Undergraduate non-completion rates: Differences between UK universities *

JILL JOHNES & JIM TAYLOR
Department of Economics, University of Lancaster, U.K.

Abstract. The non-completion rate of university students differs substantially between UK universities. This paper provides estimates of non-completion rates for the 1979 and 1980 entry cohorts into each university and suggests a number of reasons which may have contributed to these inter-university differences. Statistical analysis indicates that a large proportion of the inter-university variation in the non-completion rate can be explained by three main factors: the scholastic ability of each university's new entrants (as reflected by A-level score), the subject mix of each university, and the proportion of each university's students accommodated in a hall of residence. The main conclusion is that inter-university comparisons in the non-completion rate are of little value unless account is taken of differences in the scholastic ability of each university's intake of students.

This paper is concerned with the non-completion rate of undergraduate entrants into UK universities. It is important in our view to investigate non-completion rates for two main reasons. Firstly, little research has yet been undertaken on this topic in the UK. We know of no previous work which investigates the disparity in non-completion rates between all UK universities. Since this disparity between universities is immense (varying from under 4% to over 20% between institutions), it would be helpful if some explanations for these disparities between institutions could be found. The universities themselves should certainly be interested in discovering why their non-completion rate differs from those of other universities, especially those universities which have high non-completion rates.

The second reason for investigating non-completion rates is more ominous. The Government has made it clear in its white paper *Higher Education: Meeting the Challenge* (DES, 1987a) that far more attention will henceforth be paid to measuring the performance of individual institutions

"so that its record can be evaluated by the funding agencies, governing bodies, students and employers." (p. 18)

Moreover, this will require

"the timely collection, analysis and, desirably, publication of more information about performance. The funding bodies will need at an early stage to enter into a dialogue with institutions about what measures of performance it might be serviceable and feasible to collect, and also how these indicators might be used to assess institutions' delivering of provision contracted for with public funds". (DES, 1987b, p. 10)

The Government is particularly concerned that institutions receiving public funds should be

"accountable for the uses to which the funds are put and for the effectiveness and efficiency with which they are employed". (DES, 1987b, p. 1)

Since one of the performance indicators referred to in *Higher Education: Meeting the Challenge* is the non-completion rate of those entering institutions of higher education, it is the aim of the present paper to investigate differences in this variable between UK universities.

We should make it clear at the outset that we have nothing to say about whether there exists an optimal non-completion rate (for each institution) or what this optimal non-completion rate might be. Far more information (and analysis) would be required concerning the nature of the relationship between the net benefits produced by each institution and its non-completion rate before any attempt to estimate an optimal non-completion rate could be made. To assess the economic costs of non-completion, for example, information would be required about the subsequent education, training and work histories of a sample of non-completers and a matching sample of graduates. Our objective in the present study is strictly limited to investigating the reasons why non-completion rates vary between universities. This is a necessary first step towards the construction of policies (within individual institutions) aimed at achieving a more satisfactory non-completion rate.

A related issue concerns the distinction between 'non-completion' and 'wastage'. The non-completion of a higher education course does not mean that the recipient receives no benefit. Moreover, non-completion occurs for reasons other than students failing to meet the required academic standards. Indeed, many students who 'drop out' of their courses are likely to 'drop in' to other courses at other institutions of higher education as a result of discovering that their initial choice of degree course was in some way inappropriate. Some attrition is inevitable (and may indeed be desirable) especially in the first few months of a degree course. The matching of student abilities and preferences to courses requires flexibility and adaptability on the part of both the student and the institution. Switching courses within institutions at the end of the first year of higher education helps to improve this matching process but sometimes inter-institutional transfers are also necessary. Non-completion is therefore a more appropriate term than wastage in the present context.

The remainder of this paper is in four sections. Section I describes the data used to obtain a measure of non-completion and applies this to all UK universities. Non-completion rates are calculated for males and females separately. In section II, various factors which may contribute to an explanation of inter-university differences in non-completion rates are investigated before testing the significance of these explanations in a statistical analysis of non-completion rates in section III. The final section presents the main conclusions.

I. Non-completion rates in UK universities

There is no widely accepted measure of non-completion. Different measures can be calculated for different purposes. Since our aim is to investigate inter-university differences in the non-completion rate of those entering under-graduate courses, a single measure of non-completion is calculated in the present paper which is based upon the proportion of any given entry cohort of undergraduates who fail to complete their degree course at the university where they originally registered.

