How is Australia's Higher Education Performing? An analysis of completion rates of a cohort of Australian Post Graduate Research Students in the 1990s.

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ABSTRACT

Whilst there have been concerns expressed over the performance of higher education in Australia, there is little hard data regarding what level of performance that is actually being achieved. Even basic quantitative measures of performance, such as completion rates of students, are somewhat complex to measure, given the variety of choices students can make before completing, or not completing, their university studies. This paper reports the progress towards completion of the 1992 cohort of students who undertook their postgraduate research at Australian universities between 1992 and 1999. The results indicate that after eight years of study, only 53 per cent of postgraduate research doctoral students had completed the courses that they had enrolled in 1992. For students studying for a masters research degree, only 31 per cent had completed their courses over the same period. However, an additional 14 per cent of these masters research students completed courses other than the ones in which they were initially enrolled. Based on the results to the end of 1999, the upper estimate of the likely final completion rates for doctoral research students is 65 per cent and 47.5 per cent for masters students.

The high non-completion rates and lengthy period of study, for masters students I particular, are of concern, both in terms of the inefficiency of resource use and the delayed flow of benefits arising from these students successfully completing their studies. Some estimates of inefficiency of resource use are included in the paper.

There is a range of factors affecting completion rates for this 1992 cohort. These include the student's gender, field of study, age, study mode (full- or part-time) and institution attended. Whilst the results vary for masters and doctoral students, some broad general conclusions can be made. Completion rates are generally higher for science-related courses. Female students are generally equally or more likely to complete their courses than male students. Full time students have higher completion rates than part time or external students. Students under twenty five have the highest completion rates, though students in the 25 to 29 age group do not perform as well as most of the older age groups, especially in the case of doctoral students. The variation in performance across institutions suggests that the universities with lower completion rates could benefit by examining their practices and benchmarking themselves against the better performing universities, particularly in relation to the factors addressed here.

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1. Introduction

A concern about the current performance of higher education research and research training institutions is the long completion times and low completion rates for postgraduate research students.[1] These issues were identified in the Department of Education, Training and Youth Affairs (DETYA) discussion paper *New Knowledge, New Opportunities* released in June 1999. The subsequent white paper, *Knowledge and Innovation: A policy statement on research and research training*, noted that:

> 'There was general acceptance of the need to improve student completion rates and times to graduation, whilst at the same time, recognising the Government's responsibility to provide information on completions, to encourage such a focus.'

The purpose of this paper is to provide useful information on completion rates, specifically to:

- Analyse the completion rates of postgraduate research students who commenced in 1992 at a publicly funded university.[2] The crude completion rates of these students are presented here to provide a better understanding of the performance in postgraduate research fields;
- estimate a 'final' completion rate; and
- establish which characteristics help explain completion.

The analysis has potentially significant policy implications. The white paper, *Knowledge and Innovation*, announced major policy changes to the arrangements for funding of higher education research in Australia in December 1999. Performance-based funding for research training was one of the new policies. Institutions will be rewarded for ensuring that students complete their degrees. This study will therefore also provide a benchmark for assessing the impact of the new arrangements on research degree completion rates.

The structure of the paper is as follows. Section 2 covers student progress and outcomes to 1999. Section 3 provides a brief discussion of a range of factors thought to influence completion rates. The effect of these characteristics on completion rates is then estimated using a binomial logistic model. Section 4 estimates a final completion rate and section 5 considers the wastage associated with non-completion of research degrees.

2. Student Outcomes by 1999

This section provides an overview of the study outcomes, at the end of 1999, of the postgraduate research students who commenced between January and March 1992. During that period 5552

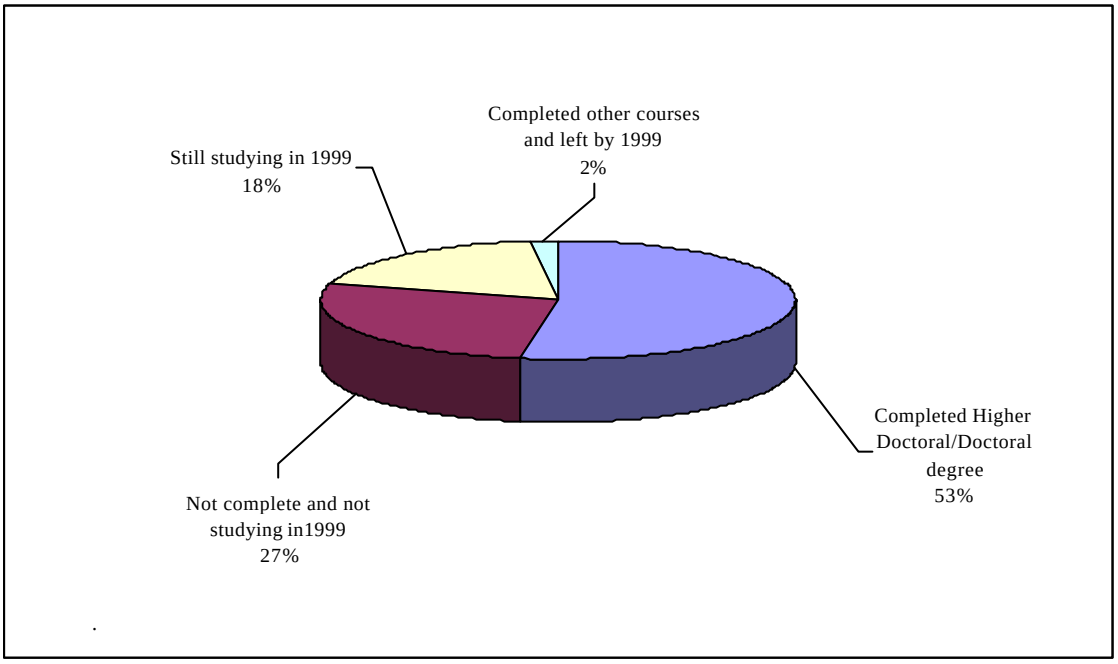
[1] Postgraduate research studies include higher doctorate, doctorate by research or masters by research award courses.

[2] The postgraduate research students sample is taken from the 1992 commencing student cohort data base which is derived from information supplied to the Department of Education, Training and Youth Affairs by publicly funded universities as part of the Higher Education Statistics Collection. Only non-overseas students who enrolled between January and March 1992 are included in the sample. The sample therefore consists of 6034 postgraduate research students. Here doctorate includes higher doctorate and doctorate students.

non-overseas students commenced a postgraduate research award, of which 2647 commenced a doctorate and 2905 began a masters degree.[3,4]

As set out in Figures 1 and 2, as of the end of 1999 just under 53 per cent of the doctoral students and 43 per cent of the masters students had completed their degrees.[5] Similar proportions (18% and 16% respectively) of doctorate and masters degree groups were still studying in 1999. A considerable proportion (27% and 39%) of each respectively group were not studying in 1999 and had not completed any course[6]. For both groups, around 2 per cent had finished courses at a lower level than that they had enrolled in and had left the institution.

Figure 1: Status of 1992 commencing doctoral students at 1999



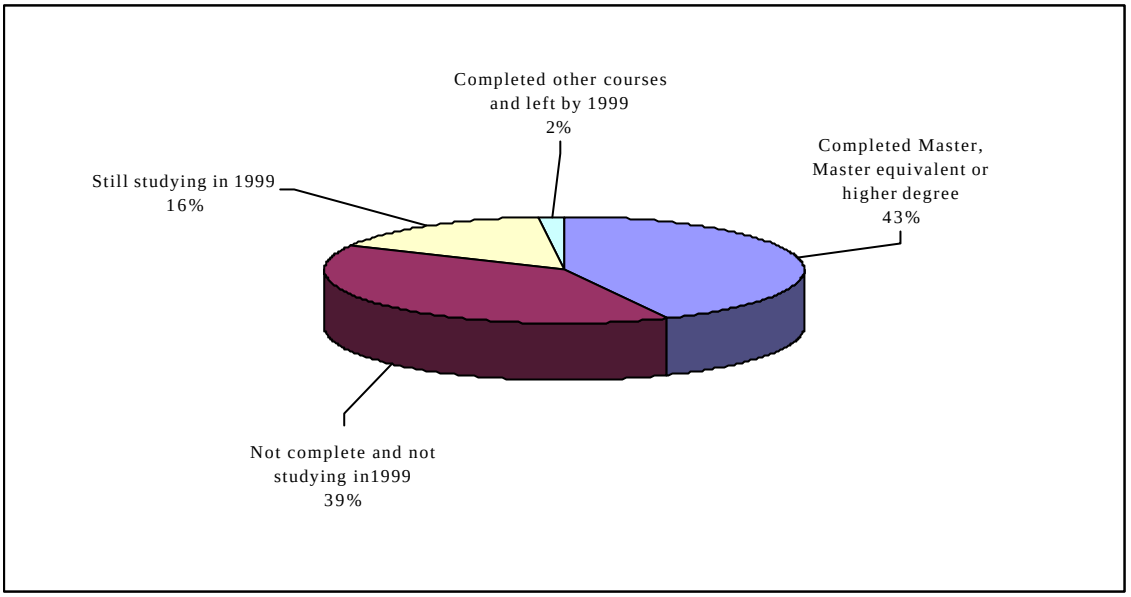
[3] Non-overseas students are as identified in the higher education data collection manual. Students who enrolled on the basis of a previous incomplete award and who therefore might start the current period of study with some credit have been excluded in this section. This simplifies the interpretation of the results. As a result, the sample is reduced to 5552.

[4] A limitation of the data is that there is no information on whether a student has transferred to another institution or has changed status, from full-time to part-time or vice versa.

[5] 31 per cent of the masters research students completed the same course by 1999. Once those who completed either a higher or equivalent degree were included, the completion rates for masters students increased to around 43 per cent.

