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Commerce matriculants:

gender and ability

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Abstract

The gender and qualifications of matriculants entering the Faculty of Commerce and Administration were compared with those entering the rest of the University. The results show that the Faculty has, over the past ten years, attracted students of lower ability than the rest of the University. Whereas females have equal representation at the University, it is apparent that the proportion of females in the commerce faculty lags some years behind the rest of the University. However, there was evidence that both differentials were declining.

Keywords

Commerce Matriculants: Gender and Ability

Introduction

The New Zealand Government has fostered an 'open entry' policy for university education. Students have the right to enter university, even though they have no formal academic qualifications, when they reach the age of 20 years and nine months. As a consequence, the number of undergraduate courses taken in New Zealand universities has increased by 14 per cent over the period 1979 to 1984. The popularity of commerce courses has increased at an even faster rate. The corresponding increase in commerce courses was 27 per cent (Department of Education, 1980, 1985). It is believed that the increased representation of females at university was an important determinant of the observed increase.

This paper reports two, basically independent, analyses of the characteristics of matriculants of the Faculty of Commerce and Administration of Victoria University of Wellington. The first study was essentially exploratory in nature and did not test formal hypotheses. It sought to measure the progress the faculty had made towards equal representation of both sexes in the student body. The second study was a comparison of the ability of commerce matriculants with respect their peers in the rest of the university. To the author's knowledge, little research has been carried out into either area. Indeed, the latter analysis has little utility where high entry standards can be set in the face of overwhelming demand (for example, Foy & Waller (1987) cite that 14 students applied for each pharmacy place in UK universities).

Hypotheses

It can be argued that the sexes are equal, on average, on a number of accounts, for example, numbers born each year and numbers that are eligible to attend university. Therefore, it is reasonable to expect equal representation at university in terms of both numbers and academic ability. A tentative, and by no means uncontroversial, model is presented in Appendix 1 to provide a basis for the argument that the abilities of commerce matriculants should be similar to those entering other faculties of a university.

Thus the research questions of the second study were addressed with the following null hypotheses.

H_1: the average ability of matriculants registering for the commerce degree was not different from the average ability of other matriculants over the past ten years.

H_2: the average ability of matriculants registering for the commerce degree did not change over the past ten years.

Victoria University of Wellington, through its faculty of Commerce and Administration, has shown a strong commitment to management education. However, over the past five years demand for commerce courses has outstripped supply. Enrolment restrictions were based, in the main, on prior academic performance. Thus an increase in the average ability was to be expected in the latter half of the data.

The first section demonstrates that the proportion of female matriculants in the commerce faculty has increased dramatically over the past decade. This begs the question as to whether there has been a change in the abilities between the sexes. This aspect was tested using the null hypothesis:

H_3: the ability of matriculants registering for the commerce degree was independent of gender.

Method

The data used in the analyses reflected the pragmatic aspects of the data that was available to the researcher. The analysis of gender proportions was based on full-time, as defined by Dawbin (1978 to 1987), matriculants. The fact that part-time students were ignored in this part of the study must be clearly recognised.

For the second study, decisions were made to: (a) test the hypotheses on the sub-set of matriculants who had undertaken the Seventh Form year of study[1]; and (b) use a three-way Analysis of Variance (ANOVA). The dependent variable was initially measured as the ordinal classification of Scholarship (4), A Bursar (3), B Bursar (2) and Higher School Certificate (1). The choice of this estimate of ability represents a compromise. Although more precise estimates were available for some groups of matriculants, their use was contra-indicated for the very reason that there was not a common series of examinations on which to base the estimate. The variable was converted into a normal deviate based on the sample mean and standard deviation[2].

The assumptions required for an ANOVA, in order of decreasing importance, are that the observations were independent, sampled from a normal distribution and were of the same variance. Since students can only matriculate once, there was no reason to assume that the important independence assumption was denied. Given the large number of students that attend the Seventh Form, it can be argued that the distribution of the underlying population, in terms of academic ability, was normally distributed. The homogeneity of variance assumption was not violated[3].

The factors used in the ANOVA were Sex (female/male), Year (1977-1986) and Faculty. The latter factor distinguished between the commerce faculty (matriculants enrolled in the bachelor of Commerce and Administration degree) and the rest of the University (matriculants enrolled for bachelor degrees

in Arts, Science and Law). The factors were treated as fixed-effects in the ANOVA. The reason for treating Year as a fixed-effect was based on the argument that the objective of the study was to examine relationships over a specific period of ten years. To acknowledge the nonorthogonality, the sums of squares were calculated using an hierarchical or sequential sums of squares approach (Hull & Nie, 1981, p. 8).

