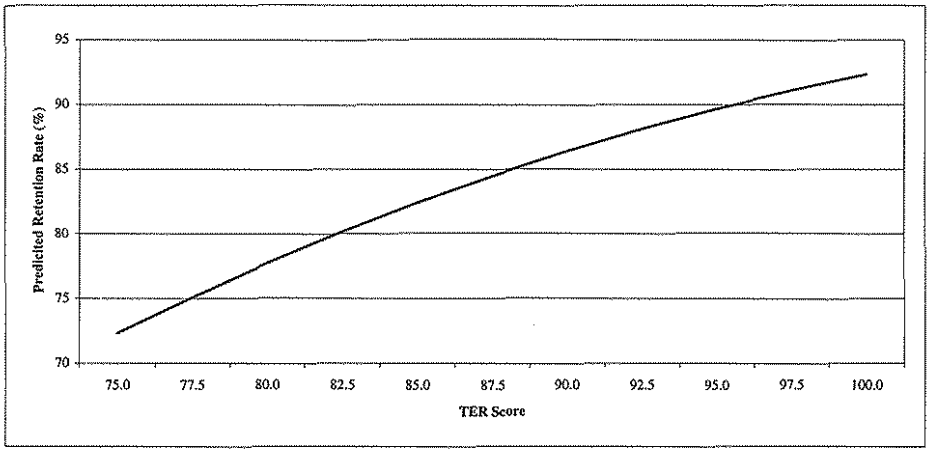
For notes to Table, see Table 3.

The findings suggest that there is a positive association between continuing at university and students' TER score. This is illustrated in Figure 3, which shows that approximately 78 percent of students with a TER score of 80 are predicted to continue at university. In comparison, the predicted retention rate of students with a TER score of 95 is 90 percent. This finding in comparable with findings by Urban *et al.* (1999) and Martin *et al.* (2001) for Australia, Johnes (1997) and Johnes and

McNabb (2004) for the UK and Marcus (1989) and Tucker (1992) for the US.

Figure 3

Predicted University Retention Rates by TER Score



Column (*i*) in Table 5 shows that students who are studying part-time are considerably less likely to continue at university than their counterparts studying full-time, with the difference in the predicted retention rates of part-time and full-time students being approximately 34 percentage points. The lower persistence at university among part-time students is presumably the result of the factors which impede their ability to study full-time (*for example* paid employment) having an impact on their ability to continue with their university study.

Students who defer their total HECS liabilities (*i.e.* take out student loans for the full cost of their tertiary study) also have lower retention rates at university than students who pay some or all of their HECS up-front (*i.e.* students who finance their study by other means). The difference in the probability of continuing at university for these groups of students is three percentage points. This is about the magnitude of the impact of tertiary financing arrangements on students' retention rates established in the US (*for example* Dynarski, 2005). There are several perspectives that could be taken on this finding. It might, for example, be considered that the impact is small, and hence HECS debts do not have a material influence on student retention decisions. An alternative perspective is that the impact of HECS on this outcome is similar to the impact of tertiary financing arrangements in the US, and

hence there is nothing special about the HECS income-contingent arrangements in this regard.

Column (*ii*) of Table 5 suggests that students from Independent schools are five percentage points more likely to continue at university than students from Government schools. Students from all-boys schools are six percentage points less likely to continue at university than students from coeducational schools.[14]

All the other variables included in the model to examine the determinants of continuing at university are insignificant. This finding suggests that the decision to continue at university may be driven by 'pull' factors that cannot be included in the model. This issue is addressed in the following sub-section.

HECS Liability Status and Second- and Third-Year Tertiary Performance

The model of the determinants of students' academic performance in their second year (data for 2003) and third year[15] (data for 2004) of study is based on the specification employed in sub-section (a) above. The only changes are: (i) the focus on a single HECS debt variable that distinguishes those who defer all their HECS from other students; and (ii) the inclusion of the mean mark from the previous year of study in addition to (and in some specifications in place of) the TER variable that records the relative outcomes on the examinations used in the initial university admission decision.

The equations presented do not include the coeducational status of the school (*Boy* and *Girl*) and the peer effects variables (*TER4*, *Graduate* and *HighTER*).[16] They are corrected for potential non-random sample selection (see Heckman, 1979), using the model of student retention (without controls for the coeducational status of the school or peer effects) developed in the previous section to construct the sample selection correction term. The selection equation for the study of the students' marks for 2004 (third year) is similar to that presented in the previous section. Results are not presented here for space reasons.

Table 6 presents the results for three specifications of the model of the determinants of marks in second year (panel (*i*)) and third year (panel (*ii*)). Each panel contains the results when the model is estimated with the inclusion of variables for both TER score and previous mark(s) at university (columns (*i*) and (*iv*)); the inclusion of only mark(s) for

university (columns (*ii*) and (*v*)); and the inclusion of only TER score (columns (*iii*) and (*vi*)).