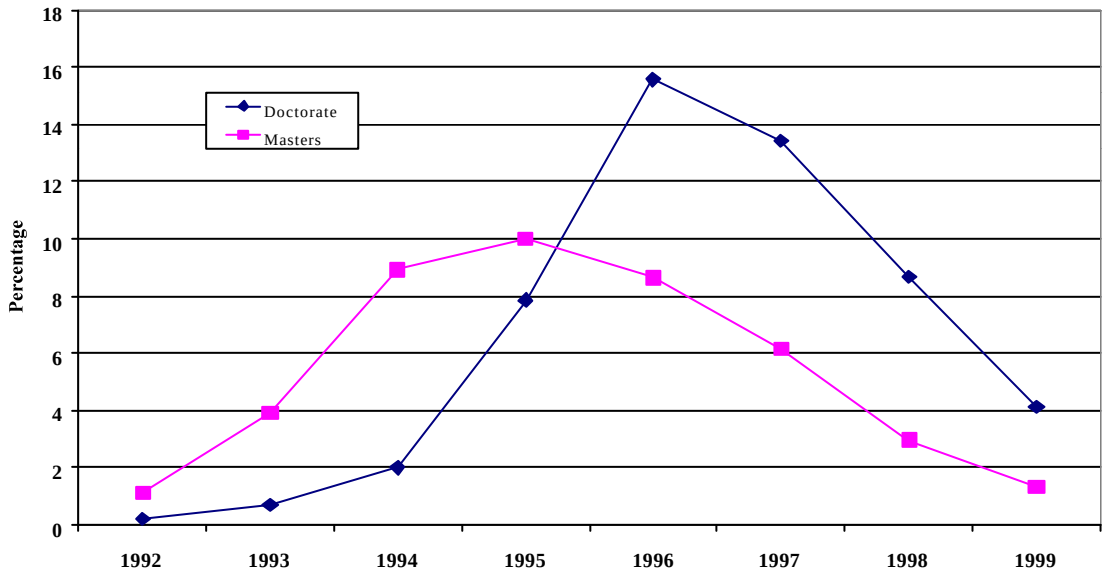
[6] A student is considered to be a non-completer if they have not completed a course and had no load between 1992 and 1999 for any three consecutive years.

Figure 2: Status of 1992 commencing masters students at 1999



The time taken to complete for the 1992 cohort of postgraduate research students is presented in Figure 3. The completion rate for masters degrees peaked at 1995 whilst doctorate completions peaked in 1996. Although the expected time to complete a postgraduate research degree varies by institution, typically a doctorate is expected to take from 2 to 4 years for full-time students and 4 to 6 years for part-time students. The notional time frame for full-time masters by research students to complete is 1 to 2 years and that for part-time students 2 to 4 years. From Figure 3, however, it would appear that few postgraduate research students in Australia completed their studies within the expected time.

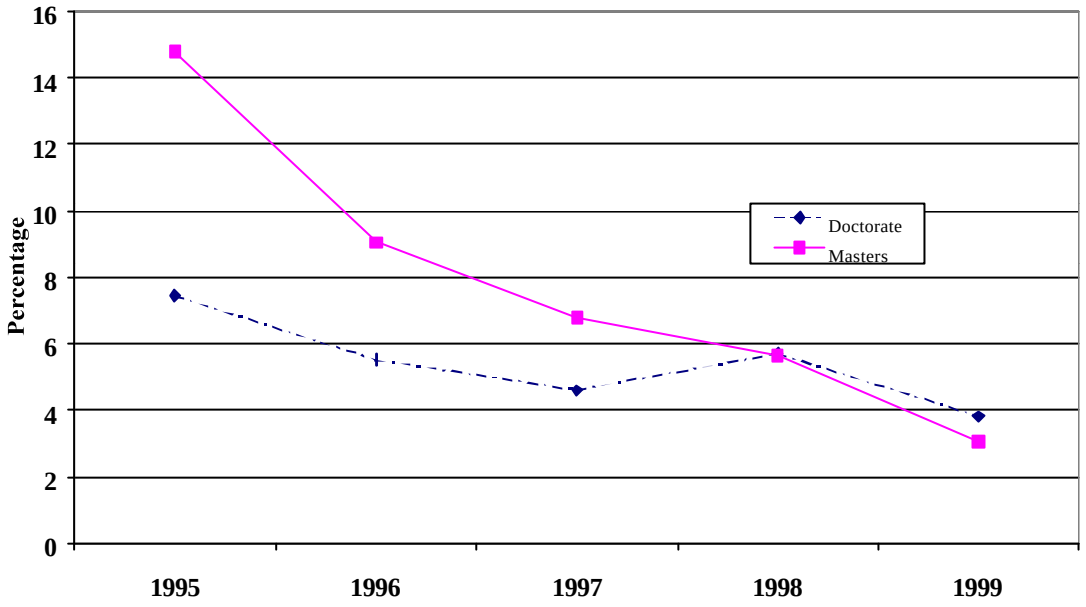
Figure 3: Postgraduate completion rates



By 1996, only about 26 per cent of doctorate students had completed the same course while only 24 per cent of master students had completed the same, higher or an equivalent course by 1995.

To investigate the rate at which students leave their courses, non-completion rates are estimated. The non-completion rate at any particular year refers to the percentage of commencing students who had not completed a course and were not recorded as studying in that or earlier years.[7] Figure 4 shows that non-completion rates were highest for both masters (14.8 per cent) and doctoral (7.4 per cent) students in 1995 before declining gradually in the following years.

Figure 4: The non-completion rate for postgraduate students



There are some irregularities in the pattern of non-completion rates for doctoral students. After falling to a low of 4.6 per cent in 1997, the rate rose to 5.7 per cent in 1998 before declining to 3.8 per cent in 1999. The reason for these irregularities is unclear but it is possible that they are the result of inconsistencies in administrative reporting. For example, study loads were generally not recorded after 3 years full-time for a masters degree or 5 years full-time for a doctorate.[8] In addition, in some instances, assessment of a thesis can take some months and as a result a completion can be recorded some time after the student has actually completed. In some situations it is possible that a completion was never reported because of such delays. These factors may have contributed to irregularity in the pattern of non-completion rates as indicated in Figure 4.

[7] See footnote 7 for definition of a non-completing student. This definition means that 1995 is the first year that non-completion rates are reported.

[8] It is important to stress that, as of 1999, this will not be an issue as universities will continue to report study loads with a status of 'studying beyond time limit' for continuing students.

3 Characteristics that Influence Completion Rates

While a wide range of factors such as availability of employment and financial support, have an impact on completion rates, the scope of the investigation presented here is restricted to those characteristics included in the higher education student database.[9] Binomial logistic regression is used to see which characteristics of the 1992 postgraduate research student cohort affect completion.

Variables included in the regression analysis are those generally recognised from other experience to be important in determining higher education outcomes. For example, gender has been consistently recognised as important in influencing progress and completion rates at the undergraduate level.[10] Research also consistently suggests that completion is related to attendance status, with students who pursue degrees on a full-time basis having greater success. The field of study and age are included for the same reason. Finally, since completions are likely to vary across institutions, institutional dummies were created, resulting in two models for both doctorates and masters degrees: one regression with institutional dummies and one without. This enabled the measurement of the variation in completion rates that could be attributed to institutions.

Details of the regression are presented in Appendix C. Table 1 summarises the results for the two models. The table sets out the predicted probabilities for each characteristic, holding other characteristics constant (at their average values). The probabilities refer to the likelihood of completion of an award (at the same institution) by 1999.[11,12]

[9] These include an increased frequency in student employment (to finance the costs of their education) (FASTS, 2000); availability of financial support (Jacks et al., 1983; Abedi et al, 1987); and excessive teaching responsibilities among graduate students (AAU/AGS 1993).

[10] See for example Urban et al. (1999).

[11] An award here refers to the same, equivalent or higher-level award only.

[12] Variables to capture the research intensity of each university and the average academic ability of postgraduate students for each university were originally included in the regression. These variables proved to not be significant.

Table 1 : The Impact on completion of a change in selected characteristics

	Doctorate		Masters	
	Excluding Institution Dummies	Including Institution Dummies	Excluding Institution Dummies	Including Institution Dummies
Student cohort population	52.7	52.2	42.9	42.6
Gender				
Female	54.6	53.9	45.9	45.6
Male	51.4	51.1	40.7	40.5
Mode of study				
Part-time	39.8	39.7	40.1	38.6
Full-time	59.0	58.3	46.7	46.5
External	38.2	38.0	38.0	44.1
Field of study				
Arts, Humanity and Social Science	41.4	40.6	37.8	37.0
Agriculture, Animal husbandry	54.6	54.1	52.5	52.9
Architecture, Building	31.4	31.6	34.8	32.2
Business, Administration, Economics	47.5	45.4	38.6	38.0
Education	46.1	44.9	49.6	48.3
Engineering, surveying	55.2	57.6	46.8	45.4
Health	66.7	64.5	46.6	50.2
Law, Legal studies	37.5	36.8	44.2	43.7
Science	59.1	59.1	43.4	44.3
Veterinary Science	64.6	66.4	50.6	49.6
Age group				
under 24 years	57.6	56.1	47.6	46.8
25 to 29 years	48.6	47.8	42.0	41.4
30 to 39 years	52.2	52.3	42.5	42.4
40 to 49 years	50.3	50.5	38.0	38.1
50 plus	50.2	50.6	43.1	44.0

Note: Predicted probabilities are calculated using equations reported in Tables D2 and D3 in Appendix D.
Predicted probabilities for institutions are not reported here. See distributions in Figures 10 and 11.
Source: 1992 Student Cohort.

As Table 1 indicates, male postgraduate students, both doctoral and masters, are less likely to complete than female students, other things being equal. Despite the fact that female doctoral students appear to be doing better than male doctoral students, the coefficients for gender are not significant for the doctoral students (see Table C2 in Appendix C). In contrast, studies in the United States and in Sweden indicate that women take longer to complete their degrees than men and have higher non-completion rates (OECD, 1987), although, these differences have been narrowing over the years in the United States (Baker, 1998).

