THE PERFORMANCE OF UK UNIVERSITIES AND DEPARTMENTS

by P.E.HART

1. Introduction

A university is primarily a place for learning. Though other activities, such as providing board and lodging, entertainment, sports and health care for students are important, its core business is teaching and research. In addition ,the Government has prescribed the social objectives of increased co-operation with business and of widening access, especially to students from low participation areas. The core activities generate income from the Higher Education Funding Councils. That for teaching is governed by the number of students and a unit of resource which ,for example, is larger for laboratory subjects than for arts subjects. A university's total income from teaching, denoted by I(T), also includes tuition fees from domestic and overseas students.

Income from research, I(R), may be divided into income from the Funding Councils, I(R1),and other research income, I(R2),which is usually for specific research projects financed by the public and private sectors. I(R1) depends on the grade awarded in the Research Assessment Exercise (RAE) ,the numbers of researchers submitted, and another measure of the unit of resource.

There is a case for using I(T) + I(R) to measure the core services provided by a university, or more briefly, its performance. It reflects student numbers, units of resource, and the quality and quantity of research. It is a simple measure and is available in a university's published accounts. However, it is at best a measure of gross output; it does not take costs into account. Moreover, other criteria reflecting the quality of graduates (such as 'A' level results and the proportion of first class degrees) are often included in the appraisal of universities, as in the Financial Times survey 11th May 2002. Thus I(T) + I(R) may be insufficient. The various measures of teaching and research are discussed in more detail in the following sections 2 and 3.

2. Teaching Performance

University teaching has been assessed by visiting academics who examine vast quantities of documents compiled by departments, attend some teaching sessions, consult student opinions and then report their findings. For example, the Quality Assurance Agency used marks 1,2,3 and 4 for each of the following six categories: (a) curriculum design, content and organisation, (b) teaching, learning and assessment, (c) student progression and achievement, (d) student support and guidance, (e) learning resources, (f) quality management and enhancement. Thus the maximum mark for a department was 24. Unlike the RAE mark, the QAA mark had no direct effect on funding. In principle it could have had an indirect effect by influencing student demand for places in a department.

The QAA mark is a discrete variable and subject to errors of measurement which can be substantial in percentage terms for any one category. Over the six categories the errors should offset each other so that the total mark for a department is more reliable than any mark for an individual category. If the departmental marks are averaged over a whole university there is so little systematic variation between universities that inadequate guidance is provided to potential students on their choice of university. A more useful guide would be the student staff ratio (S/S) in the departments under consideration. Departments with S/S ratios of 26 to 1 cannot provide the same degree of personal tuition as those with 10 to 1. High S/S ratios are accompanied by overcrowded lecture theatres, too few copies of library books and of periodicals, inadequate computing and photocopying facilities so that the quality of service is inevitably lower than before the transition to mass higher education.

The increase in S/S ratios is sometimes interpreted as an increase in productivity. Indeed, there was a reduction of 38% in the costs per student over the decade 1989-99. However, any firm can reduce its average costs by reducing the quality of its product, so the increased S/S ratios might not measure increases in efficiency. The introduction of on-line learning, including instant e-mail contact between students and staff, together with extensive use of handouts and other teaching aids, helped to maintain standards in spite of admitting more and more students with lower 'A' level grades. Whether quality of teaching has been reduced in spite of the computer is controversial. There is a real need to measure quality and attempts to improve the methods used in previous assessments should be supported. Until these improvements are implemented, the S/S ratio remains the most useful guide to teaching quality.

The number of students is likely to be included in any measure of the quantity of teaching services. If this is weighted by the unit of resource for each subject, and if income from student tuition fees is added, the figure of I(T) results. This measure of the gross output of teaching services is available for each department and hence for each university.

3. Research Performance

The grade awarded in the Research Assessment Exercise (RAE) is crucial in determining I(R1),the research income from the Funding Councils. These grades are awarded by peer group committees which examine the research output of university staff submitted. It is not necessary for a university department to submit all its staff. It might decide to concentrate its submission on its leading researchers in order to maximise its RAE mark. If it does, it pays the price of a reduced number of staff in the multiplier because the income generated depends on the product of the RAE mark and the number of staff submitted.

As an example, Table 1 distributes 48 physics department by their 2001 RAE grade and the proportion of staff submitted .There are seven grades ranging upwards from 1 to 5* .There were no physics departments in grades 1,2 and 3b.The remaining four grades are 3a,4, 5 and 5*.A total of 49 physics departments entered, but one outlier scoring 3a with less than 20% of staff submitted, has been omitted. The RAE committee decided that the modal physics department had an international reputation and was worth grade 5 .Most of the 48 submitted at least 95% of their staff.

