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Economics of Education. Part 10.
An Analysis of University Expenditure

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Introduction

The autonomy of National Universities has increased substantially with deregulation and corporatization. The now enhanced ability of each university to identify and implement its objectives is appropriate for institutions that are academically experienced and mature. The additional institutional autonomy is accompanied by new responsibilities. In particular, a requirement to assume management carries with it a necessity for academic planning. The ability to implement change that enhances academic achievement is itself dependent on financial planning, now a university, not a ministerial, function.

A fundamental component of planning is knowledge of the costs inherent in the work of the institution. While some basic costs are readily accessible, others are obscured by the complexity of the university - simultaneously teaching at different levels and pursuing research in a variety of forms. Extracting information from data for a whole university system is possible in principle by methods used to analyse costs for multifunctional commercial and public enterprises (Baumol *et al.*, 1982). Although this technique has been used successfully in a number of countries, its application to the National Universities was found to be only partially successful (Morgan, 2006). Moreover, by its nature it can only yield general and system-wide results, not the detailed information needed within a university for planning. The alternative is to analyse directly how an individual university uses its resources: how the money is spent, who spends it and on what activities.

Much of the necessary information is collected within the university. For academic purposes records are kept of courses taught, of students' education, and of research work. Financial accounts record expenditures by cost centres and under detailed categories. In the past some of this data was regarded in Japanese universities - though not elsewhere - as confidential to the extent of secrecy: in the future, expectations of transparency in management will ensure that it becomes more accessible.

The necessary information has been made available for this study. The data relate to a large, comprehensive, research National University, with a high commitment to postgraduate study. In many respects its activities are similar to those of other National Universities and the results and the procedures employed to obtain them may serve as useful models. The paper is divided into four subsequent sections.

* Visiting Professor, R.I.H.E., Hiroshima University (tenure: from Sep. to Dec., 2007) ;
Emeritus Professor, Lancaster University, UK; University of Newcastle, Australia

First, the sources of data are identified, then the analytical methods, including the assumptions and procedures, are summarised. The third section presents the results in tabular form and discusses them; a final section comments on the results and seeks to draw some general conclusions.

Sources of Data

Four principal sources provided the necessarily detailed data. Official university records provided three of these. The report of annual income and expenditure for the financial and academic year 2004-5 contained the essential financial information; information on courses and teaching loads is contained in the detailed records compiled by university central administration; and numbers of academic staff and students are given in the published university prospectus. Data on the uses of time by academic staff were available from surveys that had been conducted previously in the university.

In its presentation of annual expenditure, the university divides the data horizontally by cost centre (Faculty, Institute, Academic Service, Administration, etc.) and vertically by category (consumables, employment, operations & maintenance); funding from external sources is also presented (Table 1). The figures in Table 1 exclude expenditures by those components not inherently integral to higher education, notably schools and hospitals.

Numbers of academic staff and students are in Table 2. Figures for courses taught for degrees and other purposes and the corresponding student loads are collected centrally by university administration and are summarised in Table 5. The detailed central records show courses by level and purpose, by Faculty, and registration of students by Faculty. Supplementary data identifying Faculty contributions to teaching the liberal arts programme are also collected.

Table 1. Summary of University Expenditures

	Yen (millions)					
	Consumables	Employment	Operation & Maintenance	External Funds	Totals	%
Faculties	2,699	16,760	1,058	2,231	22,748	75.2
Centres & Institutes	850	478	253	206	1,788	5.9
Academic services	601	571	119	19	1,310	4.3
Academic Facilities	158	236	9	58	461	1.5
Central Administration	898	2,783	254	23	3,958	13.1
Totals	5,206	20,829	1,692	2,538	30,264	100.0
%	17.2	68.8	5.6	8.4	100	

Note. Excludes schools and hospitals

Table 2. Academic Staff and Students.

