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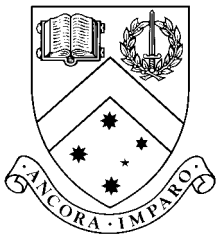

AUSTRALIA

Institutional Characteristics and the Relationship Between Students' First-Year University and Final-Year Secondary School Academic Performance

Merran Evans and Alan Farley

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Institutional characteristics and the relationship between students' first-year university and final-year secondary school academic performance.

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Abstract

A study of academic results of a student cohort in a diverse faculty of a large multi-campus university indicates that students' first-year performance at university is related to their prior academic achievement at secondary school, both overall and discipline specific, but that the extent and form of the relationship can vary by subject area and institutional – secondary school and university – characteristics. This may have implications for university selection and specification of prerequisite subjects for courses.

Key Words: Student performance, academic achievement

Introduction

Research, in Australia and overseas, indicates that secondary school academic results are relatively strong direct predictors of tertiary performance. Evidence from the literature indicates that students' performance in their first year at university is related to their secondary school achievements overall and in particular studies, but that the strength of this relationship can vary according to the nature of the institution, the discipline area studied and the characteristics of the students.

Monash University, with its several campuses and faculties, and its different traditions and cultures arising from its pre-amalgamation components, is a diverse institution. It may be viewed as a microcosm of the higher education sector in Australia and an appropriate "laboratory" for analysing key factors and institutional differences. The Faculty of Business & Economics is the largest of its type in Australia and its discipline areas range from "humanities type" management subjects to "science type" econometrics subjects. Hence it too can be regarded as representative of different facets of institutions, with results obtained and differences observed from any analysis relevant to a range of other institutions and discipline areas.

This study explored the relationship between students' final-year achievement at secondary school and first-year university academic performance in individual subjects across a range of discipline areas, secondary school categories, and campus settings. It used both an overall measure of secondary school performance (expressed as a percentile Tertiary Entrance Rank, or TER) as well as measures of performance in both pre-requisite subjects and associated subjects as predictors of university performance.

The population studied was the cohort of school leavers who were enrolled in compulsory first-year subjects in 1997 in Monash's Faculty of Business & Economics at three campuses – Clayton, Caulfield and Peninsula. The only year in which all campuses had the same pre-requisite subjects was in 1997, so this study focussed on this cohort as a means of further reducing variation to those resulting from institutional differences. Results for the three campuses were compared; the same subjects are taught at two campuses, so some analysis of different institutional characteristics can be undertaken. Results were compared also for categories of secondary school – government, independent private and Catholic private schools – and also for schools classified as disadvantaged[1].

Institutional characteristics

The Monash student profile varies considerably, both generally across the institution, and within and between the faculties, departments and campuses. On some characteristics, the student body can reflect the nature of the campus

[1] As classified by the Victorian State Department of Education.

more than the faculty profile, and the diversity apparent on each campus also relates to which faculties and departments teach there. The campuses display somewhat different characteristics, as a result of a combination of their institutional history, culture, curriculum, environment and student body.

The original Monash was based at the Clayton campus, and its culture is that of a traditional university. The majority of each student intake is of direct school-leavers aged 17 or 18 (approximately 95% in the faculty in 1997), with almost all students studying full-time. The orientation of the faculty's curriculum is more toward the analytical end of the spectrum, with an emphasis on building a theoretical framework in most disciplines. The Caulfield and Peninsula campuses were both originally part of Chisholm College of Advanced Education, and from this the faculty's courses have inherited an orientation toward a more applied coverage of most disciplines. The same set of faculty subjects is offered at each of these campuses. The Caulfield campus has traditionally a significant proportion of non-school leavers in each intake (approximately half in the faculty in 1997), with relatively high levels of part-time enrolments. The Peninsula campus has always had a higher proportion of school-leavers. It also has a lower proportion of campus-based staff, as much of the teaching is done by Caulfield-based academics. This limits student access to staff, but, partly due to its smaller size, relatively more pastoral care is available. All campuses have high levels of international students by Australian standards, but the proportion of international students at Caulfield and Peninsula is substantially higher than at Clayton.