As expected, full-time postgraduate students are significantly more likely to complete than part-time students. Indeed, the probability of full-time doctoral students completing is almost 21 percentage points higher than the probability of part-time students completing. For masters students the difference is less marked and full-time students have a probability of completion only 6.6 percentage points higher. External students have the lowest estimated probability of completion, around 38 per cent for both the doctoral and masters students. Similarly, in their

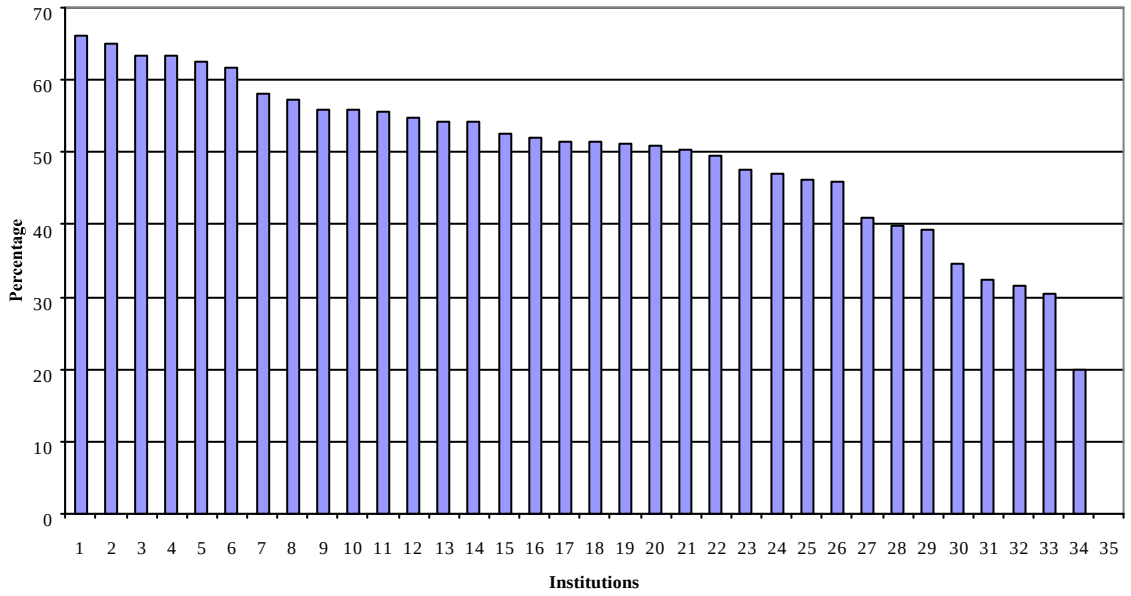
study of British doctoral students, Booth et al. (1995) found that men studying part-time or men who are registered full time but are in paid employment, have a significantly lower completion rate.

Consistent with the literature (see for example Breneman, 1976, Booth et al., 1995 and Baker, 1998), postgraduate students in science disciplines are significantly more likely to complete than those in arts disciplines. Specifically, postgraduate doctoral students who are studying agriculture, animal husbandry (with a predicted probability of 54.6 per cent), engineering, surveying, health, science and veterinary science are more likely to complete than students studying architecture, building, law, legal studies or arts, humanity and social science. The same is also true for masters research students

The likelihood of completion generally declines as age increases with the exception of those in the 25 to 29 age group. This is true for both doctoral and masters students. Doctoral students in the 25 to 29 age group have the lowest predicted probability of completion.

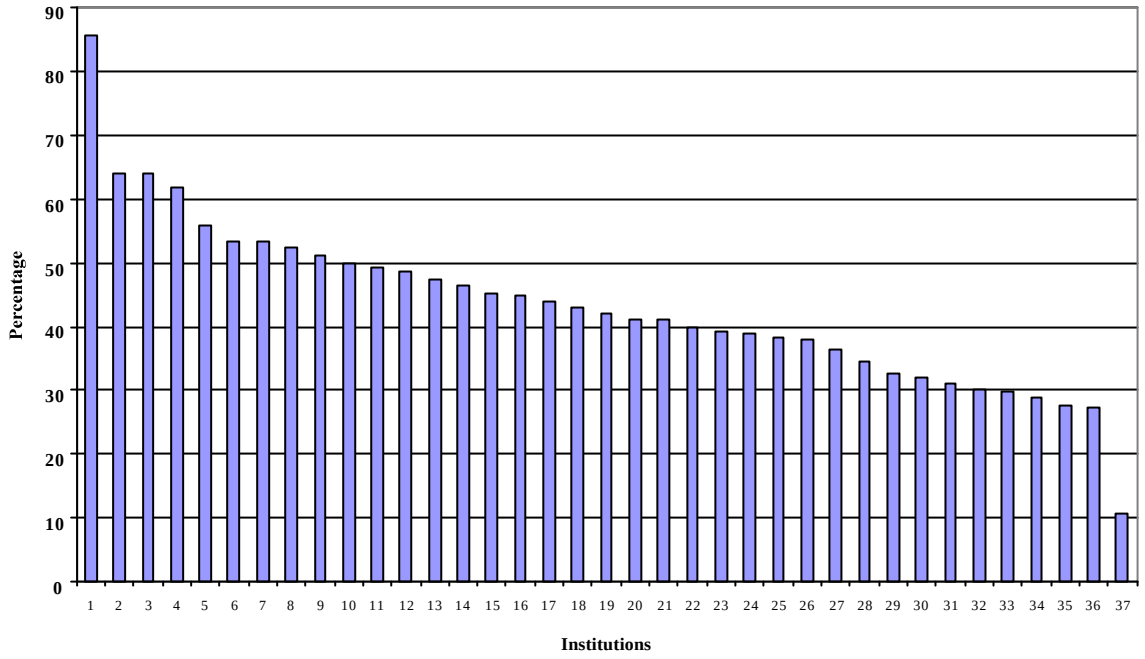
Including institutions in the regression did not change the coefficients of the other explanatory variables to any degree. However, institutions as a whole do explain a significant proportion of the variation in the completion rates of postgraduate doctoral and masters research students[13]. There is significant variation among institutional completion rates, with predicted probabilities associated with institutions ranging from 0 to 66.2 per cent for doctorate and 10.8 to 85.6 per cent for master students (see distributions in Figures 5 and 6). Completion rates for individual institutions are not reported here for confidentiality reasons.

Figure 5: Predicted completion rates for doctorate degree research by institutions, holding student characteristics constant



[13] The test statistics, given by minus twice the difference in the log-likelihood between the model with institutions and that without, exceed the critical values ($118.4 > c^2(34) \approx 48.77$) for doctorates and ($201.0 > c^2(36) \approx 50.86$) for masters.

Figure 6: Predicted completion rates for masters degree research by institutions, holding student characteristics constant



4. Final Completion Rates

Earlier, we reported that by 1999 some 53 per cent of 1992 doctoral students and 43 per cent of masters students had completed an award course, and substantial numbers were still studying. In this section, we extrapolate to estimate a final completion rate. We use a Markov Chain approach. Transition probabilities from one state to another are calculated and the resulting transition matrix is applied to the years for which there are no data, up to 2003.

Methodology

A Markov Chain is a sequence of trials of an experiment in which the possible outcomes of each trial remain the same from trial to trial, are finite in number, and have probabilities that depend only upon the outcome of the previous trial (Ernest and Richard, 1999). We define seven states: completed, not completed and not still studying, still studying, with the latter split into ranges of EFTSU consumed, 0 to < 2 EFTSU, 2 to < 3 EFTSU, 3 to < 4 EFTSU, 4 to < 5 EFTSU and >= 5 EFTSU.

The conditional probabilities can be organised in a square transition matrix T = $[t_{ij}]$ where t_{ij} is the probability that a student currently in state i will be in state j at the next observation. All entries are non-negative, the sum of the entries in each row is 1 and the process is assumed to be time independent. In this analysis the 1998 to 1999 transition probabilities are used.[14] They are

[14] We assume that students in transition from 1998 to 1999 provide the best representation of the transition probabilities for those still studying.

based on students who were either new to higher education or had a previous postgraduate award. That is, we are estimating completion rates for students who commence an award course. In our initial estimation, we do not allow for students who change universities. The transition matrices are presented in Tables 2 and 3:[15]

Table 2: Doctoral transition probabilities from 1998 to 1999

States	Completed	Not completed and not studying	5 or more EFTSU	Between 4.0 and 4.9 EFTSU	Between 3.0 and 3.9 EFTSU	Between 2.0 and 2.9 EFTSU	Between 0 and 1.9 EFTSU
Completed	1	0	0	0	0	0	0
Not completed and not studying		1	0	0	0	0	0
5 or more EFTSU	0.19	0.09	0.72	0	0	0	0
Between 4.0 and 4.9 EFTSU	0.17	0.21	0.17	0.46	0	0	0
Between 3.0 and 3.9 EFTSU	0.14	0.08	0	0.31	0.48	0	0
Between 2.0 and 2.9 EFTSU	0.13	0.28	0	0	0.18	0.41	0
Between 0 and 1.9 EFTSU	0	0.40	0	0	0	0.10	0.50

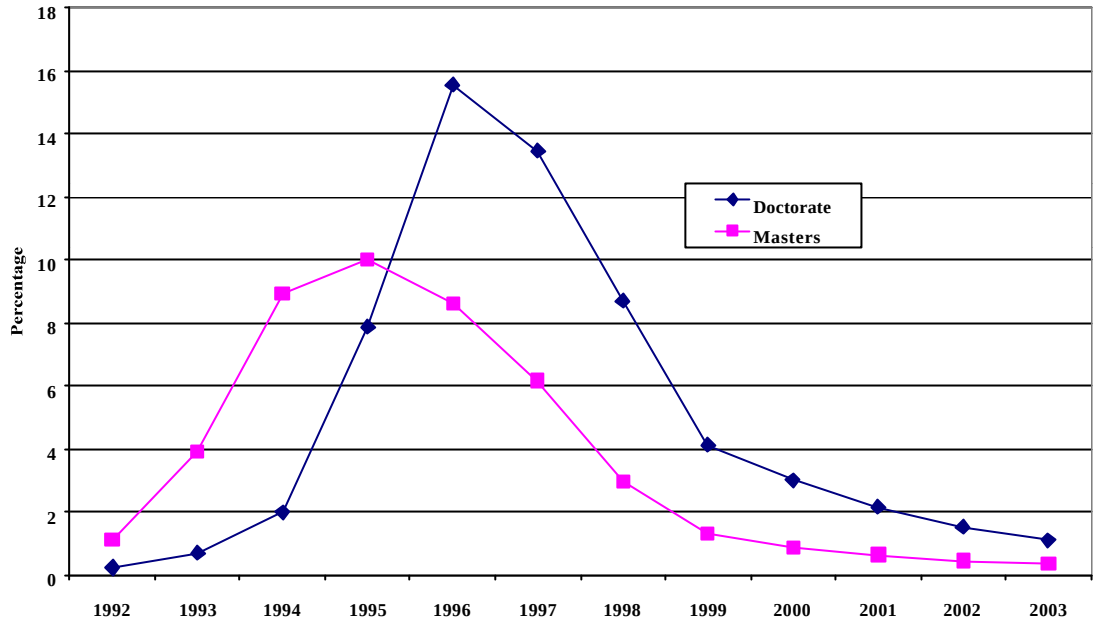
Table 3: Masters transition probabilities from 1998 to 1999

States	Completed	Not completed and not studying	5 or more EFTSU	Between 4.0 and 4.9 EFTSU	Between 3.0 and 3.9 EFTSU	Between 2.0 and 2.9 EFTSU	Between 0 and 1.9 EFTSU
Completed	1	0	0	0	0	0	0
Not completed and not studying		1	0	0	0	0	0
5 or more EFTSU	0.02	0.03	0.96	0	0	0	0
Between 4.0 and 4.9 EFTSU	0.03	0.12	0.17	0.68	0	0	0
Between 3.0 and 3.9 EFTSU	0.07	0.11	0	0.14	0.68	0	0
Between 2.0 and 2.9 EFTSU	0.13	0.24	0	0	0.13	0.50	0
Between 0 and 1.9 EFTSU	0.04	0.35	0	0	0	0.12	0.49

These matrices are applied to the students classified in 1999 into the seven states defined previously to provide estimates for 2000 and then each year to 2003. The flows are summarised in Figures 7 and 8.