	Academic Staff			Students Under-graduates (UG)	Masters	Doctors	Student/ Staff Ratio UG/PAP
	Professors & Assoc Professors (PAP)	Lecturers	Research Associates				
Faculties							
Integrated Arts & Sciences	153	1	14	610			4.0
Letters	52		6	632	132	122	12.2
Education	180	16	12	2,184	413	209	12.1
Social Science	67	5	3	1,895	224	163	28.3
Science	95	3	51	1,064	271	148	11.2
Biomedicine	141	33	122	1,821	214	680	12.9
Engineering	122	1	74	2,353	597	142	19.3
Applied Bioscience	61	1	7	459	261	142	7.5
Advanced Science of Materials	36		21		210	80	
International Development Studies	22		5		143	90	
Law School	16				113		
Centres and Institutes	82	7	31				
Others	23		23				
Total	1,050	67	369	11,018	2,578	1,776	10.5

Table 3. Use-of-Time Survey

Faculty	Proportion of Time over whole Year			
	Teaching	Research	Administration	Other
Integrated Arts and Sciences	28%	49%	16%	8%
Letters	24%	56%	11%	9%
Education	35%	46%	12%	6%
Social Science	24%	56%	11%	9%
Science	16%	53%	21%	10%
Biomedicine	18%	46%	14%	22%
Engineering	18%	57%	13%	12%
Applied Bioscience	18%	61%	9%	12%
Advanced Science of Materials	18%	60%	10%	12%
International Development Studies	24%	56%	11%	9%
Weighted mean values	22%	54%	13%	10%

Note. Indicated proportions are weighted means of responses for time used during periods of scheduled teaching and for the rest of the year by professors and associate professors.

Two studies of use-of-time in the university from surveys by questionnaire are available. The more recent (2000) had the higher response rate and appears to be statistically the more reliable. However, the older survey (Morgan, 1999) presents the data in a form more suited to analytical purposes (Table 3). By separating the responses of professors and associate professors (PAP) from those of other academic staff, by separately surveying the uses of time during periods of scheduled teaching and non-teaching periods (vacations), and by specifically identifying time devoted to teaching, research, administration, and service work, it presents data in a form directly applicable to analysis. Moreover, while the differing technical and structural designs of the two surveys prevent detailed comparison, their results generally - and particularly those for time devoted to teaching and research - are similar. Accordingly, although there have certainly been changes in the uses of time over the past 7 years, the data from the earlier survey were used in attributing costs. A new survey is now clearly desirable and would provide a useful tool.

Analytical Methods: Assumptions and Procedures

The available data provide information on the expenditure of resources - money and time - in fulfilling the academic and social obligations of the university. Identification of the elements that combine to yield these results is the purpose of analysis.

Faculties¹

Expenditure by Faculties, which accounts for 75% of total expenditure, analysed in terms of teaching, research, administration and social service provides the key step. Within the Faculties the central component is academic staff. Academic staff determine activity in all four areas and they also account directly for more than half of all Faculty expenditures.

It is taken for granted that distribution of expenditure on academic staff follows the use of professorial (PAP) time between teaching, research, administration and social service as indicated in Table 4. A major simplifying assumption is then made, that distribution of the other unallocated Faculty expenditures follows the same pattern. This assumption is less heroic than might appear. Consumables, constituting 12% of Faculties' expenditure are allocated to teaching, research and administration in the University's accounts; and external funding (10%) is designated for research purposes. The residual major component is that of expenditure on assistant staff. The work of assistant staff is determined by academic load, and experience suggests that it follows closely the pattern of academic uses of time.

On this basis, Faculty expenditure can be distributed among teaching, research, administration, and community service. A second simplifying assumption is to identify Faculty-level administration as largely devoted to educational rather than research matters. Again, experience suggests that this reflects practice: Faculty affairs are dominated by undergraduate and postgraduate courses, enrolments, examinations, and related business such as faculty development (FD); research and social service, while demanding much

individual professorial time, figure only marginally in Faculty administration. On average, Faculty administration accounts for some 12% of Faculty expenditure, so error in attributing it all to teaching is unlikely to be large.