The RAE grade is a discrete variable subject to errors of measurement. In obtaining average grades across departments, it is assumed that the distance between adjacent grades is unity. We might expect the distribution of average departmental grades across universities to be continuous, possibly following the normal curve of Gauss as a result of errors of measurement and a multitude of systematic and stochastic effects .

Table 2 distributes 106 UK university institutions by their average RAE grade in 2001 using the seven point scale across ten size classes with each class equal to 0.5 units. It can be seen that this distribution is bimodal, with modes in classes 4 and 8 so it is certainly not normal. The reason for this is that there are two populations, namely those with university status before 1992 and those granted it later when the binary divide between polytechnics and universities was abolished. The 46 post-1992 universities submitted have a unimodal distribution centred on class 4,while the corresponding distribution for pre-1992 universities is unimodal but centred on class 8. The clustering of observations at the centre of the two distributions implies that small changes in their average RAE mark can lead to substantial changes in their rank order in the published league tables.

Even the rank order of observations in the upper tail can be changed by varying the numbers of staff included in the assessment. Should excluded staff be given hypothetical marks of 0,1,2,..(or 1,2,..less than the recorded average) and new averages calculated over all staff ? Each university can reasonably argue in favour of the weights which maximise its rank in the league table. In the Alice in Wonderland world of league tables of university research, a university's rank depends on the hypothetical grades awarded to staff who were not examined by the RAE !

At first sight, this game of choosing optimum weights for omitted staff seems harmless enough; it merely results in different newspapers and their consulting firms issuing different league tables of the same universities for the same year. However, the different rankings could have deadly serious results if the Government decided to concentrate research funding in the top 20 or so universities. All 28 universities in the modal class 8 in Table 2 will jostle for a position in the top 20 by using the weights for omitted staff, together with any other plausible argument, which puts them into the top 20 according to their judgement.

For example, the quantity of research measured by I(R) or I(R1) might be used instead of the RAE grade. These monetary estimates of the quantity of research include the effects of different sizes of universities, measured by the number of staff ,and of different subject mixes, reflected by the different monetary values of the units of
resource. Sometimes the quantity of research is called "research power". Thus a large university performing average grade research will tend to have higher research power than a smaller university with high grade work. There is no shortage of arguments to justify being included in the top 20 if research funding is confined to this group. The policy of concentrating research into the top 20 universities is discussed in section 5. Meanwhile, let us turn to expenditure on teaching and research, E(T) and E(R),for it is obvious that I(T) and I(R) measure gross output without any correction for input costs.

4. Expenditure

Data on the expenditure on research financed by grant-giving authorities in the private and public sectors are available from the accounts of the relevant research contracts. Since all income from these contracts is usually spent, we may assume that non-HEFCE research income approximates research expenditure. There is no surplus and we may put I(R2) = E(R2). This research leads to some publications which may be submitted to the RAE to generate additional research income, I(R1), without additional expenditure. That is , E(R2) = 0 . Thus income derived from the RAE, though smaller than the sum of I(R2) + I(T),where I(T) denotes tuition fees and grants for teaching, is a prime source of discretionary income for those universities which score high grades.

Some teaching staff contribute to the RAE grade without obtaining research funding. They are the traditional scholars doing independent research in addition to their teaching. Their costs are in E(T) and any attempt to separate their research costs from their teaching costs is purely arbitrary. Before the RAE system was introduced, university teachers were expected to devote about a third of their time to scholarship, research and keeping up to date in their subject. Teaching, examining, marking, administration, and counselling accounted for the remaining two-thirds . In effect the RAE scheme allowed the Government to claw back a third of the usual grant from each university and to redistribute the proceeds to universities in accordance with the RAE rules. The apparent aim was to concentrate research in those university departments with the strongest research records.

The problem is that the RAE income is assigned to universities and those without decentralised budgets need not pass on this income to the departments which generate it. In the short run, they may divert RAE income to under-performing departments in an attempt to improve them, or to avoid redundancies. In the longer run, such cross-subsidisation is constrained by the market for skilled researchers. Talented staff scoring high RAE grades, without adequate research facilities, who see resources (computers, equipment ,office and laboratory space) diverted to under-performing departments are likely to move to other universities where a more decentralised budgetary system operates.

Under a centralised budgetary system, with extensive cross-subsidisation ,it is possible for a favoured department to have a high research expenditure (as the result of expensive equipment) which exceeds the research income generated .This research income may be high ,and is sometimes called “research power”, but the department still makes a negative contribution to the university. It may be that the benefits of this research to the world outside exceed the costs to the university. If so, the world outside (Research Councils and other grant giving authorities) should provide the required finance. Financing expensive research projects by cross-subsidisation, because sufficient outside finance is not available, damages the research capacity of other departments and is a recipe for a long term decline in the reputation of the whole university.