This non-completion rate is defined as follows:

$$\text{WASTAGE} = \frac{\begin{array}{l}\text{Number of} \\ \text{undergraduate} \\ \text{entrants} \\ \text{in year t}\end{array} - \begin{array}{l}\text{Number of} \\ \text{undergraduates} \\ \text{who graduated} \\ \text{by year t} + 6\end{array}}{\text{Number of undergraduate entrants in year t}} \qquad (1)$$

Using a six year cut-off point means that any students who eventually obtained their degree after six years are assumed not to have completed their degree course. The number completing after six years is likely to be negligible. It should also be pointed out that a small proportion of non-completers transfer to other institutions of higher education and so the non-completion rates for individual institutions tend to overestimate the non-completion rate for the higher education system as a whole. Thus, 7.1% of the non-completers in the 1979 entry cohort and 8.3% of the non-completers in the 1980 entry cohort transferred to another institution.[1]

Non-completion rates were calculated for all UK universities using the 1979 and 1980 undergraduate entry cohorts. These are shown in Table 1. Three features of the non-completion rates presented in Table 1 are worth noting. Firstly, there are substantial differences in the non-completion rate between institutions. Secondly, the non-completion rates obtained for the 1979 cohort are highly correlated with those obtained for the 1980 cohort (R = 0.95). Thirdly, with only one exception (York's 1980 cohort) the non-completion rate is higher for males than for females. On average across all universities, the non-completion rate was 44% higher for males than for females for the 1979 cohort and 50% higher for the 1980 cohort. Females are therefore far less likely to 'drop out' than males.

It is useful to examine not only inter-university differences in the overall

Table 1. Non-completion rates in UK universities

University	Non-completion rates[a]					
	1979			1980		
	males	females	total	males	females	total
Aston	19.8	9.4	17.1	20.3	9.0	16.8
Bath	12.7	8.8	11.4	15.1	12.4	14.1
Birmingham	13.3	8.6	11.5	12.1	7.9	10.5
Bradford	17.1	11.2	15.2	18.9	10.6	16.0
Bristol	9.1	7.1	8.3	7.4	7.3	7.3
Brunel	22.2	23.5	22.5	25.0	11.5	21.8
Cambridge	3.9	2.8	3.6	3.8	2.5	3.4
City	19.4	18.0	19.1	21.8	11.3	19.3
Durham	7.3	4.4	5.9	5.5	4.8	5.2
East Anglia	15.3	9.6	12.8	11.4	7.4	9.6
Essex	17.1	10.0	14.4	17.0	10.4	14.6
Exeter	11.5	8.9	10.3	10.2	7.4	8.8
Hull	16.0	8.9	12.8	15.2	9.2	12.3
Keele	18.8	13.7	16.6	20.9	10.1	16.3
Kent	14.8	8.0	11.9	15.6	9.9	13.3
Lancaster	12.9	9.4	11.4	9.5	7.7	8.7
Leeds	13.7	8.9	11.7	12.2	8.9	10.9
Leicester	15.3	8.3	12.2	11.4	7.5	9.7
Liverpool	15.9	12.4	14.7	16.3	11.1	14.3
London[b]	17.3	13.3	15.7	17.7	14.6	16.5
Loughborough	14.0	7.1	11.8	10.8	9.2	10.3
Manchester	16.4	10.2	13.9	13.9	11.1	12.8
UMIST	21.2	10.7	18.6	16.5	9.8	14.8
Newcastle	21.7	11.9	18.2	20.6	10.6	16.9
Nottingham	10.5	7.8	9.4	10.9	6.7	9.2
Oxford	6.4	6.3	6.4	7.1	6.8	7.0
Reading	14.5	11.8	13.3	15.0	8.4	12.0
Salford	22.8	14.1	20.8	22.3	11.5	19.5
Sheffield	12.8	8.7	11.2	12.8	5.8	9.9
Southampton	12.0	8.7	10.9	11.3	5.3	9.1
Surrey	18.3	8.8	14.7	17.8	9.8	14.7
Sussex	12.8	12.6	12.7	13.6	10.6	12.2
Warwick	12.5	8.0	10.2	14.3	7.9	11.5
York	10.1	7.7	9.0	8.6	8.7	8.7
Aberdeen	25.3	19.3	22.4	28.2	18.0	23.6
Dundee	21.8	15.7	19.7	25.7	15.1	22.4
Edinburgh	17.9	15.9	16.9	16.0	11.9	14.0
Glasgow	23.9	17.5	21.0	24.1	17.0	20.8
Heriot-Watt	24.8	15.5	22.8	24.4	11.3	21.5
St. Andrews	19.2	12.9	16.1	16.9	7.7	11.8
Stirling	17.7	11.3	14.6	19.2	10.0	14.9
Strathclyde	23.8	15.3	20.9	24.5	16.0	21.6
Queen's	14.1	9.5	12.3	14.2	7.3	11.5
Ulster	16.1	16.7	16.4	17.2	15.0	15.9
Wales	20.0	12.8	16.9	18.2	12.1	15.7
All universities	15.7	10.9	13.8	15.3	10.2	13.3

Note:

[a] See text for the definition of the non-completion rate used in this table.

[b] The non-completion rate at London may be over-estimated since students not completing at one School may have done so at another.