[15] At a first glance, the dropout transition probability for doctorate students in the 3.0 – 3.9 EFTSU range looks a bit odd. However, for this group of students, a bigger proportion has, in fact, moved into the higher EFTSU range compared with students in other EFTSU range.

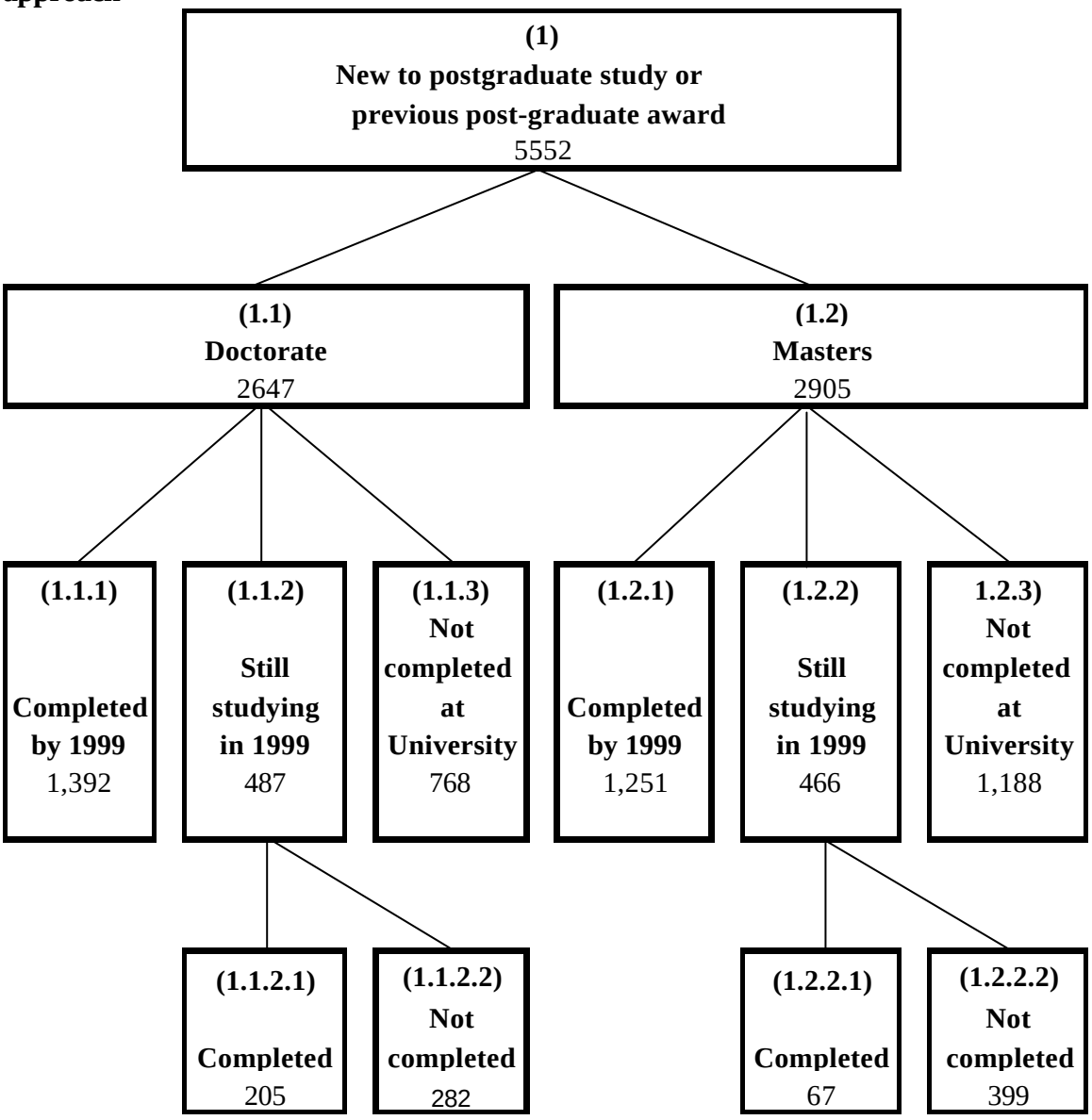
Figure 7: Postgraduate research completions - estimated after 1999



It is estimated that 60.3 per cent and 45.4 per cent of postgraduate research doctoral and masters students will complete the same, equivalent or higher level course by the year 2003.[16] The full story is presented schematically in Figure 8.

[16] If the period is extended to 2005, the completion rates are only marginally increased to 61.6 per cent for doctorates and 45.9 per cent for masters. At the limit, we end up with 63.1 and 48.6 per cent respectively.

Figure 8: Higher degree flows and completion – estimated as at 2003 using a Markov Chain approach



The results could, potentially, over-estimate the completion rates because the same transition probabilities are applied each year from 2000 to 2003.[17] Indeed, a sensitivity test, using the 1997 to 1998 transition probabilities gives somewhat higher completion rates (see Figure B1 in Appendix B).

To test the robustness of the estimates an alternative approach based on a more complicated set of flows is used. Specifically, the 1999 postgraduate research students who were still studying were divided into the five EFTSU ranges used in the Markov Chain. It is then assumed that students in each of these EFTSU ranges will:

- complete in 2000 in the same proportion as students in 1998 (remaining still studying

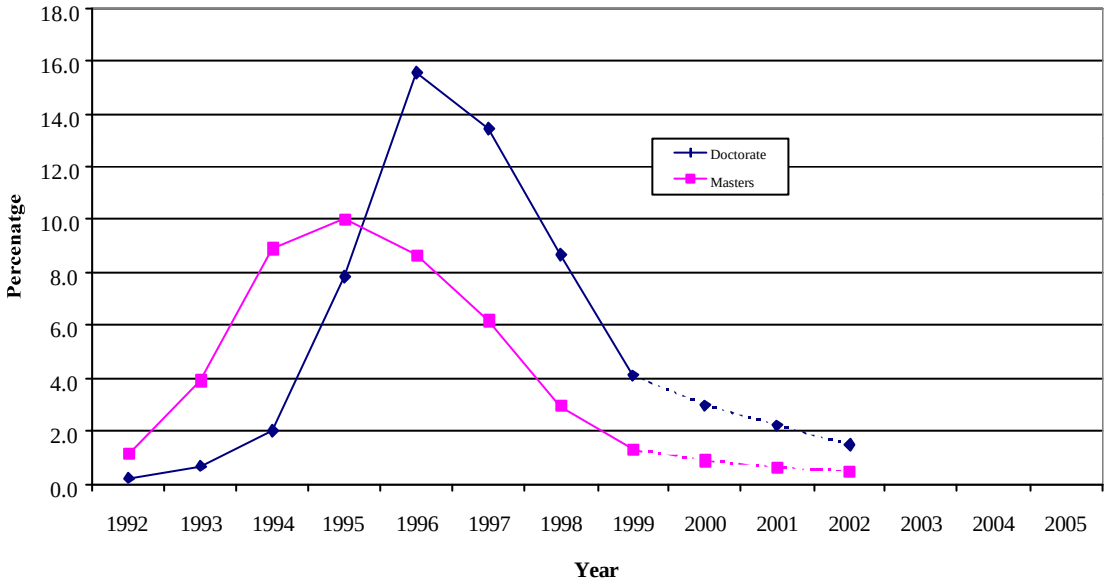
[17] By applying the same transition probabilities from years 2000 to 2003, we assumed that the behaviour of these remaining students are the same as those in transition from 1998 to 1999. We might expect the annual probability of not completing to increase over time, everything being equal.

students) who completed in 1999;[18]

- complete in 2001 in the same proportion as students in 1997 (remaining still studying students) who complete in 1999; and
- complete in 2002 in the same proportion as students in 1996 (remaining still studying students) who completed in 1999.

The problem with this approach is that the analysis can only extend three years (to 2002). The results are summarised in Figure 9. Completion rates are estimated to be 59.1 per cent for doctorate and 45.1 per cent for masters. These compare with 60.3 per cent and 45.4 per cent, respectively, using the Markov Chain method to 2003, indicating that our estimates appear to be quite robust.