The results suggest that students' marks in second year and third year are largely driven by their previous marks at university. For example, column (*i*) indicates that a one percentage point increase in students' average mark in first year increases their marks in second year by approximately two-thirds of a percentage point. Column (*iv*) suggests that a one percentage point increase in average marks in first year and second year increase marks in third year by 0.18 and 0.69 percentage points, respectively. The impact of students' previous marks at university does not vary substantially when the model is estimated without TER in the estimating equation (see columns (*ii*) and (*iv*) of Table 6).

The impact of students' TER score on marks in second year and third year is considerably less than its impact on marks in first year, when controlling for previous marks at university. Hence, in the estimation of the determinants of second-year academic performance using the model controlling for previous marks at university and TER score, the estimated coefficient for TER is 0.21. It is insignificant in the estimation of the determinants of third-year performance using the same model. In comparison, in the estimation of the determinants of first-year performance, the estimated coefficient for TER is about unity.

When the model does not control for students' marks at university, the impact of TER on second- and third-year academic performance is larger than that when the model controls for previous marks at university. Thus, columns (*iii*) and (*vi*) show that a one percentage point increase in students' TER score increases their marks in second year by 0.77 of a percentage point, and increases marks in third year by 0.52 of a percentage point. The higher impact of TER score in the models not controlling for university marks reflects the strong correlation between TER score and first-year marks.

Similar to the relationship in first year, students studying part-time have lower marks than students studying full-time in second year and third year. The reduction in marks for part-time students in second year and third year is 7.7 and 2.3 percentage points, respectively. The decline in the effect of studying part-time on university performance with years of study may suggest that part-time students become better at balancing study and other activities (such as market work and the care of children) as they move towards the completion of their degree.

Table 6
Estimated Determinants of Students' Second-Year and Third-Year Tertiary Performance

	Panel (*i*) Marks for Second-Year Tertiary Performance Dependent Variable = *Mark*						Panel (*ii*) Marks for Third-Year Tertiary Performance Dependent Variable = *Mark*					
	Column (*i*)		Column (*ii*)		Column (*iii*)		Column (*iv*)		Column (*v*)		Column (*vi*)	
	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value	Coeff.	't' Value
Constant	1.910	0.47	18.942	11.54 ***	-4.086	0.83	16.193	4.11 ***	11.164	6.02 ***	21.842	3.59 ***
Gender												
Female	1.059	2.83 ***	0.866	2.21 **	2.334	5.21 ***	0.482	1.20	0.516	1.29	2.685	4.35 ***
Locality												
Noncity	-0.536	0.80	-0.543	0.78	-0.725	0.90	-0.723	1.04	-0.642	0.93	-2.205	2.08 **
Course Preference												
Third-Fourth	1.070	1.27	1.037	1.18	-0.478	0.47	0.523	0.59	0.603	0.68	-0.293	0.21
Course Load												
Part-time	-7.783	10.65 ***	-7.424	10.34 ***	-11.300	13.10 ***	-2.303	3.61 ***	-2.259	3.54 ***	-4.182	4.90 ***
Liability Status												
Defer100	-0.134	0.03	0.100	0.24	-0.462	0.97	-0.309	0.75	-0.314	0.79	-0.723	1.15
School Size												
Large	-0.505	0.93	-0.249	0.75	-1.313	2.01 **	-0.089	0.16	-0.155	0.28	-1.457	1.69 ***
School Type												
Catholic	-0.659	1.29	-0.567	1.05	-2.007	3.27 ***	0.080	0.15	0.042	0.08	-1.778	2.16 **
Independent	-0.052	0.10	0.349	0.65	-2.713	4.40 ***	0.225	0.41	0.064	0.12	-2.288	2.76 ***
TER Score												
TER	0.212	4.58 ***	(b)		0.769	15.23 ***	-0.066	1.45	(b)		0.518	8.17 ***
Marks in 2001												
Mark2001	0.675	28.54 ***	0.722	33.37 ***	(b)		0.178	5.78 ***	0.166	5.58 ***	(b)	
Marks in 2002												
Mark2002	(b)		(b)		(b)		0.690	23.51 ***	0.685	23.45 ***	(b)	
Correction term												
$\hat{\lambda}$	-3.161	2.09 **	-6.306	4.64 ***	-3.871	2.12 **	-3.317	1.72 *	-2.628	1.41	-14.286	5.11 ***
	Adjusted r^2 = 0.49		Adjusted r^2 = 0.48		Adjusted r^2 = 0.26		Adjusted r^2 = 0.49		Adjusted r^2 = 0.49		Adjusted r^2 = 0.45	
	Mean *Mark* = 64.70		Mean *Mark* = 64.70		Mean *Mark* = 64.70		Mean *Mark* = 66.53		Mean *Mark* = 66.53		Mean *Mark* = 66.53	
	Sample Size = 1,796		Sample Size = 1,796		Sample Size = 1,796		Sample Size = 1,645		Sample Size = 1,645		Sample Size = 1,645	

For notes to Table, see Table 3.