Source: Universities Statistical Record, Cheltenham.

non-completion rate, but also the time profile of non-completion. This is done for the 1979 cohort in Table 2, which shows the proportion of non-completers leaving in each calendar year following their entry. A very similar picture is obtained for the 1980 entry cohort. For the university sector as a whole, around 53% of those who leave do so within fifteen months of entry. The proportion then declines (exponentially) until it approaches zero in the sixth year after entry.[2]

Measuring the non-completion rate as the proportion of students in any given entry cohort who did not complete their degree course within a six-year period can be criticised on the grounds that it fails to take into account any differences there may be in the time profile of undergraduate wastage. On average across all universities, 53% of the undergraduates who leave an institution prematurely do so within the first fifteen months of their entry. Table 2 indicates, however, that the time profile of undergraduate wastage varies markedly between universities. Since it could be argued that if non-completion is to occur, it is better if it occurs earlier rather than later, the measure of non-completion should be weighted by the length of time each non-completer is a registered student. Non-completion which occurs towards the end of a course is therefore regarded as being more costly (at least to the taxpayer) than non-completion which occurs early in a student's course. The following measure of non-completion takes the time profile of each university non-completion rate into account:

$$\text{WASTAGE*} = \text{WASTAGE} \times \frac{w_1P_1 + w_2P_2 + ... + w_tP_t + ... + w_7P_7}{w_1 + w_2 + ... + w_t + ... + w_7} \qquad (2)$$

where:

WASTAGE $=$ as defined by equation 1;
w_t $=$ number of months completed by end of year t ($w_1 = 3$, $w_2 = 15$, $w_3 = 27$, ... $w_7 = 75$);
P_t $=$ proportion of total non-completers who 'dropped out' in year t.

In practice, WASTAGE AND WASTAGE* were found to be closely related ($R = 0.91$) even though the time profile of undergraduate wastage varied markedly between universities. Omitting Edinburgh and Glasgow raised the value of R to 0.95.

Which of these two measures of wastage is the most appropriate for present purposes? Since the aim of the paper is to explain inter-university variations

Table 2. The percentage of non-graduates leaving in each year after entry from the 1979 entry cohort

University	% leaving in each year						
	1979[a]	1980	1981	1982	1983	1984	1985
Aston	9.3	42.4	25.7	14.9	3.0	3.7	1.1
Bath	13.5	55.0	19.8	4.5	5.4	1.8	0.0
Birmingham	16.1	42.9	21.5	9.1	1.9	8.5	0.0
Bradford	11.7	40.4	24.6	15.2	3.5	4.1	0.6
Bristol	12.0	52.7	25.7	4.8	3.0	0.0	1.8
Brunel	7.9	40.0	26.1	14.5	9.7	1.2	0.6
Cambridge	3.3	59.3	19.8	11.0	5.5	0.0	1.1
City	7.5	38.4	39.7	8.2	6.2	0.0	0.0
Durham	10.9	52.5	24.8	5.9	5.0	1.0	0.0
East Anglia	8.0	65.6	9.8	12.9	2.5	1.2	0.0
Essex	11.9	51.5	22.4	9.0	4.5	0.7	0.0
Exeter	12.5	54.3	17.4	10.3	4.3	1.1	0.0
Hull	5.1	50.9	23.1	17.6	3.2	0.0	0.0
Keele	5.5	56.3	21.9	11.7	3.1	1.6	0.0
Kent	12.0	42.7	28.2	11.1	3.4	2.6	0.0
Lancaster	11.7	46.2	20.0	15.9	4.8	1.4	0.0
Leeds	14.7	32.0	22.9	25.8	2.6	1.3	0.8
Leicester	13.5	47.2	19.7	10.7	6.2	2.8	0.0
Liverpool	11.7	49.8	16.4	14.6	6.0	0.7	0.7
London[b]	9.2	44.7	12.4	13.3	4.5	5.9	10.0
Loughborough	8.2	47.9	22.7	12.4	7.2	0.5	1.0
Manchester	9.5	57.5	18.1	13.3	0.7	0.5	0.5
UMIST	8.8	53.7	28.8	7.8	0.5	0.5	0.0
Newcastle	2.9	61.5	21.1	8.6	3.4	1.7	0.7
Nottingham	13.2	53.7	16.8	9.5	6.3	0.5	0.0
Oxford	0.5	40.1	12.0	37.5	8.9	1.0	0.0
Reading	16.0	60.8	16.5	3.8	2.5	0.4	0.0
Salford	12.3	47.2	26.2	9.1	5.2	0.0	0.0
Sheffield	16.7	48.6	19.0	14.3	1.4	0.0	0.0
Southampton	8.3	40.9	29.5	17.4	3.8	0.0	0.0
Surrey	11.5	31.7	30.9	17.3	2.9	4.3	1.4
Sussex	0.7	50.0	24.3	14.0	2.9	8.1	0.0
Warwick	10.2	64.6	9.2	11.2	2.9	1.5	0.5
York	9.7	54.8	16.1	10.8	7.5	0.0	1.1
Aberdeen	8.2	45.7	24.7	16.5	4.8	0.0	0.0
Dundee	5.1	47.1	20.3	18.1	8.0	0.7	0.7
Edinburgh	3.8	16.7	18.9	46.7	4.3	8.6	1.0
Glasgow	3.8	8.6	42.0	20.0	14.4	8.3	2.9
Heriot-Watt	6.9	33.0	32.5	16.3	7.4	2.5	1.5
St. Andrews	0.0	50.8	18.3	11.9	7.1	7.9	4.0
Stirling	10.1	52.9	20.2	5.9	8.4	1.7	0.8
Strathclyde	5.6	36.3	36.5	14.1	6.6	0.7	0.2
Queen's	6.4	40.6	24.3	16.3	9.9	2.5	0.0
Ulster	8.0	60.0	18.7	8.0	4.0	1.3	0.0
Wales	8.0	43.7	33.6	9.4	3.2	1.6	0.4
All universities	8.8	44.5	23.4	14.5	4.8	2.6	1.5