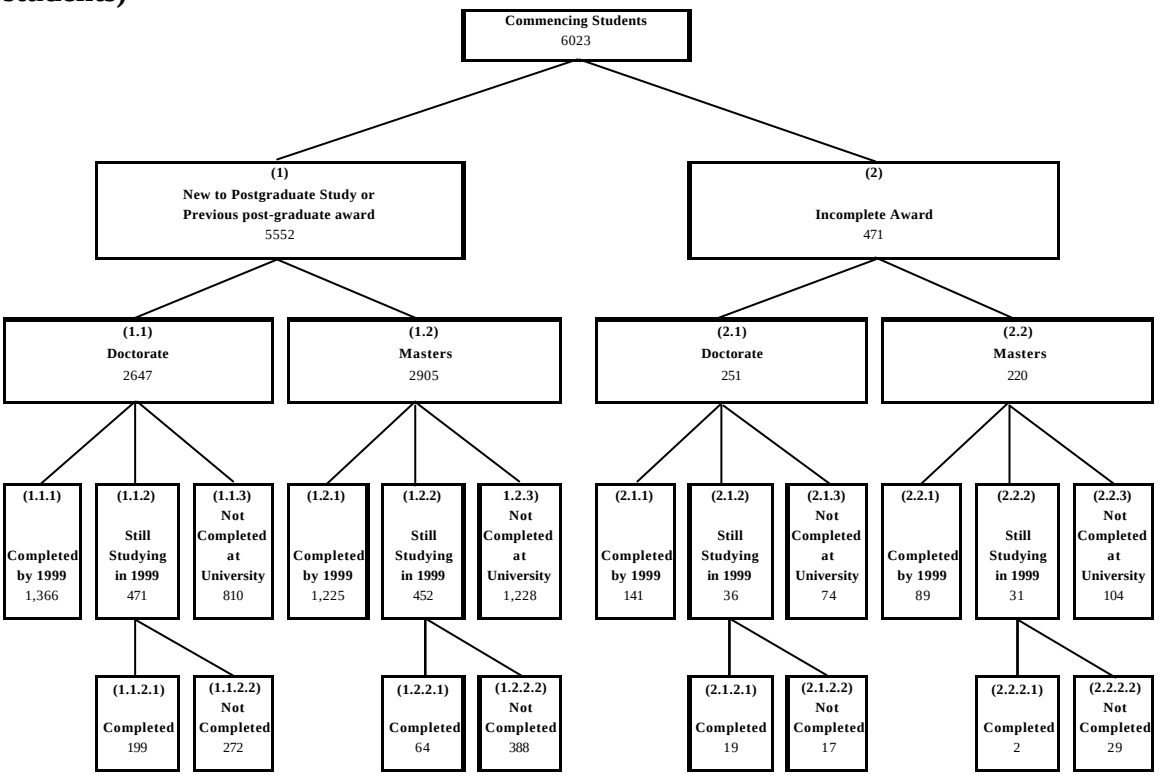
Figure 9: Postgraduate research completions – estimated after 1999 using an alternative approach



One limitation of the above methodology is that it does not allow for the fact that some students will transfer from one institution to another. We do not have information on such students. However, we do know which commencing students had a prior incomplete postgraduate award. If we assume that the system is in a steady state then we can take the recommencing students in 1992-1999 to represent those in our 1992 cohort who drop out and later recommence. We explain our approach (based on Urban et al., 1999) by referring to Figure 10.

[18] Postgraduate research students who were still studying in 1998 were again divided into the same five EFTSU ranges as previously. The proportion of students in each EFTSU range who completed in 1999 were calculated and the total completed are the sum of all five EFTSU ranges. These are the same proportions we used to estimate those who complete in 2000 of those still studying in 1999.

Figure 10: Higher degree research flows and completions (including recommencing students)



It should be noted that certain boxes differ between Figures 9 and 10 (1.1.1, for example). This is because students who recommence in subsequent years at the same institution (i.e. 1993 to 1999) have failed at their first attempt and are treated as 'not completed' in Figure 10. Their subsequent attempts are captured by those who commenced with an incomplete award. The rate at which the students who are still studying gain an award is also considered. This is estimated using the Markov Chain described above (assuming that those who do not complete by 2003 drop out).[19]

The final probability of completion for the 1992 cohort is defined as:[20]

$$P_1 + \frac{(1-P_1)qP_2}{(1-q(1-P_2))}$$

where $q = N_R/[(1-P_1)N + (1-P_2)N_R]$ and the relevant terms are defined as:

P_1 the probability of completion in the first period of attending university;

P_2 the probability of completing in subsequent periods of attending university;

q the probability of returning after leaving university without completing an award;

[19] Estimation is carried out separately for those who are new to postgraduate study (including those who had a previous award) and those who enter with an incomplete award for both doctorate and masters.

[20] See Urban et al, 1999 for the derivation of the final completion probability.

N the size of the cohort; and

N_R the number of returning students.

Using Figure 10 for doctoral students,

P_1 = [(1.1.1)+(1.2.1.1)]/(1.1) = 0.591

P_2 = [(2.1.1)+(2.1.2.1)]/(2.1) = 0.637

N = (1.1) = 2647

N_R = (2.1) = 251

and q = 0.214

Using the above methodology, it is estimated that 65.2 per cent of doctoral students in the 1992 cohort will complete an award course at some time. For masters students, only 47.5 per cent will complete at some stage.[21] This compares with the earlier 'naï ve' estimates of 60.3 per cent and 45.4 per cent respectively.

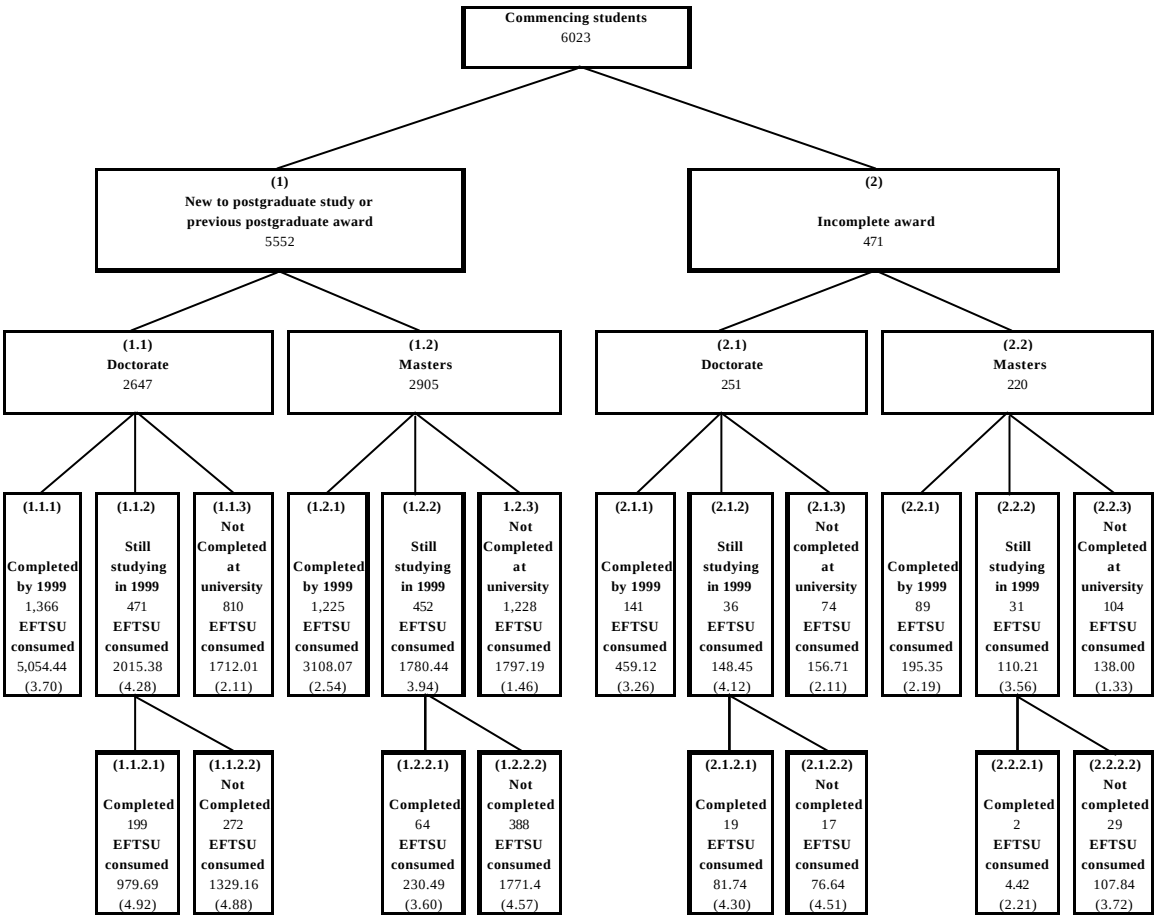
5. Use of resources to complete an award

Another aspect of postgraduate research outcomes is whether the resources consumed to attain postgraduate research awards are used efficiently. Figure 11 presents information on the average number of study units consumed, expressed in equivalent full-time study units (EFTSU). The cohort is split into two groups: those new to postgraduate study or have a prior postgraduate award and those with a prior incomplete award.[22]

[21] The final completion rates for doctorates and masters increase to 66.6 per cent and 48.0 per cent respectively if the Markov Chain estimation is extended to 2005.

[22] The estimated EFTSU in boxes 1.1.2.1 to 2.2.2.2 are derived using the estimated final completions model from section 4. For example, we estimated that 28 of the remaining doctoral students in the 4 to 4.9 EFTSU range will complete in 2000 and hence their estimated EFTSU consumption equalled 28 multiplied by 4.45, (the mean for that range) that is, a total of 124.6 EFTSU consumed. The total estimated EFTSU consumption of all doctoral students who completed in 2000, therefore, equalled the sum of all EFTSU consumed in each range. The same estimation is applied to those not completed.

Figure 11: Higher degree research flows, completions and EFTSU consumption



Note: EFTSU in brackets is average EFTSU consumed.

Overall the information provided in Figure 11 indicates that the average number of study units consumed by those who completed their awards by 1999, for example, 3.7 and 2.5 units for doctoral and masters students respectively in group 1, is not a cause for concern.

What is of some concern, however, is the relatively high consumption of study units by those still studying. As indicated in Table 4, 24.3 per cent of EFTSU undertaken by the cohort was consumed by students still studying (16 per cent). As we would expect those who did not complete a degree and were not still studying consumed, on average, the least EFTSU. Nevertheless, due to the relatively high non-completion rates, the EFTSU consumed by this group represent 22.8 per cent of study units consumed by the cohort. It is these two groups of students that we should be concerned about.

Table 4: EFTSU consumed by level of course and education status at 1999

	EFTSU consumed by cohort					
Status at 1999	**Doctorate EFTSU**	**Per cent of total doctorate EFTSU**	**Masters EFTSU**	**Per cent of total masters EFTSU**	**Total EFTSU**	**Per cent of total EFTSU**
Not completed and not still studying	1868.7	19.6	1935.2	27.1	3803.9	22.8
Still studying	2163.8	22.6	1890.7	26.5	4054.5	24.3
Completed	5513.5	57.8	3303.4	46.3	8817.0	52.9
	9546.1	**100.0**	**7129.3**	**100.0**	**16675.4**	**100.0**

At this point it is pertinent to consider whether the new regime for funding research training will improve efficiency. The new funding scheme requires that students admitted to doctoral programmes occupy a scholarship for a maximum of four years of full-time equivalent study only. For masters students, the maximum period will be two years of full-time equivalent study. Once students complete or withdraw, places will be available for reallocation to institution through a performance-based funding formula. This will enable new students to take up research opportunities and to ensure that public investment in research training provides a reasonable return through timely completion of our research students.