In universities with centralised budgets, the cross-subsidisation of teaching is even larger than that for research. A university aims to obtain sufficient teaching income, I(T) to cover its teaching expenditure, E(T). It suffers financial penalties if it admits too many or too few undergraduates so it has every incentive to achieve its entry target. Even if it equates I(T) and E(T) in the aggregate, it might be unable to reach this target for each department. Most universities find it difficult to attract qualified students to some subjects and compensate for these shortfalls by exceeding entry targets for the more popular subjects. The result is that a wide variation in S/S ratios across departments emerges. Departments with high S/S ratios ,and an excess of I(T) over E(T), subsidise those with low S/S ratios which have an excess of E(T) over I(T).

There are many reasons this disequilibrium. Economic factors are important and explain why, for example, applications for agriculture are declining while those for finance are increasing ; students prefer degree courses which lead to well paid jobs. Gender effects are also important. The increasing numbers of female applicants, together with their superior 'A' level results, lead to an increasing proportion of female undergraduates. But this increase is not uniformly spread across all subjects. Many females opt for English ,for example, rather than for engineering, because they have been well taught by excellent female graduates in English in their schools. The virtuous circle continues when more excellent female undergraduates complete their courses and become good teachers of the next generation of females at school. Other subjects, such as media studies, become very popular irrespective of economic or gender effects. The reasons for changes in the demand for different subjects are complex. The problem is that the number of students in the numerator of the departmental S/S ratio changes more quickly than the number of staff in the denominator, so that wide variations in this ratio arise across departments.

With centralised university budgets and extensive cross-subsidisation, it will be difficult to remove this disequilibrium. Departments with low S/S ratios will regard them as normal, following the traditional pattern of UK universities. They may well dislike the replacement of this pattern by an institution of mass higher education. They may even believe it is their duty to maintain traditional student staff relationships in spite of Government policy on higher education. In such circumstances, the decentralisation of university budgets, so that each department has to ensure that its expenditure does not exceed its income, may be necessary to remove the fundamental disequilibrium which produces the wide variation of S/S ratios across departments.

5.Research Policy

The RAE scheme for allocating I(R1) across universities is based on the theory that there are economies of scale and scope to be achieved by concentrating the limited funds available in the best university departments. It is inefficient to spread the misery of inadequate funding evenly across all university departments. The concentration policy should ensure that at least some high quality research will continue.

As noted already, this concentration policy may be thwarted by universities with centralised budgeting which decide to divert their I(R1) from successful to unsuccessful departments in

an attempt to improve the performance of the latter. Perhaps such universities do not believe the theory of research economies of scale and scope. While it is clear that if there is excess capacity, such as unused laboratory space, an increase in the number of researchers will tend to reduce average costs, it is also clear that if there is no excess capacity, so that a new laboratory has to be built to accommodate an extra research team ,then average costs are likely to increase. The extra research team need not produce economies of scale.

Perhaps there are still economies of scale to be obtained from large research teams in large research units applying for large research grants. They may be favoured by grant-giving authorities which attempt to minimise their administrative costs. It costs as much to vet an application for small grant as it does for a large grant, so they favour large and fewer grants. To support this bias towards large projects, they may appeal for multi-disciplinary research applications and combined applications from more than one university. In the case of the European Commission, an important research sponsor, the research requested may involve several disciplines, several universities in several countries.

From the viewpoint of the researchers, the administrative costs of liaison are formidable and their research efficiency is impaired. In effect the research sponsors pass a large portion of their administrative costs to the researchers. There is unlikely to be any significant reduction in the combined administrative costs of the sponsor and the researchers arising from large research projects. Even so, university researchers have to dance to the tune played by the grant-giving authorities, if they want research funds, and propose large projects.

Advocates of large scale university research believe that the RAE committees are impressed by a large volume of books, papers and reports produced by large research centres and award them high marks accordingly. These centres may be staffed by full-time contract researchers, visiting and retired academics who do little teaching, marking, examining etc. and can concentrate on research. The traditional university teacher undertaking solitary research ,in addition to teaching duties, finds it difficult to compete with a research centre for scarce research resources, so he or she joins a research centre. This usually means that he or she works on a research topic chosen by a sponsoring committee. The scope for individuality, so important in academic research, is severely curtailed. The opportunity cost of large research centres, in terms of forgone research of individual university teachers may be considerable.