Results and discussion

Representation by gender

The number of full-time matriculants at the university has increased, on average, by 25 per year over the period 1977-87. This is equivalent to a growth rate of approximately 2.5 per cent per annum (Table 1). The number of commerce matriculants has grown at an even faster rate. The annual increase, expressed as a proportion of all full-time matriculants, was in excess of 2 per cent. Thus over the ten year period, the regression analysis indicated that the proportion of commerce matriculants has almost doubled; from just over 20 per cent in 1977 to just over 40 per cent in 1986.

The growth in the proportions of females attending the University is apparent. Ten years ago, they were under-represented (41 per cent of full-time matriculants), in 1986 they achieved parity[4]. A even faster growth rate was evident for female commerce matriculants (2 per cent per annum). The rate of growth was remarkably stable (r^2=0.97) This must be offset, however, by the fact that they were grossly under-represented in 1977 (under 20 per cent). By 1986, they accounted for approximately 40 per cent of Commerce matriculants. Thus it was apparent that the proportion of females in the Faculty of Commerce and Administration lags some years behind the University average.

Ability

Table 2 presents the results of the ANOVA which tests the hypotheses of the second study. The sample relates to those who entered the university directly from the Seventh Form. There was little evidence that the mean ability of the University's matriculants had significantly changed over the ten year period (Year, p=0.07)[5]. This result was to be expected[6].

Statistically significant differences were observed in the average abilities between the Commerce Faculty and the rest of the University (Faculty, p<0.001). Thus H_1 was rejected. The cell means, aggregated over the ten year period, showed that 50.8 per cent of the non-commerce matriculants were above the total University mean (cell mean, expressed as a standard deviate, was +0.02). The corresponding statistic for the commerce matriculants was 47.2 per cent (cell mean, expressed as a standard deviate, was -0.07).

A statistically significant result is of limited importance unless the differences in the means is of practical

Table 1   Number of full-time matriculants by year and gender

Year	Commerce Faculty		Total University	
	Male	Female	Male	Female
1986	197	138	624	566
1985	262	141	719	532
1984	190	91	656	478
1983	178	86	582	471
1982	172	76	637	474
1981	157	61	605	422
1980	179	60	599	428
1979	170	45	639	343
1978	144	39	631	376
1977	152	42	634	393
Total	1,802	779	6,326	5,049

Notes:

(a)   Includes all full-time students, the matriculants studied were a major subset.

(b)   Ordinary least squares regression with Year-1976 as the independent variable produced the following statistics, the standard errors of the coefficients are presented in parentheses.

Dependent variable	Intercept	Slope	r^2
Percentage of Female matriculants, University	40.0 (1.6)	0.90 (0.25)	0.78
Percentage of Female matriculants, Commerce	17.1 (1.2)	2.15 (0.20)	0.97
Number of full-time matriculants, University	944.3 (32.8)	24.8 (5.3)	0.86
Commerce matriculants as percentage University	19.4 (2.8)	2.16 (0.45)	0.86

Table 2   Analysis of variance table: tests of H_1, H_2 and H_3.

Source of variation	Sum of squares	Degrees of freedom	Mean square	F ratio	Significance of F ratio
Year	15.63	9	1.74	1.75	0.07
Sex	0.02	1	0.02	0.02	0.90
Faculty	14.31	1	14.31	14.40	<0.001
Year by Sex	13.33	9	1.48	1.49	0.15
Year by Faculty	29.36	9	3.26	3.28	0.001
Sex by Faculty	0.96	1	0.96	0.97	0.33
Year by Sex by Faculty	7.23	9	0.80	0.81	0.61
Explained	80.74	39	2.07	2.08	<0.001
Residual	8,062.06	8,108	0.994		
Total	8,142.80	8,147	0.999		

importance. The evidence would point to the fact that there was an important imbalance in abilities between the commerce matriculants and their peers in the rest of the University. The imbalance in ability (Table 3) can be put into perspective in that the faculty was, in comparison to the rest of the University,

(a)   unable to recruit 57 per of their expected Scholarship students (p<0.001);

(b)   unable to recruit 15 per cent of their expected A Bursar students (p<0.001);

(c)   able to recruit 17 per cent more B Bursar students than expected (p<0.001); and,

(d)   unable to recruit 3 per cent of their expected High School Certificate students (p>0.10).