Previous analyses

Admission to Australian tertiary institutions is selective and based on prior achievement. Previous academic performance is generally determined according to one or some combination of various indices, such as secondary school results or ranking (overall or in specific subjects), the score on some form of scholastic aptitude test, school recommendations, and other relevant experience or submitted folio of work.

In the business and commerce fields the main relevant prior studies relate to either accounting or economics. Farley and Ramsey (1988) demonstrated that both academic ability, as measured by the university entrance score, and previous accounting knowledge gained in the final-year of secondary school were strong predictors of performance in first-year university accounting at the Clayton campus of Monash from 1981 to 1985. They also found that having studied mathematics in the final year of secondary school was significant. Their models achieved results capable of explaining almost half of the variation in student results in accounting by use of these factors as predictors.

Students' performance in economics at school has been found elsewhere to be related to their university economics performance by Lumsden and Scott (1987). This was not the case in the reviews of Siegfried and Fels (1979) and Siegfried and Walstead (1990) of mainly US studies, whereas Anderson, Benjamin and Fuss (1994) found the relationship complex, and positive only for relatively successful secondary students. Milkman *et al* (1995) explored the relationship between mathematics and economics. An early study by Downes (1976) found economics and mathematics significant in explaining first-year performance in all subjects in the faculty at Clayton, using data from both the mid 1960s and 1972 – a result confirmed in this current study for the 1997 cohort.

Results

Results are shown in Tables 1 and 2. A five per cent significance level was used to measure influence.

The relevance of various factors in explaining students' first-year university marks sometimes differed according to discipline area, the campus and secondary school attended.

Institution-independent factors

Some factors appear to be independent of the institutional factors, campus or secondary school category:

1. Students' marks in final-year school advanced mathematics.

   These were significant, and positively related to their university performance, in the models for twelve of the fourteen subjects analysed. Of the other two, one was significant at the 10% level

and for the other (Business Communication) mathematics was considered unlikely to be significant.

2. Students' marks in final-year school accounting.

These were significant, and positively related to their performance in all first-year university accounting subjects.

The factor representing disadvantaged schools did not appear to be significant at any campus.

Institution-related factors

The significance of some other factors indicates variations between campuses, and hence could be related to institutional factors.

1. A general measure of academic ability (as represented by the TER) relative to the significance of performance in individual final-year school subjects.

Students' TER appeared significant in explaining the variation in their university marks in all cases when it was the sole explanatory variable. However, when other information, such as their performance in specific school subjects, was also included in the model, the significance of the TER varied according to their campus. At the Clayton campus students' TER was significant and positively related to their university performance for all subjects, but Accounting was the only subject for which students' performance in the associated final-year school subject was also a significant factor. On the other hand, at the Caulfield and Peninsula campuses, students' TER was not significant in explaining their performance in any subject, whereas final-year school subject marks were significant and positively related to their university performance in associated subjects.

2. Final-year school marks in English and university performance.

At Caulfield and Peninsula both English and ESL showed a significant, and positive, relationship with university subjects in Business Communication, Management and Marketing while not appearing significant in other subjects. At Clayton neither subject was significant for any model which also included the TER.

3. The type of secondary school attended.

At Clayton there were significant differences in students' university performance according to the category of school attended, when other factors were held constant. In all but one subject, there was a significant difference in the results obtained from students coming from non-Catholic independent schools and those from government schools, conditioned upon other variables. For an equivalent entry score, the estimated average difference in first-year university subject mark obtained ranged from approximately 2 to 8 marks in favour of government school students. At Clayton, in two subjects there were significant performance differences between students from government schools and those from Catholic schools; with an average difference of approximately 4 marks in favour of government schools in both cases. (Differences by school category reflect earlier findings by West, 1985). However, at the Caulfield and Peninsula campuses there was no evidence of differences in performance of students between the categories of schools.