Teaching

After identifying the total expenditure in each Faculty designated for teaching, it is necessary to consider how this is distributed between the various courses. The data identify the numbers of courses taught and of students enrolled in courses in each Faculty and in each of four categories: liberal arts, undergraduate, masters, and doctors.²⁾ It is assumed that expenditures on consumables and on operations and maintenance within the total provision for teaching are distributed among the courses in proportion to student numbers. Similarly it is assumed that academic staff and assistant staff expenditures within teaching provision are distributed in proportion to the number of courses taught at each level. Both of these assumptions appear to be rational. They allow the average expenditure on courses in each category for each Faculty to be estimated. Further, the average expenditure on teaching *per* PAP and the average formal 'contact time' for each PAP is identified for each Faculty.

To establish expenditure on teaching *per* student it is necessary to include data on courses taken in Faculties other than that in which the student is registered; and on courses at levels other than that for which a student is registered. A major source of the former is the requirement for undergraduate students to take specified numbers of liberal arts courses, many of which are provided by the Faculty of Integrated Arts and Sciences and include smaller language classes and larger classes in more general topics; in addition many undergraduate students take courses provided by other Faculties. In the second category, doctoral students regularly take courses formally designated as masters' courses. The available data allow estimation of the consequent variations in costs. In combination with the somewhat variable Faculty requirements for 'credits', these enable estimates to be made of the average costs of teaching students in different Faculties and at different levels (Table 8).

Research

In allocating research expenditure the complexities encountered in distribution of costs in teaching between courses at different levels do not arise. Two other complicating factors do exist: allocation of expenditure among different categories of research workers, and costs of supervision and research training of graduate students.

Four categories of research workers can be identified within Faculties: professors and lecturers (PAPL), research fellows, masters' students and doctoral students. With rare exceptions all of these are less than full-time researchers. Academic staff (PAPL) spend about half their time on research (Table 3); from the use-of-time survey and anecdotal comment, it appears that on average about one-quarter of the time of research fellows is spent on teaching; a requirement to obtain 30 'credits' over two years implies that masters'

students are regarded as half-time research workers; and similarly, doctoral students, requiring 20 'credits' over three years, are seen essentially as 0.78 full-time equivalent (fte) research workers. Accordingly, allocation of research expenditure for each Faculty is done on the basis of the proportions of fte research workers represented by the four categories (Table 9). The implicit assumptions - that the apparent weightings are appropriate and that the inherent abilities of the four categories to incur expenditure are equal - will limit the reliability of the distribution.

A large number of graduate courses is provided in each Faculty. Even so, inspection of the numbers of students enrolled indicates that a substantial number of the courses are offered on a 2-year cycle for masters' and a 3-year cycle for doctoral students. While these courses satisfy a large part of the formal requirements, graduate students also obtain 'credit' from research supervisions. In laboratory disciplines supervisions may take the form of research group meetings; in the literary disciplines there may be smaller individual meetings. The supervisions also imply costs: it is assumed that they can be regarded as equivalent to one course (*i.e.* 2 credits) *per* year. By professors, the supervisions may well be regarded as part of the collaborative research programme; for students they represent research training. Costs, identified as part of the research component in terms of professorial time are reflected as research training expenditures *per* student on the basis of graduate student/PAP ratios (Table 14).

Community Service

Activities other than the key academic functions constitute a significant use of professorial time and consequently of expenditure. Distribution of these costs within Faculty cost centres presents no obvious problem: the work is almost exclusively attributable to academic staff with the essential support of assistant staff. Analysing the form of this work is far more complex. It includes non-degree teaching, advice and consultancy, clinical work in hospitals and elsewhere, involvement in work for professional organisations, and community social work. Only a limited range of activity is quantified, notably non-degree teaching: some 540 courses (with a total student load of 1500) are recorded, almost half of them in the GS of Education; a high level of time devoted to clinical work is shown for the GS of Biomedicine and generally for work for the professions and the community (Morgan, 1999). For analytical purposes, no attempt has been made to sub-divide the expenditures beyond professorial (PAP) unit costs.

Research Centres and Institutes

In total there are some two-dozen centres and institutes in the university. For the analysis, not all are placed in this designated category. Three have been included with Faculties as they make explicit contributions to Faculty teaching; others are dealt with as Academic Services and Facilities (below); and for convenience, two are grouped with an element of Central Administration as providers of community services. The remaining ten are identified as Research Centres and Institutes.