Figures 12 to 15 provide the distribution of actual and estimated consumption of EFTSU for doctoral and masters students who complete an award course and those who had not completed, including those still studying.[23] Figure 12 shows that 956 doctoral students (or 36.1% of all doctoral students) are estimated to have completed their degree in 4 full-time equivalent study years.[24] However, a further 338 students are expected to complete within one additional year, and it is most unlikely that the new rules will discourage these students from completing. For masters students, only around 18 per cent had completed their degrees in 2 full-time equivalent study units (Figure 13). However, it is important to note that 206 masters research students had completed a doctorate degree and therefore had extended their unit consumption to at least 4 full-time years.

For students who had not completed an award, 27.9 per cent of all doctoral students had consumed 4 EFTSU and had not completed their degrees (Figure 14). For masters students, those who had consumed 2 EFTSU and had not yet completed amounted to 30.0 per cent of all masters students (Figure 15).

[23] For demonstration purposes, the following distributions of actual and estimated EFTSU consumption of postgraduate research students include only students who were new to postgraduate study and those with a previous award.

[24] One full-time equivalent study year represents the consumption of 1 EFTSU.

Figure 12: Actual and estimated EFTSU consumption of completed postgraduate doctoral students

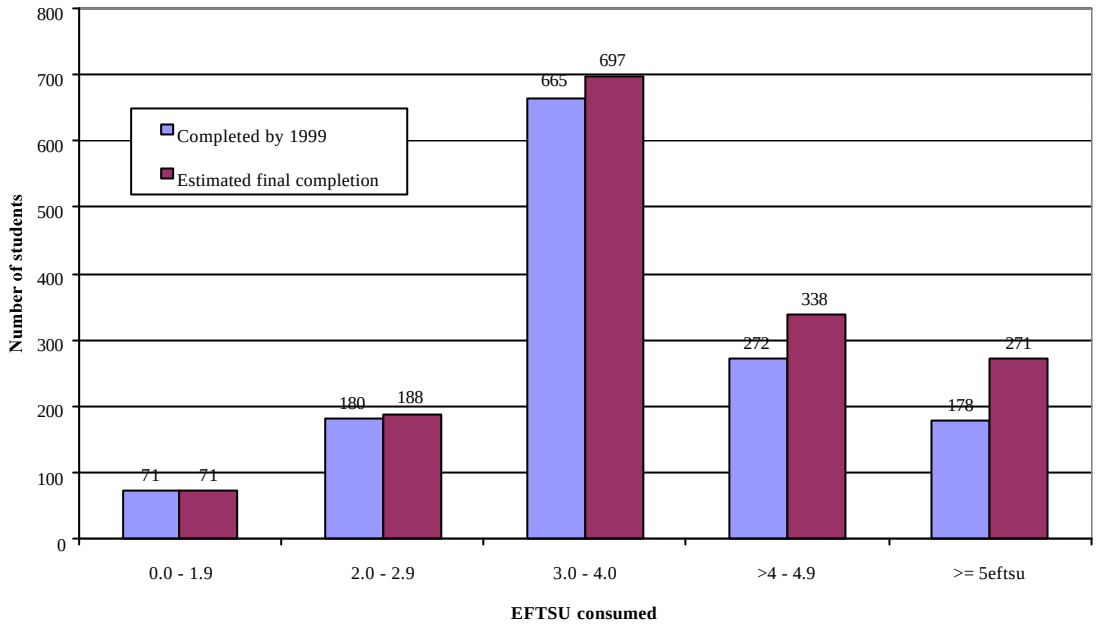


Figure 13: Actual and estimated EFTSU consumption of completed postgraduate masters students

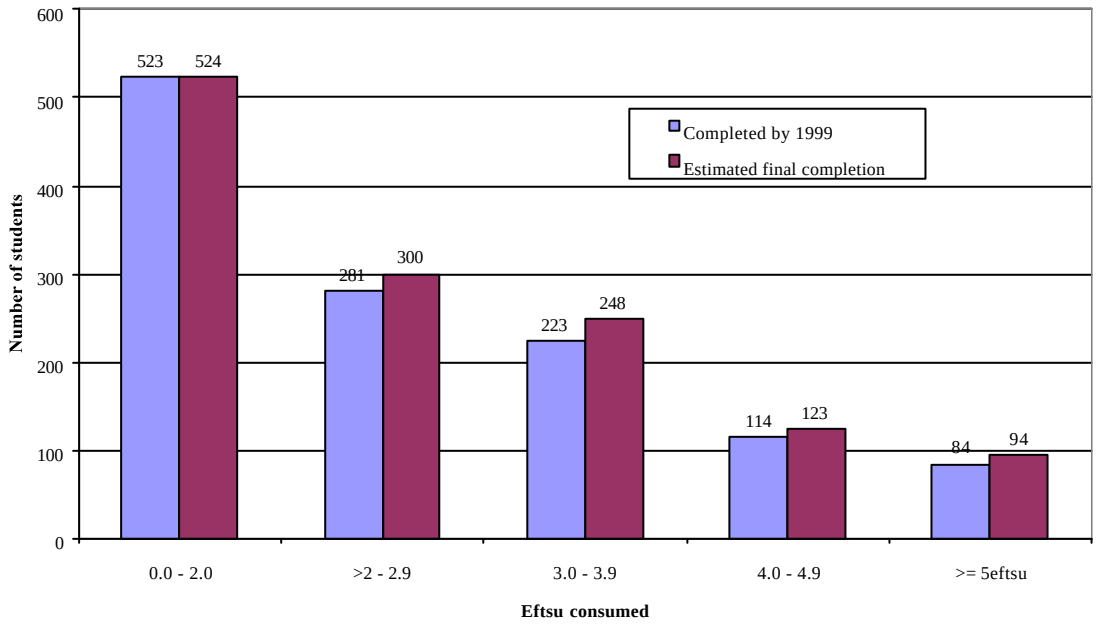


Figure 14: Actual and estimated EFTSU consumption of not completed postgraduate doctoral students

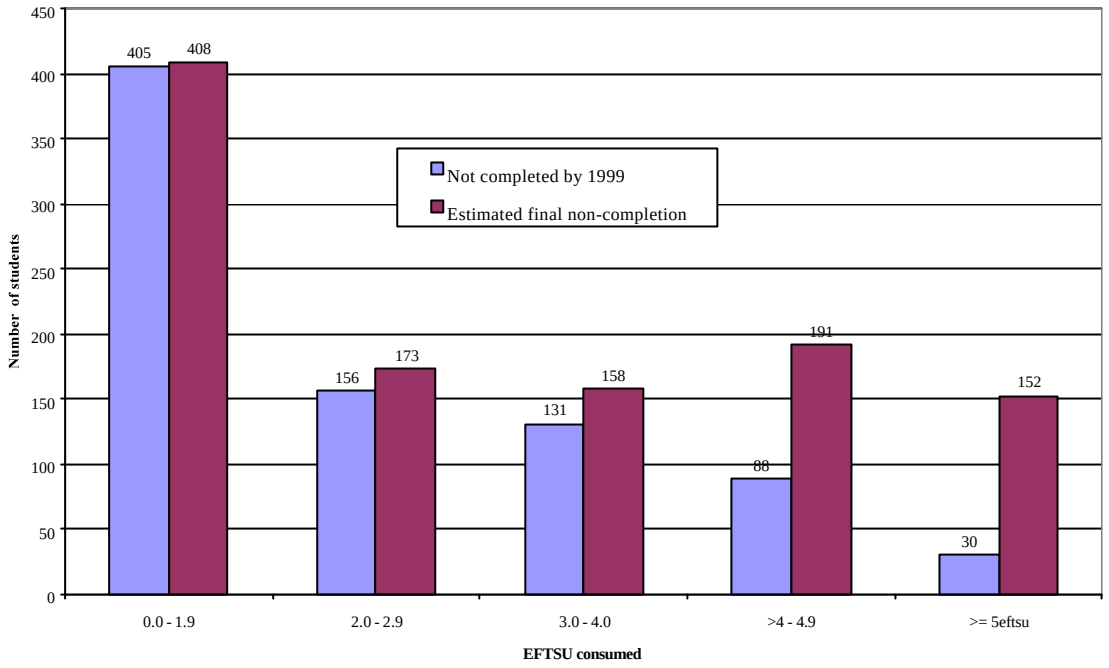
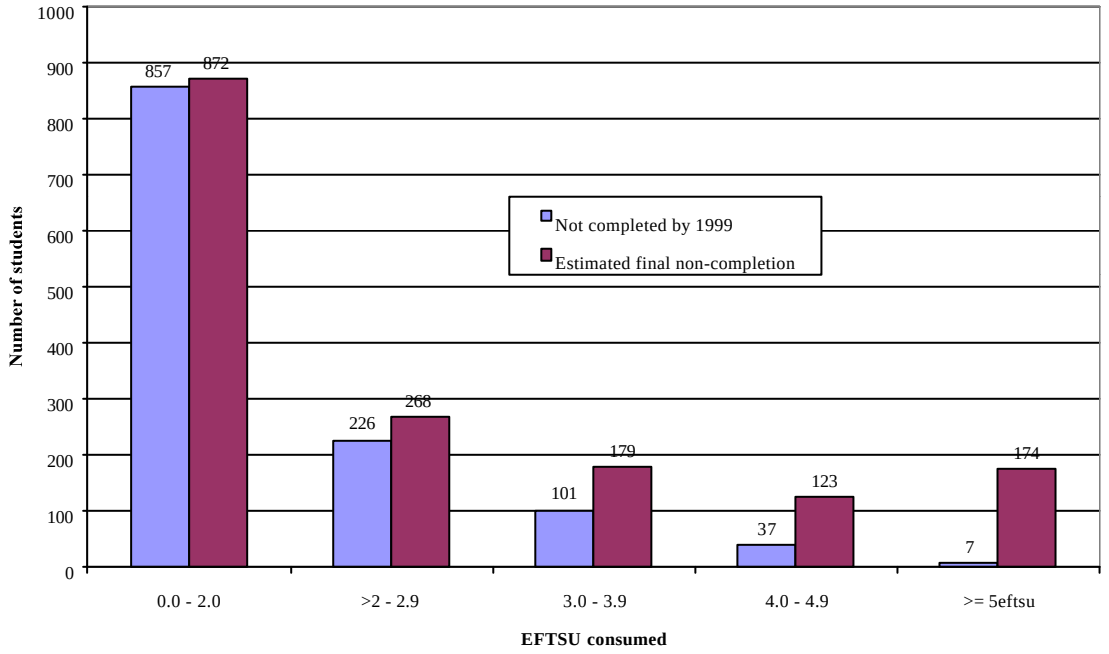


Figure 15: Actual and estimated EFTSU consumption of not completed postgraduate masters students



Overall, the results presented here suggest that in the case of doctoral students the new research funding arrangements will have only a minor impact and that the 4 full-time equivalent years of study is appropriate. Nevertheless, they will provide some pressure for those at the high end of the consumption of study units to complete more quickly. In the case of masters students, however, the impact of the new research funding scheme may be more noticeable because of the relatively large numbers of students exceeding the 2 full-time years of study rule.