Despite having a large impact on first-year performance, many of the other variables in the estimating equation only have a minor impact on marks in second and third year in the models controlling for both TER score and university marks, and the models controlling for only university marks.[17] For example, column (*i*) shows that women in their second year at university have marks that are only one percentage point higher than the marks of men. Women's mark advantage over their male counterparts is two percentage points in first year. Similarly, course preference, HECS liability status, school size and school type, are significant determinants for first-year academic performance but are insignificant determinants for second-year performance.

The statistical insignificance of the HECS liability status variable among second- and third-year students, and its statistical significance among first-year students, is important in terms of attaching weight to the possible channels through which it affects tertiary academic performance among commencing students. Tinto's (1975) longitudinal model has a focus on both social and academic integration: 'seen as the interaction between the individual with given sets of characteristics (backgrounds, values, commitments, etc). and other persons of varying characteristics within the college, social integration, like academic integration, involves notions of both levels of integration and of degrees of congruency between the individual and his social environment' (Tinto, 1975, p.107). As Birch and Miller (2006b) have established differences in socioeconomic background between students who defer HECS and those who pay their liability up-front, the empirical results here suggest that the effects of these socioeconomic background factors, and the motivation influences noted in Section IVa, are being picked up by the HECS variable in the study of first-year outcomes, and being dissipated by the integration that is the central component in Tinto's (1975) model when higher-year students are analysed. In other words, there are immersion effects operating at the university level, so that, with time, students take on the value of their peers. To this extent, the main effect of HECS appears to be as a proxy for socioeconomic background and the related circumstances that impact on study habits and commitment: If the impact of HECS was simply linked to a need to engage in market work, it is difficult to see why the effects identified among first-year students would not carry across to second-year and third-year students.

Finally, Table 6 shows that the sample selection correction term ($\hat{\lambda}$) is statistically significant in each model of the determinants of academic

performance in second and third year (the exception being for the study of third year controlling for marks in first and second year). Given the construction of the lambda term as a positive variable, the negative coefficient for $\hat{\lambda}$ implies a negative correlation between the error terms in the selection equation for whether the student continues at university and the errors terms in the equation for marks in second and third year.[18] In other words, the unobservable characteristics that lead to a lower likelihood of continuing into the second or third year, for example traits that attract a better alternative (*for example* offered a good job) are linked to superior academic results in the second and third years of study. This lends some, albeit indirect, credibility to the 'pull' hypothesis as to why some students discontinue their tertiary studies. Note, however, that this 'pull' influence is on the basis of factors other than early achievement, as measured by the TER variable that is included in the model.

Conclusion

This study has extended the conventional analysis of the determinants of university academic performance in Australia by incorporating into the study students' HECS liability status. Students who pay all their HECS liability up-front differ from students who defer all their HECS liability in many ways (see Birch and Miller, 2006b). It is apparent from the analyses reported above that these two groups of students also differ on the basis of their examination performance during their first year at university, and in their propensity to continue their studies beyond the first year.

The mean conditional link between first-year university marks and deferring all HECS liabilities in the above analyses for Australia is statistically significant, but the magnitude is only of moderate importance. This is consistent with the literature reviewed in Section II, which shows that while students' academic performance at university can be influenced by the arrangements in place for funding their study, there is considerable variability in results, which is possibly indicative of offsetting sets of influences. In this regard, attention has been drawn to the discussion in the literature that student debt may enhance students' motivation, and thus favourably affect academic performance over the range of TERs where ability and motivation are substitutable. The research drawing links between time spent working and student outcomes is also relevant, as students may increase their market work to

cover HECS liabilities. Finally, as the background of students who defer their HECS differs from that of students who pay their HECS up-front, Tinto's (1975) interactionalist model may provide a basis for explaining the empirical results.

The differential impact of HECS debts on first-year academic performance across TERs in Australia may be a reflection of the different channels of influence outlined above. It suggests that the motivation element is important among students with relatively low TERs, which is where motivation and ability would be expected to be substitutable. Future studies that survey students should attempt to collect information on motivation and the reason for study.