However, the inferiority of the commerce students was not consistent over the ten year period (Faculty by Year interaction, p=0.001). In 1983 and 1986 they had greater average ability than the rest of the University, in 1978 they were effectively equal. Figure 1 gives the visual impression that the average ability of commerce matriculants had improved over the ten year period. The Spearman rank correlation coefficient (r_s=0.51, p=0.02) indicated the presence of a temporal trend. Ordinary least squares regression confirmed the slope was positive, although the evidence that it differed from zero was relatively weak (p=0.03). Thus H_2 was rejected.

In contrast, the average ability of all matriculants had not significantly changed (Year factor in ANOVA, p=0.07 and slope not different from zero, p=0.76).

The reasons why the commerce faculty has managed to attract more able matriculants in recent years are unclear. It is believed that enrolment restrictions played a subsidiary role. Faculty policy had been to accept, without reservation, any student achieving a B Bursary or better. Enrolment restrictions only affected those students with the HSC qualification. In these cases, the decision to admit the student to the Faculty was made on academic performance in earlier examinations, for example, Sixth Form Certificate. Even though the proportion of HSC matriculants in the Faculty was representative of the total University over the period studied, there was some weak evidence (p=0.03) that their proportion was declining at about 1.5 per cent per annum (Table 4). This decline can be attributed primarily to admission standards. In contrast, the proportion of HSC matriculants at the University was declining at a significantly slower rate (0.36 per cent per annum, p=0.05). The Spearman rank correlation coefficients indicated a consistent downward trend for both groups. Given the policy of open entry, the decline can be tentatively attributed to an increase in the numbers of more able students attending university.

Table 3   Distribution of ability of the matriculants studied

Ability	Commerce		Rest of the University	
	Actual	Expected	Actual	Expected
Scholarship	18	42.0	162	138.0
A Bursar	450	532.6	1,833	1,750.0
B Bursar	852	727.5	2,266	2,390.5
Higher School Certificate	581	598.9	1,986	1,968.1
Total	1,901		6,247	

Notes:

(a)   The calculated chi-square was 63.1 on 3 degrees of freedom (p<0.001).

(b)   The cell chi-squares for Scholarship (17.9), A Bursar (16.7) and B Bursar (27.8) were statistically significant (p<0.001) on 1 degree of freedom.

Figure 1   Average ability of the matriculants studied
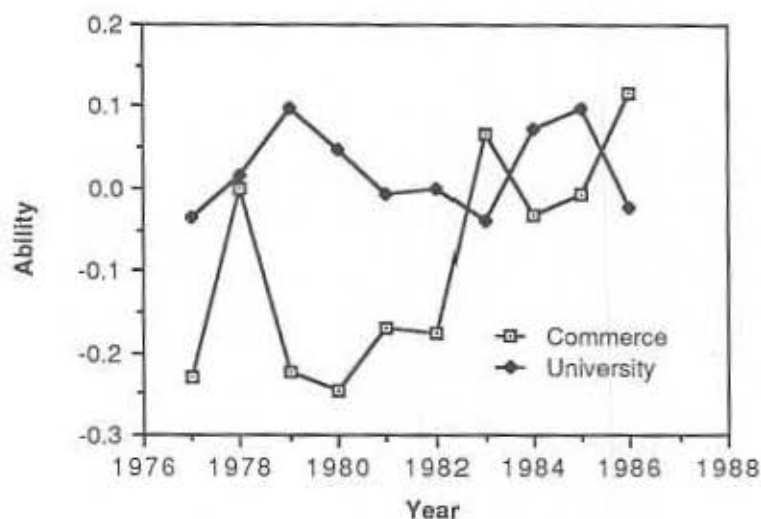
Notes:

(a)   Ability was measured using the deviate transformed data.

(b)   Regression/correlation using Year as the independent
       variable produced the following statistics.

Dependent variable	Ordinary least squares regression			Spearman rank correlation	
	Slope	Standard error	Probability	r_s	Probability
Commerce	0.030	0.011	0.03	0.51	0.02
Total University	0.002	0.006	0.76	0.07	0.39

8.