Note:

[a] % of 1979 non-graduates leaving in October to December.

[b] The figures given for London may have been distorted by the movement of medical students between Schools.

Source: Universities Statistical Record, Cheltenham.

in the proportion of each undergraduate cohort who fail to complete their degree course, WASTAGE is used as the dependent variable in the following statistical analysis.

II. Inter-university differences in the non-completion rate: Some possible explanations

Students leave university prematurely for many different reasons: examination failure, poor academic progress, transfer to another institution, dissatisfaction with their course, dissatisfaction with their social life, poor health, financial difficulties, family problems and so on. Although individual institutions attempt to categorise students according to their main reason for leaving, this data base is an unreliable source of information since the procedures used vary between institutions. In addition, inadequate detail is provided about the reasons for leaving, as is clear from Table 3 which indicates that about 50% did not complete their course for 'other reasons'. This division of non-completion into separate causal categories does not therefore provide much help in identifying the reasons underlying non-completion.

This section investigates some of the underlying factors which may be expected *a priori* to influence an institution's non-completion rate. Our search for explanatory variables is restricted, however, to those for which we can

Table 3. Non-completion of degree course: reason for leaving

Reason for leaving	Percentages in each category	
	1979 cohort	1980 cohort
Transferring to another institution	7.1	8.3
Examination or academic failure	37.7	39.6
Poor health	3.1	2.5
Other reasons	52.1	49.6
Total	100	100

Note:
Data on reasons for leaving are available for individual institutions but there is a serious possibility that these data are not reliable. One large university, for example, had 99% of its non-completers leaving for 'other reasons' and none for reasons of academic failure for the 1979 cohort. This is simply not credible and casts grave doubts upon the accuracy of the information provided in this table.
Source: Universities Statistical Record, Cheltenham.

obtain quantitative measures. Since variables such as the quality of supervision and the quality of life at each institution cannot be measured directly, their influence on the non-completion rate is assumed to be reflected by several quantitatively measurable variables (such as student/staff ratios and various measures of types of accommodation used by students at each institution). This pragmatic approach is necessary if an attempt is to be made to discover the factors responsible for causing inter-university differences in the non-completion rate.

The factors that may be expected to influence each institution's non-completion rate can be conveniently divided into two broad categories: those which are student-related and those which are institution-related. We now consider these in turn.

Student-related factors

Previous work on a sample of entrants to the University of Lancaster (Johnes, 1988) indicates that the following factors *inter alia* influenced the probability that any *individual* student left prematurely: previous scholastic record; type of school attended immediately before proceeding to university; and parental occupation. This earlier work therefore suggests that the academic ability of each university's intake of students and the socio-economic background of these students could be expected to influence its non-completion rate. Using the mean A-level score of each university's intake of students, we expect the non-completion rate to be higher in universities in which their students have achieved a low A-level score on average.

The socio-economic background of students can be proxied by using the percentage of each university's intake of students who attended either an independent school or a grammar school. We expect the non-completion rate to be lower in those universities which have a high proportion of students coming from independent or grammar schools. This variable may be acting as a proxy, however, not only for social class but also for the type of training that students receive before entering university. Independent schools, for example, may provide more appropriate training in the types of study skills required at university than is provided by comprehensive and secondary modern schools.

Another student-related factor is a student's sex. Again, previous work on a sample of Lancaster students has indicated that the factors affecting the non-completion rates of males differ from those affecting females. It has already been shown that the non-completion rate is far higher for males (on average across all universities) than for females. This suggests that inter-university variations in the non-completion rate are likely to be higher in those

universities with a high ratio of male to female students. On the other hand, the male/female ratio may simply be standing as a proxy for other variables, such as subject mix. It may therefore be more useful to investigate inter-university variations in the non-completion rate for males and females separately. We do this in section III.