6. Conclusion

While there are many issues involved in assessing the research training performance of Australia's universities, a useful starting point is the completion rates of students in undertaking their studies. There is little hard evidence available on such completion rates, because the analysis is complex, requiring detailed information on the progress of students in completing their studies. The study undertaken here addresses this deficiency by presenting the results of a quantitative analysis of the performance of the 1992 cohort of postgraduate research students studying at Australian institutions. Performance is defined here as the rate at which these students had successfully completed their studies by 1999, eight years after commencement and the latest year for which information was available.

The results indicate that after eight years, only 53 per cent of postgraduate research doctoral students had completed the courses that they had enrolled in 1992. An additional 2 per cent of these doctoral students completed a course other than the one they enrolled in, although this was at a lower level than doctorate. Almost 18 per cent of the doctoral students who commenced in 1992 but were still studying in 1999 had not completed any award. The remaining doctoral research degree students, close to 27 per cent of the total, were no longer studying.

For students studying for a masters research degree, only 31 per cent had completed their courses after eight years. However, an additional 14 per cent of these masters research students had completed courses other than the ones they were initially enrolled. Of these students, about 7 per cent completed courses of a higher (doctorate) level. Of the remaining 7 per cent, about 5 percentage points completed studies at the same level (masters coursework) and about 2 percentage points completed studies at a lower level. In addition, 16 per cent of masters students who began their research degree in 1992 were still studying in 1999 while the remaining 39 per cent were no longer studying in 1999.

Based on the results for this cohort to 1999 the likely final completion rates for the cohort were estimated. The estimates indicate that around 65 per cent of students will complete the postgraduate research doctorate they enrolled in and 47.5 per cent of masters research students will complete their masters degrees (or a higher award) at the same or different institution. These figures should be taken as upper bounds because they assume constant transition rates after 1999, and, based on the earlier years, non-completion rates are likely to increase as students fail to complete.

The study also confirms the view that few students completed their chosen courses within the expected time. Of those doctoral students who had completed, 36 per cent completed within 4 full-time study years. However, only a small proportion take more than four years. This suggests that the limit for funding doctorates under the new research training scheme is appropriate and should encourage most students to complete within the four year period.

The high non-completion rates must be a cause for concern. They represent a considerable waste of resources. The particularly high non-completion rates for masters students, along with the very long study periods for many students, indicate that universities need to look at their selection and supervision practices carefully. The performance based funding of the new research training scheme should assist in focussing universities' attention to this problem.

The regression analysis also throws up challenges to universities. The analysis revealed that there is considerable variability in completion rates across disciplines, gender, age, study mode and institutions. The differences in completion rates across disciplines suggest systemic problems. Science courses may be more structured and involve group work and closer supervision. However, is this justification for poor completion rates in arts subjects, for example, or does it suggests that supervision practices in the poorly performing disciplines need review? The variation by personal characteristics may be understandable in some cases, such as the poor performance of external students. However, one could ask whether universities tailor their supervisory practices to the circumstances of the student. Finally, the variation in performance across institutions indicates that many universities need to examine their practices and benchmark against the best performing universities. Hopefully, the performance element of the new research training scheme will provide the incentive for universities to improve their practices in selection and supervision of research students.

Appendix A

Table A1: 1999 Postgraduate (research) academic progress and outcomes

	Commenced in 1992	Completed the same course by 1999	Not completed a course and dropout[1]	Still studying in 1999[2]	Completed other courses by 1999 and left[3]					
					Doctorate Research/ Coursework	Master Research/ Coursework	Postgraduate Qual/Prel	Graduate Diploma	Graduate Certificate	Bachelor
Doctorate by Research	2647	1392 (52.6%)	715 (27.0%)	487 (18.4%)		43 (1.6%)		7 (0.26%)		3 (0.11%)
Master by Research	2905	904 (31.1%)	1142 (39.3%)	466 (16.0%)	206 (7.09%)	141 (4.9%)	3 (0.1%)	30 (1.03%)	4 (0.14%)	9 (0.31%)
Total	5552	2296 (41.4%)	1857 (33.4%)	953 (17.2%)	206 (3.7%)	184 (3.3%)	3 (0.05%)	37 (0.67%)	4 (0.07%)	12 (0.22%)

Note:

1. A student is considered a dropout if he/she had not completed a course and was away for three consecutive years.
2. These students include those who had not completed the same course and those who had completed other level courses and still studying, presumably, for the same course they commenced in.
3. The same three years rule also applied here. That is, if a student had completed other courses and was away for three consecutive years then the student is considered to have left the institution.

Source: 1992 Student Cohort.

Table A2: 1999 Completion Rate of Higher Degree Research Students by Type of Enrolment

	Commencements		Completions		Commencements		Completions		Commencements		Completions	
Type of Enrolment	PhD	%	Number	%	Masters	%	Number	%	Total	%	Number	%
External	66	2.5	21	31.8	229	7.9	88	38.4	295	5.3	109	36.9
Full time	1789	67.6	1083	60.5	1332	45.9	631	47.4	3121	56.2	1714	54.9
Part time	792	29.9	288	36.4	1344	46.3	532	39.6	2136	38.5	820	38.4
All	2647	100	1392	52.6	2905	100	1251	43.1	5552	100	2643	47.6

Source: 1992 Student Cohort.

Table A3: Percentage of commencements and completions by gender and type of enrolment

	External	Full-time	Part-time	Total
Commencement				
Female	6.1	53.9	40.1	41.8
Male	4.8	57.9	37.3	58.2
Total	5.3	56.2	38.5	100
~~Completion rates (as at 1999)~~				
Female	36.2	53.8	44	48.8
Male	37.7	55.6	34.1	46.7
Total	36.9	54.9	38.4	47.6

Source: 1992 Student Cohort.

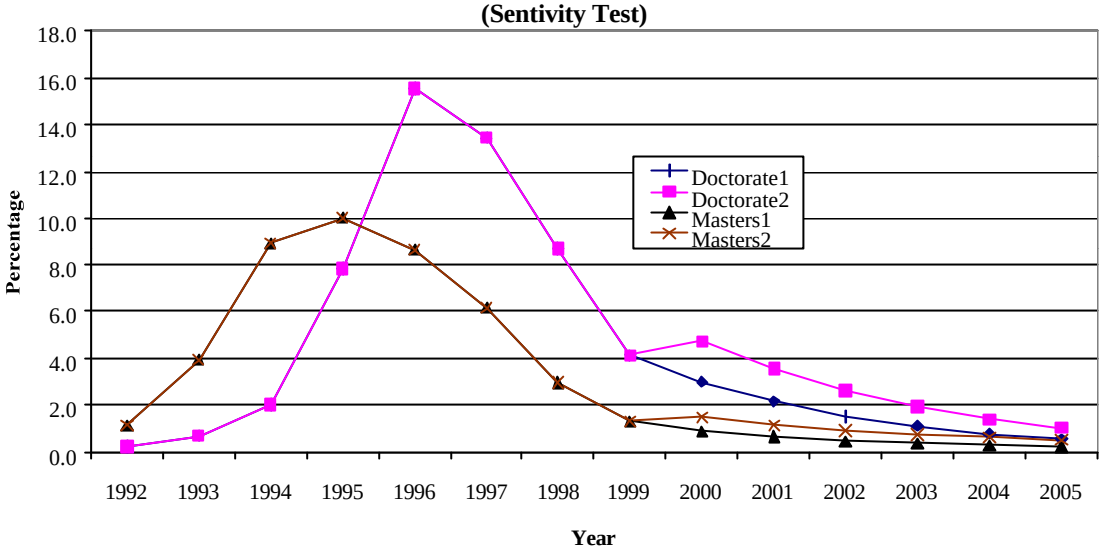
Table A4: Completion rates by gender, type of enrolment and age group

	Female				Male				Total			
	External	Full-time	Part-time	Total	External	Full-time	Part-time	Total	External	Full-time	Part-time	Total
19 & under												
Commencements	0	1	0	1	0	2	0	2	0	3	0	3
Completions	0	1	0	1	0	2	0	2	0	3	0	3
Completions rates (%)	0	100	0	100	0	100	0	100	0	100	0	100
20 to 24												
Commencements	11	450	82	543	3	838	130	971	14	1288	212	1514
completions	3	267	38	308	2	522	49	573	5	789	87	881
Completions rates (%)	27.3	59.3	46.3	56.7	66.7	62.3	37.7	59.0	35.7	61.3	41.0	58.2
25 to 29												
Commencements	22	231	142	395	20	382	188	590	42	613	330	985
completions	8	114	65	187	9	201	61	271	17	315	126	458
Completions rates (%)	36.4	49.4	45.8	47.3	45.0	52.6	32.4	45.9	40.5	51.4	38.2	46.5
30 to 39												
Commencements	47	335	354	736	70	450	473	993	117	785	827	1729
completions	18	177	165	360	28	228	171	427	46	405	336	787
Completions rates (%)	38.3	52.8	46.6	48.9	40.0	50.7	36.2	43.0	39.3	51.6	40.6	45.5
40 to 49												
Commencements	43	166	278	487	44	159	325	528	87	325	603	1015
completions	13	80	113	206	12	71	104	187	25	151	217	393
Completions rates (%)	30.2	48.2	40.6	42.3	27.3	44.7	32.0	35.4	28.7	46.5	36.0	38.7
50 & over												
Commencements	18	67	74	159	17	40	90	147	35	107	164	306
completions	9	34	28	71	7	17	26	50	16	51	54	121
Completions rates (%)	50.0	50.7	37.8	44.7	41.2	42.5	28.9	34.0	45.7	47.7	32.9	39.5
Total												
Commencements	141	1250	930	2321	154	1871	1206	3231	295	3121	2136	5552
completions	51	673	409	1133	58	1041	411	1510	109	1714	820	2643
Completions rates (%)	36.2	53.8	44.0	48.8	37.7	55.6	34.1	46.7	36.9	54.9	38.4	47.6

Source: 1992 Student Cohort.