None of these has explicit teaching responsibilities or substantial educational expenditures; none has

registered undergraduate or graduate students though their academic staff do make limited contributions to teaching. Accordingly their expenditures, largely identified as research, yield values for unit professorial research costs only (Table 10).³⁾

Central Academic Services and Academic Facilities

These two groups are treated together as they provide services and facilities for the whole university. There are two major centres of academic services, the Information Media Centre (computing) and the Library; a third contributor is the University Archive. Substantial facilities are provided by the Health Service, the International Student Centre, and the Centre for Promotion of Intellectual Property; smaller expenditures are incurred by a Beijing research centre and a regional Seminar House. An arbitrary decision has identified some managerial activities as Academic Facilities. These include the substantial expenditures of the President's Office and the Board and of the Audit and Medical Policy Offices: all of these clearly contribute to the whole community of the University. The role and contribution of the Centre for Promotion of Intellectual Property is more limited but for convenience it is also included here.

Some teaching is provided by the Services and Facilities, though apart from small contributions to the liberal arts programme this is not scheduled. In the university accounts, though some expenditure by the Academic Services is identified as teaching and research, this is likely to be a nominal assignment. For analytical purposes, the combined expenditures are treated as distributable on a *per capita* basis over the whole academic community (*i.e.* academic staff and students).

Central Administration

The remaining functions of the Central Administration are located in six Offices. Of these, five are essentially committed to serving teaching and research: Education, Academic, Information Policy, Finance, and Personnel & General Affairs. The sixth is the Community Collaboration Office, which with the Community Cooperation Centre and the Collaborative Research Centre provide a central university contribution to community service.

Identification of the expenditures in terms of teaching and research for two of the five principal Offices is clear: the Education Office and the Finance Office provide services primarily to teaching and to research respectively. The three other Offices contribute significantly to both functions. An arbitrary division has been made assigning their expenditures equally to teaching and research (Table 10).

Results and Discussion

In recent years many studies of university costs have been made by methods developed for multi-product organizations. These methods have the advantages of enabling results to be obtained for a large set of institutions by using a limited amount of data from each of them. For universities, the data have typically

been proxies for total costs and total outputs in terms of graduates and research; the proxies have been input measures, numbers of students and amounts of funding. The results have provided estimates of average unit costs for teaching and research across the data set (Cohn *et al.*, 1989). Not all systems have proved amenable to more than limited basic analysis by this method (Morgan *et al.* 2005).

An alternative approach is provided by detailed analysis of the resources, time and money, expended on the academic and other activities of an individual university. This has important advantages: it uses outputs rather than inputs as measures of activity and is capable of providing detailed estimates of the variations in resources employed across diverse academic disciplines. While this information is in a form suitable for institutional review and planning it comes at a cost. It requires extensive and detailed data on expenditures, use of time, and student and staff loads in the various disciplines and at the various levels. Moreover, analysis of these data require either explicit information on how the resources are employed or assumptions that are both rational and credible (see *e.g.* O'Neil, 1971; Verry and Davies, 1976). The method employed here reduces the burden of collecting data for individual activity by substituting averages at the levels of Faculty and Central facilities, services and administration.

The most prominent analytical results are commonly expressed as unit costs, that is, expenditure of money or time by or for the activities of an average person, course of study or research programme. Most familiar are results expressed in unit costs *per* student, largely because student numbers frequently determine funding. For planning purposes this is important; but of at least equal importance to a university are unit