University-related factors

Several previous studies have indicated that the non-completion rate is higher in some subjects than in others (Wankowski 1972, De Rome and Lewin 1984, Johnes 1988). Exactly why a student is more likely to leave prematurely in some subjects than in others is not clear. Perhaps some subjects are simply easier to fail than others. Whatever the underlying cause may be, it is necessary to test the extent to which the subject mix of an institution influences the non-completion rate. This is done by including a set of subject-related variables; that is, the percentage of undergraduates in each main subject group.[3]

Other university-related factors which may be expected to exert some influence on the non-completion rate are the student-staff ratio, the length of course and the type of accommodation available to students. A higher student/staff ratio should raise the non-completion rate in so far as less personal supervision is available in universities in which the student/staff ratio is high. Similarly, a longer course may be expected to raise the non-completion rate since the probability of a problem arising will increase as the duration of a degree course increases. Whether the type of accommodation provided to students will affect the non-completion rate is more problematic. Students who live at home may be less likely to leave prematurely than those who have to live in rented accommodation because they may not have to face the same financial burdens. On the other hand, students who move away from home when they go to university may be more independently-minded and have a greater chance of surviving a university course. Although no definitive *a priori* relationship can be hypothesised it seems plausible to include some measure of type of accommodation offered by each institution. The percentage of students living at home and the percentage in halls of residence are therefore included in the empirical analysis.

Not all factors which are likely to affect non-completion rates are easily measurable. Since some of these factors are more likely to be present in some types of universities than in others, each university was classified according to four broad types of institution. Binary variables were used to identify the following three groups: ex-colleges of advanced technology, new greenfield universities and universities located in Scotland. This division can be supported

on the following grounds. Firstly, the ex-colleges of advanced technology are more vocationally-oriented and have close links with industry. They may therefore be expected to attract more vocationally-motivated students, which in turn should reduce the non-completion rate. Another characteristic of the ex-colleges of advanced technology which may be expected to raise the non-completion rate is the higher proportion of their students on sandwich courses. The additional demands placed on sandwich course students may have a detrimental effect on the non-completion rate of the ex-colleges of advanced technology. Secondly, the new greenfield universities have developed on different lines (academically and organisationally) than the older civic universities and this may have had an effect on non-completion rates. The fact that they are all campus universities (some being located well away from major urban areas) may also have an effect on non-completion rates, though in which direction we do not speculate. Thirdly, Scottish universities have different traditions from universities in the rest of the UK, one of the most relevant for the present paper being that the majority of first year students are a year younger on entry than their counterparts elsewhere in the UK. Since younger students are (by definition) less mature, this may be expected to have an adverse effect on the non-completion rate of Scottish universities.[4]

III. Empirical results

Differences in the non-completion rate between universities are investigated in this section by using multiple linear regression analysis. Weighted least squares was used in order to overcome the problem of heteroscedasticity in the dependent variable, WASTAGE.[5] The statistical analysis was repeated using logit analysis with binomially distributed errors (since the dependent variable is a proportion). Only the weighted least squares estimates are reported here since the results are very similar to those obtained using logit analysis.

The explanatory variables which were included in the regression analysis are defined as follows:
(i) Student-related variables:

SEX = male undergraduate entrants as a percentage of total undergraduate entrants;

SCHOOL = percentage of undergraduate entrants who attended a grammar or independent school;

ASCORE = average A-level score of undergraduate entrants[6] (only students with two or more A-levels are included);
A = 5, B = 4, C = 3, D = 2, E = 1.

(ii) University-related variables:

MEDICAL = percentage of undergraduate entrants enrolling on medical and health courses;

SCIENCE = percentage of undergraduate entrants enrolling on science courses;

ENGTECH = percentage of undergraduate entrants enrolling on engineering and technical courses;

BUSINESS = percentage of undergraduate entrants enrolling on administrative, business and social science courses;

PROFESSIONAL = percentage of undergraduate entrants enrolling on professional courses;

LANGUAGES = percentage of undergraduate entrants enrolling on language courses;

ARTS = percentage of undergraduate entrants enrolling on arts courses;

LENGTH = percentage of first years on a course lasting for four years or more;

STUDSTAFF = ratio of undergraduate entrants to full-time teaching staff (wholly university financed);

LIVHOME = percentage of full-time students living at home;

HALL = percentage of full-time students living in halls of residence;

EXCAT = 1 if a university was previously a college of advanced technology and 0 otherwise;

NEW = 1 if university is one of the new greenfield universities established in the 1960s and 0 otherwise;

SCOTTISH = 1 is a university is located in Scotland and 0 otherwise.