The pressure for large research projects often comes from Government departments or private industry which want answers to problems they cannot solve in-house. It is cheaper for them to use university experts than to commission a report from a research firm or institute in the private sector. To counter this, universities could charge full commercial fees for research undertaken for Government department or commercial clients. By charging low fees, universities are indulging in unfair competition with the private sector research companies. It is true that universities would welcome the income from charging full commercial rates for their research, but the Inland Revenue might question their charitable status and may tax any profits from subsidiary research companies.

Applied research in universities for clients presents further problems when the results are confidential and cannot be published. The academic careers of the researchers are hindered and because the results cannot be entered in the RAE, such research does not help the university's RAE grade. Of course, the university might use the income generated by such research in a claim for great "research power" ,but in the absence of peer review this claim is unlikely to be heeded.

The RAE scheme is itself very expensive and absorbs valuable scarce resources in the form of the time of the RAE committee members who are usually at the peak of their careers. It is time to assess the RAE scheme to see whether its undoubted benefits have been outweighed by dis-benefits. It might be more efficient to revert to the previous funding arrangement which included a third of the total university grant for research and allow universities freedom to set their own research programmes.

6. Social Objectives

Universities must improve their links with business and widen access to students from low participation areas. These criteria of performance will be discussed in turn, beginning with business links with teaching and training.

Business Links.

Universities have always had close co-operation with the professions, particularly those in medicine, law and the church. Nowadays these time-honoured associations are supplemented by a wide range of subjects from accounting to zoology. There are imbalances with too few graduates in some subjects (e.g. electronic engineering) and possibly too many in others (e.g. media studies). The business problem is not so much that universities graduate too many students as that the subject mix differs from that required by business. This imbalance is not new: over twenty years ago it was shown that the proportion of graduates in the UK was comparable with those in Germany but the proportion of engineering graduates was much lower (Prais, 1981).

The causes of this disequilibrium are complex. There are gender effects: females tend to avoid engineering in spite of the good job prospects. But both genders seem reluctant to study some subjects even though the employment prospects are excellent (e.g. Construction Management at Reading, a Grade 5 department in the RAE). The universities can make a major contribution to business by providing schools with more information on the job prospects and starting salaries of graduates in different subjects, especially those not taught at school.

The shortage of qualified skilled labour is even more serious at the technician level. Qualified gas fitters, electricians, plumbers and many other technicians are in very short supply. Teenagers prefer to attend a university, rather than to train for a well-paid job as a technician, because of the university social life. In particular, a university is an excellent marriage mart or dating agency. Universities could help business to overcome the shortage of skilled technicians by following the practice of some American Universities of providing

two-year associate degrees in vocational subjects. Students on such courses would obtain a degree rather than a diploma and would also have an adequate taste of university social life. Such a policy would help to achieve the Government's target of 50% entry into higher education, would make a major contribution to the country's stock of skills, and would please many students who would be happier taking a two-year associate degree rather than an honours degree over three or four years.

Research links between universities and business are just as important as those for teaching. As suggested in section 5, universities could create subsidiary research companies to undertake the research required by business. The implicit assumption is that a business is unable to perform this research in-house and is unable to commission it from the private sector, possibly because the expertise is available only in a university. These implicit assumptions may be wrong. Many large businesses have the required expertise and have research facilities which are superior to those in universities. This does not hold for small and medium enterprises (SME) but they have ready access to research consultancies in the private sector if they are prepared to pay commercial research fees. These fees may seem high, but they have to cover the costs of all the unsuccessful tenders made by a private research consultancy. A useful rule of thumb is that one in five tenders is successful, so that one contract has to finance itself and all the work done in preparation of four unsuccessful tenders. A university subsidiary research company would face the same problem and would eventually have to charge commercial rates to SME. The SME would argue that they already pay taxes which are used in part to finance universities and so a substantial discount is justified. The universities would reply that they are already under-funded, that their staff are grossly underpaid and so they cannot undertake commissions from business which do not cover the costs of their research subsidiaries. If firms are prepared to cover the universities' research costs, there is considerable scope for improving the co-operation between universities and business.

Widening Access.

There is a long tradition of universities providing scholarships to a small minority of bright but disadvantaged students as the result of competitive examinations. Nowadays, when all students with average 'A' level grades can enter higher education, the problem is that disadvantaged students are under-achieving at 'A' levels, or not staying at school after 16 years to take 'A' levels. The latter problem is being addressed by the Government in the form of special grants. The universities can help by providing more information to schools, parents and students in low participation areas where the benefits of university education are not appreciated.