Appendix B

Figure B1: Postgraduate Research Completions - estimated after 1999 (Sentivity Test)



Note: Doctorate1 and Masters1 were estimated using 98-99 transition probabilities while Doctorate2 and Masters2 , 97-98 transition probabilities.
Source: 1992 Student Cohort.

Appendix C

'Having completed' is a binary or dichotomous outcome; that is, it can take only one of two values (completed or not completed). The basic formulation of the logistic regression model is

$$Logit \quad P_i = \log\left(\frac{P_i}{(1-P_i)}\right) = bX_i + \varepsilon_i \qquad \text{(C1)}$$

where P_i is the probability of the outcome occurring (e.g. having completed), b is a coefficient vector, X_i, the variable vector and ε_i, the error term (see Hosmer and Lemeshow (1989) and Agresti (1990) for a detailed discussion of logistic regression). The logistic regression models reported here were estimated using maximum likelihood estimation techniques (SAS, version 6).

The coefficients from the binomial logistic regression can be converted into estimated probability values using the following formula:

$$P_i = \frac{\exp(\alpha + \sum_{i=1}^{n} \beta_i x_i)}{1 + \exp(\alpha + \sum_{i=1}^{n} \beta_i x_i)} \qquad \text{(C2)}$$

Table C1 presents the completion pattern of the 1992 postgraduate students and also the observed odds ratios. The results of the binomial logistic regression models for postgraduate research doctorates and masters are summarised in Tables C2 and C3.

Tables C2 (excluding institutional dummies) and C3 (including institutional dummies) summarise the results of regressions. The overall global testing for the joint significance of the explanatory variables suggests that the combined effects of all the explanatory variables are significantly different from zero. The models also satisfy the Hosmer and Lemeshow Goodness-of-Fit Test. When the data are partitioned into 10 different groups for both completed and not completed, the expected and observed probabilities fit reasonably well, indicating the model fits the data well. Institutional dummies, as well as, other dummies, such as, age group, field of study and mode of study, are significant (as a group) on the basis of the log-likelihood ratio test. Table C4 describes the characteristics of the populations.

Table C1: 1992 postgraduate research student cohort completion pattern, as of 1999

	PhD Completion			Masters Completion		
	Yes (1)	No (2)	Odds (1)/(2)	Yes (4)	No (5)	Odds (4)/(5)
Gender						
Female	580	510	1.137	553	678	0.816
Male	812	745	1.090	698	976	0.715
Mode of study						
Part-time	288	504	0.571	532	812	0.655
Full-time	1083	706	1.534	631	701	0.900
External	21	45	0.467	88	141	0.624
Field of study						
Arts, Humanity and Social Science	259	385	0.673	349	557	0.627
Agriculture, Animal husbandry	36	26	1.385	32	30	1.067
Architecture, Building	11	26	0.423	25	48	0.521
Business, Administration, Economics	67	92	0.728	78	185	0.422
Education	108	175	0.617	175	206	0.850
Engineering, surveying	163	130	1.254	219	231	0.948
Health	247	118	2.093	121	142	0.852
Law, Legal studies	10	21	0.476	18	24	0.750
Science	472	273	1.729	222	270	0.822
Veterinary Science	19	9	2.111	11	10	1.100
Age group						
under 24 years	513	261	1.966	371	372	0.997
25 to 29 years	228	209	1.091	230	318	0.723
30 to 39 years	390	389	1.003	397	553	0.718
40 to 49 years	199	294	0.677	194	324	0.599
50 plus	62	102	0.608	59	83	0.711

Source: 1992 Student Cohort.

Table C2: Binomial logistic regression of completion/non-completion, postgraduate research students

Parameter	Doctorate (N = 2647) Estimate	Pr > ChiSq	Odds ratio	Masters (N = 2905) Estimate	Pr > ChiSq	Odds ratio
Intercept	-0.6004	0.0002		-0.2988	0.0203	
Gender						
Female	REFERENCE CATEGORY			REFERENCE CATEGORY		
Male	-0.1282	0.1391	0.88	-0.2132	0.0087	0.808
Mode of study						
Part-time	REFERENCE CATEGORY			REFERENCE CATEGORY		
Full-time	0.7785	<.0001	2.178	0.2664	0.002	1.305
External	-0.0677	0.2827	0.935	-0.0909	0.5508	0.913
Field of study						
Arts, Humanity and Social Science	REFERENCE CATEGORY			REFERENCE CATEGORY		
Agriculture, Animal husbandry	0.5345	0.0542	1.707	0.5993	0.0251	1.821
Architecture, Building	-0.4337	0.2473	0.648	-0.132	0.6095	0.876
Business, Administration, Economics	0.2478	0.1855	1.281	0.0339	0.833	1.035
Education	0.1927	0.2133	1.212	0.4809	0.0002	1.618
Engineering, surveying	0.5575	0.0003	1.746	0.3716	0.0033	1.45
Health	1.045	<.0001	2.843	0.3616	0.0115	1.436
Law, Legal studies	-0.1631	0.6833	0.849	0.2652	0.4096	1.304
Science	0.7162	<.0001	2.047	0.233	0.0509	1.262
Veterinary Science	0.948	0.0235	2.581	0.5221	0.2434	1.686
Age group						
under 24 years	REFERENCE CATEGORY			REFERENCE CATEGORY		
25 to 29 years	-0.3628	0.0047	0.696	-0.228	0.0552	0.796
30 to 39 years	-0.2162	0.0684	0.806	-0.2088	0.0566	0.812
40 to 49 years	-0.2943	0.041	0.745	-0.3955	0.0026	0.673
50 plus	-0.2998	0.137	0.741	-0.1818	0.3518	0.834
Restricted log-likelihood	-3662.427			-3971.098		
log-likelihood function	-3409.453			-3909.413		
Degree of freedom	16			16		
Max-rescaled R-squared	0.1216			0.0282		

Source: 1992 Student Cohort.

Table C3 : Binomial logistic regression of completion/non-completion, postgraduate research students[1]

Parameter	Doctorate (N = 2647) Estimate	Pr > ChiSq	Odds ratio	Masters (N = 2905) Estimate	Pr > ChiSq	Odds ratio
Intercept	-0.7213	0.0009		-0.4642	0.0353	
Gender						
Female	REFERENCE CATEGORY			REFERENCE CATEGORY		
Male	-0.1145	0.1954	0.892	-0.2084	0.0121	0.812
Mode of study						
Part-time	REFERENCE CATEGORY			REFERENCE CATEGORY		
Full-time	0.7533	<.0001	2.124	0.3212	0.0004	1.379
External	-0.0698	0.8547	0.933	0.2265	0.3353	1.254
Field of study						
Arts, Humanity and Social Science	REFERENCE CATEGORY			REFERENCE CATEGORY		
Agriculture, Animal husbandry	0.5459	0.0561	1.726	0.651	0.0206	1.918
Architecture, Building	-0.3907	0.3026	0.677	-0.2139	0.4251	0.807
Business, Administration, Economics	0.196	0.3058	1.217	0.0419	0.8061	1.043
Education	0.1756	0.2736	1.192	0.4641	0.0014	1.591
Engineering, surveying	0.6869	<.0001	1.987	0.3504	0.0106	1.42
Health	0.9778	<.0001	2.659	0.5396	0.0004	1.715
Law, Legal studies	-0.1625	0.6888	0.85	0.2777	0.4108	1.32
Science	0.7496	<.0001	2.116	0.3055	0.0149	1.357
Veterinary Science	1.062	0.0136	2.892	0.5176	0.2605	1.678
Age group						
under 24 years	REFERENCE CATEGORY			REFERENCE CATEGORY		
25 to 29 years	-0.3314	0.0115	0.718	-0.2215	0.0705	0.801
30 to 39 years	-0.1507	0.2165	0.86	-0.1778	0.1208	0.837
40 to 49 years	-0.2242	0.1334	0.799	-0.359	0.0092	0.698
50 plus	-0.2192	0.2874	0.803	-0.1117	0.5785	0.894
Restricted log-likelihood	-3662.427			-3971.098		
log-likelihood function	-3350.247			-3808.936		
Degree of freedom	50			52		
Max-rescaled R-squared	0.1485			0.0729		

Note:

1. Institutions are included in this regression. As expected, there are significant variations among institutions in completions and as a group they significantly explain some of the variations in the completion rates of postgradute research students. Institution coefficients are not presented here for confidentiality reasons.

Source: 1992 Student Cohort.

Table C4 : Variable Mean and Standard Deviation of the 1992 Student Cohort

	Doctorate (N = 2647)	Masters (N = 2905)
Variable	**Mean**	**Mean**
Gender	0.5882	0.5762
Mode of study		
Part-time	0.2992	0.4627
Full-time	0.6759	0.4585
External	0.0249	0.0788
Field of study		
Arts, Humanity and Social Science	0.2433	0.3119
Agriculture, Animal husbandry	0.0234	0.0213
Architecture, Building	0.0140	0.0251
Business, Administration, Economics	0.0601	0.0740
Education	0.1069	0.1312
Engineering, surveying	0.1107	0.1549
Health	0.1379	0.0905
Law, Legal studies	0.0117	0.0145
Science	0.2815	0.1694
Veterinary Science	0.0106	0.0072
Age group		
under 24 years	0.2924	0.2558
25 to 29 years	0.1651	0.1886
30 to 39 years	0.2943	0.3270
40 to 49 years	0.1862	0.1797
50 plus	0.0620	0.0489

Source: 1992 Student Cohort.

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