Table 4. Unit Professorial Expenditures

Faculty	Total	Expenditures				TOTAL Excluding Academic Employment
		Academic Employment Expenditures (PAP)	Teaching	Research	excluding Academic Employment Community Service	
Int. Arts & Sciences	16.19	11.93	2.01	2.09	0.16	4.26
Letters	16.88	12.91	1.32	2.45	0.20	3.98
Education	18.27	12.98	1.77	3.39	0.09	5.25
Social Science	16.80	12.20	2.08	2.29	0.22	4.60
Science	24.18	15.62	2.49	5.63	0.44	8.56
Biomedicine	41.77	25.22	3.71	11.49	1.36	16.55
Engineering	26.81	16.25	2.48	7.60	0.47	10.56
App.Bioscience	25.87	12.56	3.63	9.00	0.68	13.31
Adv. Science of Materials	29.11	15.52	2.37	10.64	0.57	13.59
Int. Dev.Studies	23.11	13.98	3.12	5.60	0.41	9.13
Law School	19.91	12.94	3.15	3.39	0.44	6.98
Res.Centres & Institutes	68.75	15.35	0.00	53.41	0.00	53.41
Univ Services, Facilities & Admin	5.14					4.64

Yen million

Note. Figures do not include external funding.

costs *per professor*. This arises not merely from the historic view of university structure, derived from von Humboldt - and at least until recently still evident in the funding of German and Japanese universities; it also corresponds to resources over which the university exercises full control, unlike variable student numbers and preferences.

Overall professorial unit costs are shown in Table 4. The range of costs is wide, even when the figures for Research Centres and Institutes are excluded. In part this is due to differences in professorial employment costs between the Faculties. While this in itself may be a source of fascinating speculation, comparison of figures excluding these expenditures is more revealing. Excluding academic employment costs, Faculty expenditures are distributed approximately two-thirds on research, slightly less than one-third on teaching, and one-twentieth on community service: this reflects the pattern shown in the use-of-time survey.

Faculties.

Teaching

Teaching provides courses in four different categories: liberal arts, undergraduate, masters, and doctoral. Both the total numbers of courses and their distribution among these levels vary (Table 5). The Graduate School of Education teaches by far the largest number of courses. With the exception of the atypical Faculty of Integrated Arts & Sciences, which is responsible for a large majority of liberal arts courses, all other Faculties teach a larger number of graduate courses than undergraduate courses. The average number of courses taught *per professor* also varies, with the laboratory Faculties generally offering fewer courses. There is little correlation between time devoted to teaching as reported in the survey and contact hours as indicated by the average number of courses taught: many other activities are involved in total teaching time.

Table 5. Numbers of Courses Taught by Faculty and Level

	Total Number of Courses	Distribution of Courses by Level				Number of courses <i>per PAP</i>
		Liberal Arts	UG	Masters	Doctors	
Int. Arts & Science Letters	1,603	72%	25%	3%		10.5
Education	1,055	2%	46%	45%	7%	20.3
Social Science	2,612	1%	47%	43%	9%	14.5
Science	930	5%	42%	42%	11%	13.9
Biomedicine	1,159	5%	36%	50%	9%	12.2
Engineering	1,172	1%	45%	16%	38%	8.3
App. Bioscience	928	5%	47%	40%	8%	7.6
Adv.Sci. Materials	499	9%	29%	54%	8%	8.2
Int.Dev. Studies	301	1%		69%	30%	8.4
Law School	252	10%		74%	17%	11.5
	62			100%		

The proportion of Faculty expenditure attributed to teaching largely conforms to the results of the use-of-time surveys. The results of the two available surveys are similar and indeed are similar to results reported for the National Universities generally. The GS of Science provides an exception, showing quite large differences between the two surveys and differing also from data for other laboratory-based Faculties (Table 3). To examine the effects of this probable discrepancy, a set of calculations for GS Science was performed by replacing its reported uses of time with the average values for the university. The results for expenditure on teaching change by less than 3% (largely because of internal compensation between the proportions for 'teaching' and 'administration').

Expenditure on teaching courses shows a consistent pattern across all faculties: expenditure *per* course diminishes in the sequence liberal arts > undergraduates > masters > doctors (Table 6). This arises from the differences in the average sizes of classes at the four levels and reflects the assumption that student numbers determine expenditures on consumables, and operational & maintenance costs. A clear difference is also revealed between the costs of teaching in the laboratory and literary Faculties.