It is suspected that student choice has been the major influence. It can be tentatively argued that ten years ago, commerce was not generally accepted as an academic subject of high repute. Thus the better students were counselled, by parents and teachers, to undertake other studies. Today, the greater exposure of commerce in the media together with the potential rewards, both financial and non-financial, has made commerce subjects far more popular. That is, student motivation (Herzberg, 1966; Maslow, 1970; Porter & Lawler, 1968) has lead to the increase in potential candidates and enrolment restrictions have resulted in more able students being recruited into the commerce faculty.

Strictly interpreted, there was little evidence that the proportions of Scholarship, A and B Bursars had changed at the University over the ten year period. Essentially a similar picture emerges for B Bursars in the commerce faculty. The major explanation for the increase in the average ability of commerce matriculants relates to the proportion of A Bursars. They were increasing over time at the rate of 1 per cent per annum (p=0.06).

The proportion of Scholarship matriculants in the commerce faculty was well below the University average and there was weak evidence that the situation was not being rectified (r_s=-0.41, p=0.12). A partial explanation for these results lies in the fact that the matriculants for the rest of the University contains the important cadre of students undertaking intermediate studies. They would include aspirants for the professions of medicine, dentistry and veterinary science. Secondly, given the fact that Scholarship students invariably attend university, a decline in their proportion was to be expected given the general increase in the popularity of university study.

There was no evidence of any significant differences between the sexes over the ten year period studied (Sex and its interaction with the other two factors, p's>0.15). Ceteris paribus, this was indicative of the absence of major gender bias in terms of the academic ability. Thus the data does not reject H_3. However, the impreciseness in the measurement of the ability variable must be borne in mind. It is suspected that minor gender biases in ability may exist (Mutchler, Turner and Williams, 1987).

Concluding remarks

As an historical review, this paper provides evidence on two policy areas which are worthy of consideration by the commerce faculty. Firstly, why are females still under-represented? The observation that the proportion of females has grown at over twice the rate of the rest of the University is but mitigating evidence. The fact is that the commerce faculty is some years behind the rest of the University in the proportion of female matriculants.

The opinion that females should represent approximately half of commerce matriculants is, of course, based on the premise

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Table 4   Temporal analysis: regression/correlation using Year
            as the independent variable and percentage of
            students in each class as the dependent variable

| Dependent variable | Ordinary least squares regression | | | Spearman rank correlation | |
	Slope	Standard error	Probability of slope $\neq$ 0	r_s	Probability
High School Certificate					
Commerce	-1.53	0.57	0.03	-0.71	0.01
Total University	-0.36	0.15	0.05	-0.53	0.06
B Bursary					
Commerce	0.50	0.69	0.49	0.37	0.15
Total University	0.10	0.23	0.68	0.20	0.29
A Bursary					
Commerce	1.10	0.57	0.09	0.52	0.06
Total University	0.27	0.23	0.28	0.31	0.19
Scholarship					
Commerce	-0.07	0.06	0.29	-0.41	0.12
Total University	-0.01	0.03	0.94	0.09	0.40

that such a target is fair and reasonable. Systematic proportion gender biases are discernible, world-wide, in certain subjects. For example, males are generally over-represented in the physical sciences and engineering courses, whereas females dominate educational and librarianship courses (Department of Education, 1980, 1985; Ferber 1984). The reasons for these differences have been addressed in the literature (Maccoby & Jacklin, 1974; Deboer, 1984) but little specific attention has been paid to the situation with commerce faculties.

Thus the question of whether there is an unwarranted gender imbalance depends upon the position of commerce courses in this continuum. The education literature provides mixed evidence. In 1980, a third of commerce graduates in the US were female (Ferber, 1984). However, there is recent evidence to suggest that parity is achievable. McInnes and MacNeill (1985) report that the percentage of female students in accounting courses in the US had increased from 28 per cent (1977) to 49 per cent (1985). Accountancy majors are the dominant group in the commerce faculty, thus there are indications that parity is achievable in the near term. Nevertheless, the question why females are not fully represented in commerce courses needs further investigation and possibly positive action. It is believed that equal representation will lead to the elimination of the selection bias in ability (not found in this study, possibly due to the imprecise measure of ability) implied in the observed superiority of females in accounting courses reported by Mutchler, Turner and Williams (1987).