Conclusions

The results of this study demonstrated the relevance of students' secondary school performance to their academic achievement in first-year university. However, they also reveal that there are differences between the relevance of a general measure of academic ability (i.e. the TER) and discipline-specific knowledge (i.e. scores on pre-requisite and associated subjects) over a range of disciplines and institutional settings. Definitive inferences from the study of one cohort are difficult, and the models estimated only explained some of the variation in students' university performance, but some findings may have wider implications.

In the cohort investigated, the TER as a general measure of academic ability appeared to have a strong relationship with performance in the more traditional university programs, whereas discipline-specific knowledge appeared more relevant in those programs with a more applied orientation. The exceptions to this were that advanced mathematics was a strong predictor of performance in all programs, and final-year school accounting in all first-year university accounting subjects analysed. The latter finding was partly explained by the need for first-year university accounting subjects to cover much of the same syllabus as final-year school accounting, as many students undertake accounting for the first time at university and require similar basic knowledge of some elements. These results also showed no differentiation between the university performance of students undertaking English or ESL in their final year of school.

Institutional characteristics of the campuses may account for the differences observed here between the results for subjects in the same discipline areas. These may be attributable partly to the characteristics of the student population and partly to the nature of the curriculum. The test of which of these was the major influence can be partly answered by reference to the factor representing differences between the two campuses with shared subjects. This factor was insignificant in all cases, indicating no support for campus differences other than those predicted by differences in the cohorts of students admitted. The student intake profile differs significantly between these two campuses with a common curriculum. These findings suggest that it was the nature of the curriculum which was responsible for the major differences observed between the original university campus and the other campuses. However, it must be noted that there were confounding factors (staffing and pastoral care) which make definitive inferences difficult.

While the category of the school attended showed a strong impact on Clayton results, again the institutional differences appeared to be significant. This may have implications for selection. Our results indicated that some moderation of the TER by school category may be justified in the traditional university program, but may not be appropriate for a more applied style of program. The lack of significance generally of the factor representing disadvantaged schools was surprising. These results were based upon a small number of such cases, but suggested that if students were admitted to certain courses on this basis with significantly lower entry scores, they may be at risk of unsatisfactory performance in their first year unless appropriate support is provided.

Appendix: Data and analysis

The populations studied were the cohorts of school leavers who commenced study in 1997 and were enrolled in compulsory first-year subjects in Monash's Faculty of Business & Economics at three campuses – Clayton, Caulfield and Peninsula. These subjects covered the discipline areas of accounting, economics, statistics, management and marketing. While subjects at the Caulfield and Peninsula campuses were equivalent, they differed from those offered at the Clayton campus in syllabus, style and assessment. The 1997 cohort was chosen for analysis as this was the only year in which the pre-requisite school subjects were equivalent for all the faculty's courses offered on the three campuses; these courses required a specified minimum score in both English and mathematics in the final year of secondary school.

Either English or English as a Second Language (ESL) were permitted pre-requisite English subjects. To measure the relevance of students' achievement in these school subjects to their university performance, the particular subject scores obtained were included as variables in the model estimated. To ascertain if the particular English subject undertaken at school made a difference to students' university performance, a dummy variable[2] was also included in the model. The relatively advanced mathematics subject Mathematical Methods was a pre-requisite subject, but many

[2] Explanatory variables are often qualitative, so that some proxy is needed to represent them in a regression model. 0-1 dummy variables generally are used. Such an indicator dummy variable is an artificial construct, which takes the value one whenever the qualitative phenomenon it represents occurs, and is zero otherwise. Here the dummy variable = 1 for English and = 0 for ESL.

students studied in addition either the basic or the highest level mathematics[3]. Again, to measure the relevance of achievement in these different mathematics subjects, the particular subject scores obtained were included as model variables. To ascertain whether the particular additional mathematics subjects undertaken made a difference, dummy variables again were included to indicate if basic mathematics or the highest mathematics were studied. For the shared subjects, campus comparisons were made by including a dummy variable to indicate the campus concerned[4] in the models to investigate different institutional characteristics.