Greater access to disadvantaged students from schools with traditionally low 'A' level grades can be achieved by using their within-school ranks rather than their actual grades. That is, the highest ranking students from such schools would be admitted to university even if their 'A' level grades were below the national average.

Most disadvantaged students live in the inner cities and their local universities are most likely to have the detailed knowledge of the standards of their schools required to bias university

selection in their favour. Their local universities include the great civic universities and the post-1992 universities. If extra finance is provided for such disadvantaged students admitted, there is a case for biasing the extra funds towards the post-1992 universities in order to offset their lack of RAE funding. The pre-1992 universities in the inner cities already have discretionary income from the RAE funds, though they would no doubt also pursue the extra funds from widening access.

Local universities are emphasised on grounds of cost. Disadvantaged students would not have to contribute to their tuition costs, but they would have to pay for their board and lodging if they left home for a university beyond their commuting range. Universities in high housing cost areas, with expensive residential accommodation, will find it difficult to compete with the post-1992 universities for any extra finance provided for widening access.

7. Conclusions.

Since tax payers provide most of university finance, they naturally wish to know whether they are obtaining value for money. Thus there is a need to develop measures of university performance which can be related to costs. In the core activities of teaching and research, assessment committees graded each subject or department in each university. The research assessment committees were guided by the research publications which had normally been assessed already by refereed journals. Nevertheless, the burden of assessment remained onerous and costly in terms of the very scarce resources used.

The assessors of teaching had no guidelines. In fact the diversity of teaching methods between subjects and universities is so large that any attempt to apply the same six criteria to all university departments is unlikely to provide the information required on teaching performance. It is probably better, and certainly cheaper, to use the student/staff ratio of a department as an inverse measure of teaching quality. Of course, teachers in departments with high S/S ratios use every teaching aid, including computerisation, to try to overcome problems created by huge numbers of students. The fact remains that an individual student with an individual intellectual problem has a better chance of receiving individual attention in a department with a low rather than a high S/S ratio.

The RAE grades provide more information than the QAA teaching marks, but it can be manipulated by variations in the proportion of staff submitted. Moreover, the total research income generated, including that by the RAE, is a gross output measure, whereas an appropriate research performance measure should also reflect inputs.

The inclusion of costs leads to the allocation of resources within universities. In universities with centralised budgetary systems there is great scope for cross-subsidisation which diverts funds to under-performing departments. This undermines the RAE policy of concentrating the limited research funds on the best departments. If such concentration is desired, it is necessary to have decentralised university budgeting with the RAE discretionary income allocated directly to the departments which generate it.

In universities with centralised budgets, the cross-subsidisation of teaching income is even greater. Since universities face severe financial penalties if they fail to meet their quotas of domestic undergraduates, it is not surprising that the university central authorities are prepared to achieve their aggregate target entries even if it means increasing the S/S ratios of departments which already have very high ratios.

The social objectives of increased co-operation with business, especially SME, and the widening of access to disadvantaged students are laudable, but cause.financial problems. Post-1992 universities have an advantage in the competition for funds for achieving these objectives. Perhaps this competitive edge is commendable in itself, in so far as it might offset their disadvantages in the competition for RAE funds.

University of Reading.

Reference: Prais, S.J. (1981) Vocational qualifications of the labour force in Britain and Germany, *National Institute Economic Review*, November, pp. 47-59.

Table 1: Distribution of 48 Physics Departments by RAE grade and by Proportion of Staff Submitted, UK, 2001

	Proportion of Staff Submitted %			Total
Grade	**60-79 C**	**80-94 B**	**95-100 A**	
3a	3	2	1	6
4	1	6	8	15
5		8	14	22
5*		1	4	5
	4	17	27	48

Note: One outlier, scoring 3a with less than 20% of staff submitted has been omitted. No physics departments scored grades, 1, 2 or 3b.

Table 2: Distribution of UK Universities by Average RAE Grade, 2001

		No. of University Institutions		
Class	**Average Grade**	**Post-1992**	**Pre-1992**	**Total**
1.	2-2.5	1		1
2.	>2.5 - 3	1		1
3.	>3 - 3.5	7		7
4.	>3.5 - 4	20		20
5.	>4 - 4.5	13		13
6.	>4.5 - 5	4	8	12
7.	>5 - 5.5		14	14
8.	>5.5 - 6		28	28
9.	>6 - 6.5		7	7
10.	>6.5		3	3
		46	60	106

Source: Data supplied by Higher Education Funding Council to the Independent newspaper. Average points scored by each researcher entered for the RAE using a seven point scale from 1 to 5*. The distance between adjacent grades, say 3a and 3b, and 5 and 5* is assumed to be unity.

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