Secondly, the evidence points to the fact that, historically, the commerce faculty has, on average, attracted students of lower academic ability than the rest of the University. Given the measure of ability used in this study great confidence can be attached to this conclusion. However, there is strong evidence that the differential is declining and may, in fact, have been reversed. Hartnett (1987) reports a similar trend for graduate courses in the US.

There are a number of potential criticisms of this study that must not be overlooked. Although both studies concentrated on well-defined sub-sets of matriculants, which represented by far the larger majority of the population, prudence dictates that the observed results may not pertain to other matriculants. Furthermore, great care must be exercised in extrapolating the results. The University and, even more so, the Faculty of Commerce and Administration are entering a period of rapid change. Thus, uncertainty must surround the question of whether trends in historical data have any predictive ability, even in the short term. Nevertheless, this paper presents some pertinent evidence of the situation as at the start of the 1986 academic year.

Footnotes

1   At the time, students could gain the University Entrance
    qualification at the end of the Sixth Form (Grade 12).
    About a quarter of matriculants leave school after the
    Sixth Form. The greater majority stay at school for a
    further year and complete the Seventh Form. Those that
    compete in the national Bursary examinations are
    classified as Scholarship, A Bursar and B Bursar.
    Students who either do not enter these examinations or do
    not achieve a B Bursary are granted a Higher School
    Certificate for completing the Seventh Form year of study.

2   The decision to standardise the total sample (n = 8,148)
    into a deviate was done solely to aid the exposition of
    the results. Such a transformation would not, of course,
    reduce the deviations from normality.

3   Cochran's C was 0.031 on 204, 40 degrees of freedom
    (p=0.33).

4   Taking all matriculants into account, females outnumbered
    their male peers by approximately 4 per cent in 1986. In
    earlier years, the reverse was apparent.

5   Figure 1 indicates the absence of any linear temporal
    trend (r_s=0.07, p=0.39)

6   The Bursary awards are held at a fixed proportion of those
    sitting the examinations. There was little reason as to
    why one university should have a comparative average over
    other universities in New Zealand in attracting students
    of higher academic ability.

Appendix 1 A tentative conceptual framework

Figure 2 presents the tentative conceptual framework to support the belief that the ability of commerce matriculants should be similar to their peers in other faculties. Relation [7] argues that the well-being of society is a function of wealth creation. Wealth allows a nation to satisfy the community's basic needs (Maslow, 1970). Examples would be health, social welfare, education, law & order and defence. After these hygiene factors (Herzberg, 1966) have been satisfied, wealth can be used to enhance the aesthetic qualities of life, examples would be the arts, theatre etc.

Relation [4] argues that increased wealth creation is strongly associated with managerial ability. Entrepreneurship is enshrined in the general theory of economics (Keynes, 1936). Relation [2] is possibly the weakest link in the causal model. It argues that increased performance in commerce subjects is positively associated with increased managerial ability. That is, the study of commerce subjects improves or enhances managerial ability. A major argument in support of this proposition is the popularity of courses leading to Masters Degrees in Business Administration (MBA). Participants are prepared to pay high course fees in the hope that employers will pay them enhanced salaries.

Relation [1] is not only intuitively appealing, but is extremely well-documented in the educational literature. Although 'student ability' may be a conceptual parameter which is difficult to measure with absolute accuracy, high school and pre-university examination performances have proven to be adequate surrogates. They normally explain approximately 25 per cent of the variance in university examination scores (see, for example, Foy & Waller (1987) for pharmacy; Touron (1987) for medicine; Schroeder (1986) for accounting; and Ferber, Birnbaum & Green (1983) for economics).

The strength of Relation [1] is reinforced by reference to Relation [3]. The well-established professions of medicine, architecture and law have always sought and have been able to recruit those with the greatest ability. This filter has invariably occurred at the transition from school to university. Thus, path 1->3->6 has strong historical support. However, its true benefit to society is confounded by the complicated feedback relationship implied in path 5->6->7. It is tentatively suggested that the crux of this relationship is the creation of wealth. Nevertheless the contribution to the well-being of society made by the professions, arts and sciences cannot be denied.

A question that needs to be addressed is whether path 1->2->4->7 deserves greater recognition. To say that all university resources, including student inputs, should be directed through this route cannot be supported. The reverse argument is equally invalid. As a compromise, the analysis is based on the presumption of parity between the two routes. That is, the ability of students entering the two routes should be essentially similar.