The fact that the effects of HECS diminish with time spent at university, to the extent that they are not statistically significant beyond the first year, may have its basis in the workings of Tinto's (1975) interactionalist model. This longitudinal model sees the interaction of the individual and other persons in the institution, and the institution itself, generating integration and degrees of congruency between the individual and his/her social environment. Consequently, if HECS is really little more than a proxy for family background, and it is family background that affects study habits and tertiary performance, then a focus on family background, and how this affects students' goal commitment and motivation, is in order. The collection of relevant family background characteristics would then become a priority in research that aims to understanding better the variations in tertiary academic performance.

The findings reported above discount the role that market work has in affecting university outcomes. Studies that seek to address the potential impact of market work among tertiary students should examine whether time allocated to market work is sourced from leisure time or study time. This would develop a suggestion of Marlowe *et al.* (2002), namely that those students who engage in greater amounts of paid work are more conscientious and also study more.

NOTES

1. The overseas literature suggests that increases in the cost of attending university have a negative impact on university enrolments and also on the decision on whether to continue at university. The review by Leslie and Brinkman (1987) reports that the mean decrease in university enrolments

associated with a US$1,000 increase in the costs of attending university is approximately 4 percent.

2. A weakness of the study, noted by the author, is the need to identify low socioeconomic status groups by the home postal areas of students rather than through the use of direct measures of income, wealth or other attributes of parents.

3 Smith *et al.* (1998) estimate that 49 percent of students who paid their HECS up-front sourced their funds from personal savings, 34 percent from family members, 12 percent from employers and 5 percent from other sources.

4 The approach taken in these studies, and the main empirical findings, are broadly similar to results reported for the US (*for example* Stinebrickner and Stinebrickner, 2003), Canada (*for example* Robb and Robb, 1999), and UK (*for example* Smith and Naylor, 2001).

5 At the University of Western Australia, the focus university of the empirical work presented below, this is formalised through a UWay program (see Win and Miller, 2005).

6 It is noted that other recent studies, such as Dobson and Skuja (2005), cover a similar proportion of commencing students. See Dobson and Skuja (2005, p.55).

7 Birch and Miller (2006c) show, in an analysis that does not include variables for the type of high school attended, that gap-year students have slightly higher marks than other students. This mark advantage varies by gender but not by any other of the characteristics considered.

8 Specifically, Win and Miller (2005, Table 2) show that students with missing information on their first-year marks are more likely to be female, to be from rural areas and to have attended a rural school than other students. However, in terms of the other characteristics, including the TER, the two groups of students are quite similar.

9 By way of illustration, the 2002 field 'Management and Commerce' covers accounting, banking and finance, the field 'Society and Culture' covers economics and econometrics while the field 'Natural and Physical Sciences' covers mathematics and statistics. What field should a first-year Bachelor of Commerce or Bachelor of Economics student, who typically studies economics, accounting and mathematics, be assigned to?

10 Due to the small sample sizes, the two groups of students who defer a proportion of their HECS and pay a proportion of their HECS up-front are grouped together in the empirical analysis.

11 For evidence on the links between private tutoring and university entrance examinations, see Tansel and Bircan (2005). While this study is for Turkey, it seems unlikely that similar effects would not be present in Australia.

12 The variable for attending a school with a larger proportion of the student body with high TER scores (*HighTER*) is also significant, with the university achievements of students who attended schools with a larger proportion of the student body with high TER scores being less than the achievements for students who attended schools with a small proportion of students with high TER scores. This relationship, however, is only slight, with the estimated coefficient on the variable being -0.13.

13 The marginal effects are calculated using $\frac{\partial Mark}{\partial X} = \beta_x \left[\frac{(Mark) \cdot (100 - Mark)}{100} \right]$, where X is the representative explanatory variable. They are evaluated at the mean of the students' average weighted first- year mark (mean of 63.36).

14 The insignificance of the *'Independent'* variable in the model to estimate the determinants of continuing at university using the model without controls for the coeducational status of the school or peer effects is likely to be a result of the positive impact of attendance at a single-sexed Independent school being cancelled out by the negative impact of attendance at a non-Government all-boys school.

15 As the number of units completed per semester varies among students, and students are able to repeat units they have failed, and may take optional subjects outside their major, second and third years of study do not necessarily imply that the students are studying second- and third-year subjects. Rather, second and third year refer to the length of time the student has been at university.

16. Analyses were conducted using the model with the inclusion of these variables. The results are very similar to those presented above and are available from the authors.

17. A number of variables, such as school size and school type, however, are statistically significant in the examination of second- and third-year academic performance using the model not controlling for previous marks at university.

18. As Duncan and Leigh (1985, p.395) point out, 'a positive coefficient estimate coupled with a selectivity variable defined to be positive would mean...positive selectivity is present'. Hence, a negative coefficient coupled with a positive lambda variable, as in the current application, indicates negative selectivity.

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