Students' university marks in each subject were regressed against relevant explanatory variables –final-year secondary school rankings and other school outcomes and institutional information – to determine how significant school achievement is in determining university academic performance. University marks (in the range 0-100) were regressed against final-year school scores (expressed as a mark out of 50) in each pre-requisite subject and associated indicator dummy variables to determine how significant these are in determining university academic performance. In cases where a related subject is offered at secondary school, such as Accounting, Economics, and Business Management, first-year university marks were also regressed against scores in these school subjects and an appropriate indicator dummy variable. Regressions also included the TER (in the range 0-100), the overall measure of performance.

Secondary school categories were incorporated in the models, with government schools used as the reference point, enabling testing for significant differences between government, independent and Catholic schools. Two dummy variables were used – for independent and Catholic schools. In addition, the relevance of a disadvantaged school background was explored, using an indicator dummy variable.

Subject sample sizes ranged from 225 to 341 on the Caulfield/Peninsula campuses and 195 to 328 on the Clayton campus. Students entered from 383 different secondary schools at Caulfield/Peninsula, and of these 147 were independent, 80 Catholic and 149 government. At Clayton, of the total of 402 schools there were 188 independent, 90 from Catholic and 123 from government schools. Fifty-one schools classified as disadvantaged were represented at Caulfield/Peninsula and 26 at Clayton.

Various regression model specifications were examined. Models with fewer variables were analysed for each specification, but only the linear models with the full set of explanatory variables are presented to demonstrate findings which were reasonably consistent across cohorts.

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[3] Here the school subjects, Further Mathematics, Mathematical Methods, Specialist Mathematics, are referred to as basic, advanced and higher mathematics to reflect the order of increasing complexity.
[4] (=1 for Peninsula)

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Table 1

Caulfield-Peninsula – Students' results in first year university subjects

Subject	n	*Constant*	School category: *Campus indicator*	School category: *Disadvantaged school*	School category: *Independent school*	School english: *Catholic school*	School english: *English score*	School english: *ESL score*	School english: *English dummy*	School maths: *Basic Maths score*	School maths: *Advanced Maths score*	School maths: *Highest Maths score*	School maths: *Highest maths dummy*	School other: *Basic maths dummy*	School other: *Relevant Subject score*	School other: *Relevant subject dummy*	*TER*	*Adj R-squared*
Economics	295	-5.27	2.06	-1.40	-.82	.15	.04	.31	9.30	-1.82	.83	.47	-13.64	77.21	.70	-19.38	.24	.17
		-.35	.91	-.52	-.46	.07	.13	.83	.66	-2.11	3.13	1.50	-1.51	2.22	1.10	-1.54	1.39	
BusComm	275	19.80	-1.00	.945	1.53	.66	.53	.74	12.53	-1.22	.23	-.22	4.23	44.35	.16	-6.62	.11	.16
		1.62	-.56	.46	1.05	.37	2.34	2.54	1.09	-1.71	1.10	-.82	.55	1.53	.40	-.40	.80	
Managmnt	277	19.62	1.23	-.80	-1.32	-1.55	.46	.66	8.87	-.58	.37	.31	-12.07	23.63	.93	-38.44	.12	.21
		2.06	.90	-.46	-1.12	-1.10	2.50	2.91	1.01	-1.12	2.20	1.30	-1.78	1.12	2.88	-2.94	.99	
Accounting	341	-14.51	4.11	-.08	-2.91	-1.95	.22	.33	9.01	-2.21	1.10	.86	-27.71	87.92	1.31	-33.59	.22	.29
		-.72	1.52	-.3	-1.29	-.75	.62	.74	.51	-2.30	3.42	2.17	-2.43	2.20	3.98	-2.82	.98	
Statistics	341	-4 .54	.93	-.74	-.46	.63	-.32	.40	27.73	-.22	2.01	-.04	.98	12.1			.29	.27
		-2.66	.41	-.31	-.25	.29	-1.15	1.10	2.01	-.23	6.74	-.13	.10	.30			1.5	
Marketing	285	2 .52	-3.29	-.51	1.10	1.26	.64	.55	.65	.58	.08	.59	-16.59	-25.89			.12	.21
		1.60	-1.79	-.24	.74	.73	2.91	1.85	.06	.83	.34	2.02	-1.10	-.91			.87	