Figure 2 Conceptual framework
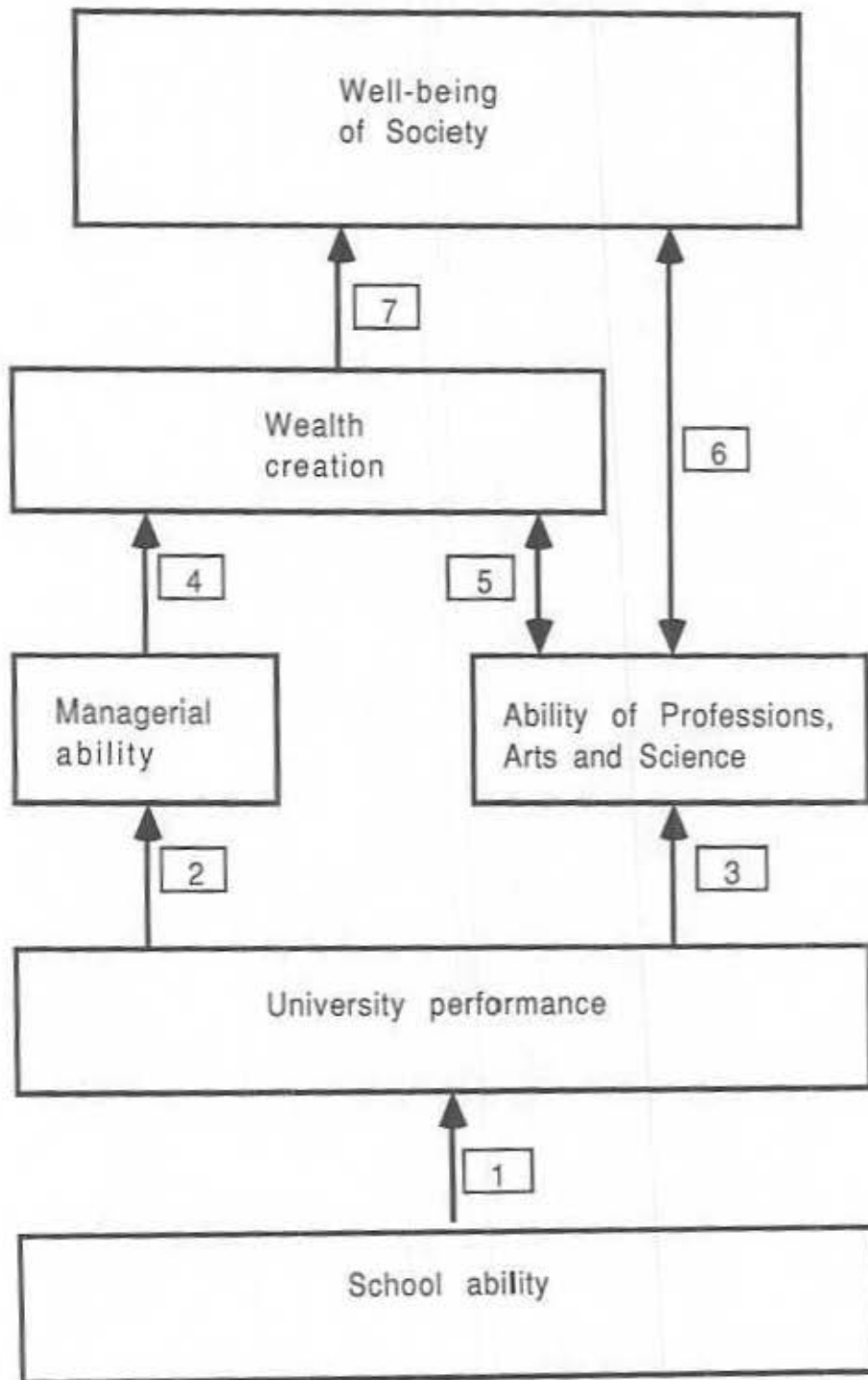
The discussion so far has concentrated solely on the quality of inputs to the two routes. It has not addressed the important question of the product of quality and quantity, that is, the weighting of the abilities and their numbers. The question on the comparative benefits to society of, say, X top scientists versus Y mediocre scientists (Y>X) is most possibly a policy decision. Nevertheless, this may become an important area of debate in the education/training of managers

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