Sources of data: *Statistics of Education*, 1979: *University Statistics: Students and Staff*, 1980/81; and Universities Statistical Record, Cheltenham.

All the above variables were calculated for both 1979 and 1980 (except for LIVHOME and HALL, which were available only for 1979) so that separate analyses could be undertaken for these two years. In addition, further tests were undertaken on a sub-set of universities which included only universities in England, Northern Ireland and Wales. This procedure allows us to test whether the estimated equations remain stable when Scottish universities (which are different in several ways from non-Scottish universities) are excluded from the analysis.

Before reporting the results of the statistical analysis, it is necessary to point out that it was not possible to obtain reliable estimates of the influence of all explanatory variables simultaneously due to the high inter-correlation between

some of these variables. We therefore investigated alternative combinations of explanatory variables, our aim being to search for uniformity in the results across time periods and between males and females. In other words, we finally selected the equations reported in tables 4, 5 and 6 using the rule of thumb that an estimated parameter had to be significantly different from zero (at the 95% level or higher [7]); and in addition, variables were included in the reported results only if their estimated parameters were significant in equations for different time periods or for both males and females separately. Many of the explanatory variables defined above are not therefore included in the regression equations reported below.[8] The reported results are not necessarily the best fitting equations (as measured by R^2), but in our view they are likely to provide the most reliable results.

The firmest result to emerge from our statistical analysis of non-completion rates is that the mean A-level score of a university's entrants plays a crucial role in determining its non-completion rate. The higher the A-level score, the lower the non-completion rate is likely to be. This is entirely consistent with the fact that students with lower ability are likely to find it more difficult to complete a degree course.[9] Furthermore, comparison between the male and female equations indicates a substantially larger effect for males than for females. The coefficient of -2 in the male equations, for example, implies that a one point increase in the average A-level score for an institution will reduce the male non-completion rate by two percentage points. Thus, a four point difference in the mean A-level score between universities can be expected to result in a difference of eight percentage points in the male non-completion rate. The coefficient of around -0.7 in the female equations implies a response of the female non-completion rate (to a one point change in the A-level score) which is about one-third of the magnitude of that for males. The significance of ASCORE is a very firm result which holds across a wide range of specifications of the estimated equations.

The other result which is very firm is that the non-completion rate in Scottish universities is substantially (and significantly) higher than in non-Scottish universities. This result holds for males and females separately, though the magnitude of the difference between Scottish and non-Scottish universities is higher for males than for females. We speculate that the substantially higher non-completion rate in Scottish universities is due to the fact that Scottish entrants tend to be one year younger on average than their non-Scottish counterparts. Being younger when they first enter university may be expected to increase the probability of students 'dropping out'. A further possible reason for the higher non-completion rate in Scottish universities is the greater incidence of four-year degree courses than in the rest of the UK.[10]

Several further results are of interest. Firstly, universities with a large proportion of their students in halls of residence tend to have lower non-com-

pletion rates. This result holds for both males and females. Although this supports the view that residence in university premises tends to reduce the probability of non-completion, we cannot dismiss the possibility that HALL may be standing as a proxy for other university characteristics.

Secondly, testing the effect of subject mix on a university's non-completion rate was plagued by problems of multi-collinearity because of the high inter-correlation between the various measures of subject mix. The most consistent results were obtained when the proportion of undergraduates in business studies and social sciences was included as an explanatory variable in the male equations, and when the proportion of undergraduates in languages was included in the female equations. The highly significant negative coefficient on BUSINESS in all equations indicates that the male non-completion rate is likely to be lower in universities with a high proportion of graduates in business studies and social sciences. The evidence that subject mix affects the female non-completion rate is less convincing since the coefficient on LANGUAGES is not significant in all equations (though it is consistently negative). Perhaps not surprisingly, the subject mix variable which produces the most satisfactory statistical results when the total non-completion rate is used as the dependent variable is BUSINESS + LANGUAGES. This variable has a highly significant negative coefficient in all equations.

Thirdly, the student/staff ratio was found to have a statistically significant coefficient in all equations in which this variable was included. Surprisingly, however, the student/staff ratio has a negative (rather than the expected positive) effect on the non-completion rate. Since we could find no plausible explanation for this maverick result, all equations were run both with and without the student-staff ratio in order to test the effect on the overall fit of the regression model. In most cases, the exclusion of the student/staff ratio from the model has a negligible effect on the estimated parameters of the other explanatory variables (though the corrected R^2 falls significantly in some cases). The equations which included the student-staff ratio are not reported in this paper.

In view of the highly significant coefficient on the Scottish binary variable in all equations in which it was included, the regression equations were estimated for non-Scottish universities separately. The inferences to be drawn from the estimated regression equations remain unchanged. The estimated coefficients in most equations, for example, remain very similar.