The table shows for each compulsory first-year university subject, the coefficients related to the explanatory variable of interest (first line) and the associated t-ratios (second line) which indicates the variable's significance in explaining the subject result, based on n observations. T-ratios exceeding 2 are significant at the 5%level.

Table 2

Clayton – Students' results in first year university subjects

Subject	n	*Constant*	*Dis-Advantage*	*Independent school*	*Catholic school*	*English score*	*ESL score*	*English dummy*	*Basic maths score*	*Advance maths score*	*Highest maths score*	*Highest Maths Dummy*	*Basic Maths dummy*	*Associate subject dummy*	*Associates ubject score*	*TER*	*Adj R-squared*
Economic1	322	-35.40	1.64	-5.19	-3.03	.06	.60	27.70	-1.28	.37	.58	-19.68	57.65	.23	-4.98	.72	.27
		-2.00	.56	-3.08	-1.54	-.23	1.57	1.95	-.99	1.82	1.99	-2.12	1.00	.90	-.50	3.3	
Economic2	302	4.92	-4.76	-4.69	-3.07	-.12	-.45	-13.06	-1.44	.60	.68	-23.73	68.03	.18	-4.33	.61	.24
		.26	-1.62	-2.63	-1.49	-.45	-1.16	-.87	-1.48	3.30	2.27	-2.49	1.57	.68	-.41	2.79	
Statistics1	320	-44.04	1.33	-2.29	.04	-.40	-.06	16.51	.07	.62	.39	-12.91	-.02			.97	.36
		-3.06	.53	-1.47	.02	-1.73	-.21	1.38	1.04	4.38	1.56	-1.60	-.20			5.31	
Statistics2	298	-1.90	-.56	-7.96	-4.28	-.30	-.14	4.06	-.20	.61	.95	-32.48	11.66			.63	.29
		-.11	-.18	-4.21	-1.95	-1.09	-.40	.29	-.14	3.11	3.15	-3.33	.18			2.80	
Managmt1	216	-2 .11	-2.10	-3.54	-2.49	.24	.69	19.94	-.48	.33	.44	-19.04	24.05	-.18	1 .32	.49	.24
		-.99	-.69	-2.03	-1.30	.89	1.40	1.11	-.32	1.47	1.49	-2.11	.36	-.40	.53	2.19	
Managmt2	195	7.98	-3.60	-3.43	-3.27	-.11	.68	33.57	.27	-.04	.73	-25.45	-16.91	-.75	33.00	.38	.18
		.40	-1.23	-2.11	-1.83	-.42	1.40	1.88	.20	-.20	2.52	-2.91	-.28	-1.71	1.76	1.84	
Accountin1	328	-6.99	-.05	-3.60	-2.49	-.28	.004	11.42	.52	.27	.65	-21.7	-24.21	.86	-25.79	.64	.41
		-.46	-.02	-2.49	-1.51	-1.33	.01	1.01	.65	1.80	2.82	-2.94	-.68	4.20	-3.15	3.68	
Accountin2	301	-4.84	-.23	-4.70	-4.24	-.30	.30	21.44	-.24	.38	.28	-8.62	12.75	.76	-28.32	.45	.27
		-.29	-.09	-3.04	-2.40	-1.28	.98	1.78	-.19	2.31	1.10	-1.03	.23	3.49	-3.24	2.21	

The table shows for each compulsory first-year university subject, the coefficients related to the explanatory variable of interest (first line) and the associated t-ratios (second line) which indicates the variable's significance in explaining the subject result, based on n observations. T-ratios exceeding 2 are significant at the 5%level.