Finally, since regression equations were estimated for two consecutive years, it is useful to investigate whether there is any correlation between the un-explained part of the variation in the non-completion rate for these two years. The existence of a significant positive correlation between these two sets of residuals would indicate that the estimated equations are mis-specified. In particular, such a result would suggest the omission of at least one important

explanatory variable from the model. The correlation of 0.79 between the residuals of equations 1 and 4 in Table 4 supports this view.

Table 4. Weighted regression results: dependent variable = non-completion rates in UK universities, 1979 and 1980

Explanatory variables	Dependent variable = non-completion rate[a]					
	1979				1980	
			Equation number			
	(1)	(2)	(3)	(4)	(5)	(6)
CONSTANT	35.76	37.11	35.76	36.46	36.12	38.33
	(19.10)	(18.81)	(14.50)	(18.27)	(16.20)	(15.48)
ASCORE	−1.55	−1.71	−1.54	−1.59	−1.59	−1.74
	(−9.27)	(−9.55)	(−7.14)	(−9.00)	(−7.91)	(−8.05)
BUS+LANG[b]	−0.12	−0.12	−0.13	−0.14	−0.13	−0.15
	(−4.67)	(−4.33)	(−4.82)	(−5.06)	(−3.90)	(−5.47)
HALL	−0.065	−0.059	−0.061	−0.063	−0.067	−0.066
	(−3.50)	(−2.83)	(−3.00)	(−3.12)	(−2.84)	(−3.12)
SCOTTISH	4.44		4.44	4.05		4.04
	(5.24)		(5.23)	(4.65)		(4.78)
$\bar{R}^2$	0.84	0.81	0.77	0.83	0.77	0.79
n	45	37	43	45	37	43

Notes:
[a] See section I for definition of non-completion rate.
[b] BUS+LANG is the percentage of entrants undertaking business, social science or language courses (i.e. BUS+LANG is the sum of the variables BUSINESS and LANGUAGES).
[c] Equations (2) and (5) have been estimated without the Scottish universities; equations (3) and (6) have been estimated without Oxford and Cambridge.
[d] Omitting universities with medical schools did not affect the results significantly.
( ) = t-ratios.

Table 5. Weighted regression results: dependent variable = non-completion rates in UK universities, 1979 and 1980 (males only)

Explanatory variables	Dependent variable = non-completion rate (males only)					
	1979				1980	
			Equation number			
	(1)	(2)	(3)	(4)	(5)	(6)
CONSTANT	41.58	43.48	40.23	43.96	44.39	45.08
	(18.90)	(20.15)	(14.11)	(17.16)	(16.78)	(14.20)
ASCORE	−2.03	−2.26	−1.91	−2.24	−2.30	−2.34
	(−10.48)	(−11.52)	(−7.58)	(−10.17)	(−9.82)	(−8.49)
BUSINESS	−0.15	−0.17	−0.15	−0.20	−0.20	−0.21
	(−3.59)	(−4.07)	(−3.61)	(−4.13)	(−3.77)	(−4.19)
HALL	−0.073	−0.056	−0.064	−0.060	−0.060	−0.062
	(−3.50)	(−2.53)	(−2.77)	(−2.59)	(−2.32)	(−2.41)
SCOTTISH	5.34		5.36	6.13		6.15
	(5.46)		(5.40)	(5.89)		(5.85)
$\bar{R}^2$	0.84	0.84	0.74	0.84	0.81	0.77
n	45	37	43	45	37	43

Notes: See notes to Table 4.

Table 6. Weighted regression results: dependent variable = non-completion rates in UK universities, 1979 and 1980 (females only)

Explanatory variables	Dependent variable = non-completion rate (females only)					
	1979				1980	
	\	\	Equation number			
	(1)	(2)	(3)	(4)	(5)	(6)
CONSTANT	22.32	24.49	21.79	21.49	22.02	21.76
	(10.55)	(11.06)	(7.69)	(9.89)	(8.98)	(7.70)
ASCORE	−0.74	−0.88	−0.69	−0.59	−0.68	−0.61
	(−3.61)	(−4.07)	(−2.67)	(−2.78)	(−2.81)	(−2.31)
LANGUAGES	−0.064	−0.084	−0.069	−0.081	−0.059	−0.092
	(−1.69)	(−1.97)	(−1.78)	(−2.01)	(−1.18)	(−2.26)
HALL	−0.075	−0.082	−0.071	−0.088	−0.092	−0.086
	(−3.50)	(−3.59)	(−2.99)	(−3.85)	(−3.49)	(−3.46)
SCOTTISH	4.20		4.18	2.28		2.22
	(4.11)		(4.06)	(2.20)		(2.16)
$\bar{R}^2$	0.65	0.56	0.57	0.59	0.45	0.52
n	45	37	43	45	37	43

Notes: See notes to Table 4.

Conclusion

There has been little interest in undergraduate non-completion rates in the UK despite the fact that around 13% of those who enter university do not complete their degree course. Since the non-completion rate varies markedly between universities (e.g. between 3.4% and 23.6% for the 1980 entry cohort), this paper has attempted to uncover some of the reasons for these inter-university disparities. Our analysis differs from previous studies of non-completion rates in the UK (of which there are few) in so far as it attempts to explain why non-completion rates vary between institutions.

The statistical analysis of the 1979 and 1980 entry cohorts indicates that inter-university variations in the non-completion rate are explained by three main factors: the mean A-level score of each university's new entrants, the proportion of each university's students reading for a business studies or social science degree (languages in the case of females), and the proportion of each university's students accommodated in a hall of residence. In addition, Scottish universities generally had significantly higher non-completion rates than their non-Scottish counterparts. We speculate that this could be a result of the fact that Scottish students proceed to university a year earlier than is normally the case elsewhere in the UK.

The main conclusion to be drawn from these results is that inter-university comparisons of non-completion rates are of little value *per se*. For such comparisons to be of some use (either to the universities themselves or to policy

makers interested in measuring efficiency in the use of resources), each university's non-completion rate would first need to be 'corrected' for at least some of the factors responsible for causing inter-university disparities. It is particularly important, for example, to take differences in the scholastic ability of each university's student entrants into account if inter-university comparisons in non-completion rates are to have any meaning.

Notes

* The authors are grateful to the Nuffield Foundation for supporting this research project under its Small Grants Scheme and to the Universities Statistical Record for supplying the data. We are also grateful to Richard Cormack, Gareth Williams and several university registrars for their helpful comments on the first draft of this paper. The authors alone are responsible for the contents of this paper.
1. According to data obtained from the Universities Statistical Record, the proportion of non-completers who transfer to another institution of higher education varies considerably between universities. For the 1979 entrants, for example, the proportion was under 1% at Exeter, Reading, Surrey, Glasgow, Heriot-Watt and Ulster while it exceeded 20% at Oxford, St. Andrews and Wales.
2. London University is an exception to this general pattern: 10% of the 1979 entrants reportedly left without a degree in 1985.
3. At least one subject group must be excluded when multiple regression analysis is used otherwise there would be perfect multicollinearity in this set of explanatory variables and the multiple regression method breaks down. A better method of assessing the impact of subject mix on the non-completion rate would be to calculate an expected non-completion rate for each institution based on its subject mix and national non-completion rates in each subject. The latter, unfortunately, are not available.
4. Ideally, average age of students at entry would have been included as an explanatory variable (under the sub-heading 'student-related factors'). This variable was not readily available to us but is likely to be very closely related to the Scottish binary variable.
5. Since WASTAGE is a proportion (p), its variance $(p(1-p)/n)$ varies inversely with the number of entrants into each institution (n). The error term cannot therefore be assumed to have a constant variance, which is required for the OLS method. Weighted least squares is appropriate in this case (Maddala 1977).
6. The majority of undergraduate entrants in Scotland have Scottish highers and not A-levels. The A-level scores for Scottish universities are therefore likely to be a less accurate indicator of the scholastic record of entrants than for non-Scottish universities. It was partly for this reason that separate tests were undertaken on the sub-set of non-Scottish universities. The same problem was encountered by Johnes and Taylor (1987).
7. One or two coefficients have t-ratios slightly below the 95% significance level in Table 6.
8. The omitted variables are: SCHOOL, LENGTH, STUDSTAFF, LIVHOME, EXCAT, NEW and the subject mix variables except for BUSINESS and LANGUAGES.
9. This result is also consistent with the highly significant positive relationship found between each university's A-level score and the percentage of graduates obtaining at least an upper second class honours degree (Johnes and Taylor 1987).

10. Further investigation of the data revealed that the Scottish binary variable was highly significantly correlated with LIVHOME*LENGTH. When this interaction term was included in the regression model instead of the Scottish binary variable, very similar results were obtained.

References

Department of Education and Science (1987a), *Higher Education: Meeting the Challenge*, Command 114.

Department of Education and Science (1987b), "Changes in the Structure and National Planning for Higher Education: Contracts between Funding Bodies and Higher Education Institutions", Consultative Document, May.

De Rome, E. and Lewin, T. (1984), "Predicting the Persistence at University from Information Obtained at Intake", *Higher Education* 13: 49–66.

Johnes, J. (1988), "Determinants of Student Wastage in Higher Education", Department of Economics, University of Lancaster".

Johnes, J. and Taylor, J. (1987). "Degree Quality: An Investigation into Differences between UK Universities", *Higher Education* 16: 581–602.

Maddala, G. S. (1977), *Econometrics*, McGraw-Hill: Kogakusha.

Wankowski, J. A. (1972), "Student Wastage: the Birmingham Experience", in Butcher H. J. and Rudd, E. (eds), *Contemporary Problems in Higher Education*.