Table 6. Average Course Expenditure by Faculty and Level

	Average Faculty Expenditure <i>per</i> Course		Relative Expenditure on Courses by Level			
	(employment costs PAP included excluded)		Liberal Arts	UG	Masters	Doctors
	Yen (000)	Yen (000)				
Int. Arts & Science Letters	696	192	1.06	1	0.88	
Education	305	66	1.7	1	0.93	0.92
Social Science	544	122	1.29	1	0.83	0.78
Science	453	150	1.19	1	0.68	0.66
Biomedicine	678	204	1.46	1	0.83	0.78
Engineering	1,309	446	1.38	1	0.73	0.7
App.Bioscience	989	326	1.13	1	0.82	0.76
Adv. Sci.Materials	858	442	1.68	1	0.64	0.58
Int. Dev. Studies	803	282	3.52	0.81	1	0.81
Law School	699	271	2.48		1	0.91
	2,170	813			1	

When the analysis is extended to student level, dramatic differences become evident. Average class sizes (Table 7) differ widely between Faculties and between the courses. These differences do not conform to the distinction between laboratory and literary Faculties: undergraduate classes in the Graduate Schools of Engineering and Social Sciences are of average sizes twice as large as those in Science and Education and four times larger than those in Letters. Classes for graduate students are far smaller than those for undergraduates: four to ten times smaller for masters' students, ten to fifty times smaller for doctoral students. Neither the undergraduate nor graduate nominal student: staff ratios offer any quantitative guide to

these differences. Mirror images of the same effects are evident in the corresponding unit costs per student (Table 8). The small average numbers of students registered for each graduate course raise the student unit costs for these courses. In the Graduate School of Engineering, expenditure on a student enrolled in a doctoral course is more than 16-times that for an undergraduate student.

Table 7. Average Numbers of Students per Class by Faculty and Level

	Average UG Class Size*	Relative Numbers of Students <i>per Class</i>			
		Liberal Arts	Under- graduate	Masters	Doctors
Int. Arts & Sciences	18.9	2.82	1.00	0.09	
Letters	14.0	5.09	1.00	0.20	0.15
Education	34.2	2.37	1.00	0.13	0.07
Social Science	59.3	1.45	1.00	0.07	0.03
Science	28.3	3.30	1.00	0.22	0.09
Biomedicine	42.9	2.17	1.00	0.18	0.11
Engineering	65.9	1.58	1.00	0.26	0.02
App. Bioscience	38.5	2.42	1.00	0.20	0.05
Adv. Sci. Materials	8.3	11.11	0.60	1.00	0.19
Int. Dev. Studies	6.0	12.39		1.00	0.29
Law School	27.8			1.00	

Note. For GS Adv.Sci.Mat, Ind.Dev.Stud. and the Law School the average number is for masters courses

Table 8. Average Expenditure on Courses per Student by Faculty and Level

	Cost of Average UG Course per Student* (Yen)	Relative Costs of Courses within Faculties			
		Liberal Arts	<i>per Student</i> Under- graduate	Masters	Doctors
Int. Arts & Science	34,570	0.37	1.00	10.40	
Letters	22,800	0.32	1.00	4.42	6.12
Education	17,500	0.54	1.00	6.15	11.32
Social Science	9,140	0.83	1.00	9.16	21.84
Science	26,020	0.44	1.00	3.88	8.58
Biomedicine	35,890	0.63	1.00	3.41	6.22
Engineering	16,430	0.71	1.00	3.06	41.96
App. Bioscience	26,840	0.68	1.00	3.14	12.22
Adv. Sci. Materials	100,800	0.31	1.34	1.00	4.16
Int.Dev.Studies	103,260	0.20		1.00	3.07
Law School	78,070			1.00	

*For GS Adv.Sci.Mat., Int.Dev.Stud., and the Law School, the average cost is for masters courses.

Research

As elsewhere in the University, expenditure on employment constitutes the major component but, particularly in high-cost areas, consumables represent an increased proportion. In laboratory subjects

consumables account for about half of all Faculty research expenditures. This emphasises the importance of external research funding. Accordingly, external funds, now greater than those provided as grants-in-aid, are included as a component of Faculty research funds in the analysis (Table 9).

Even so, employment expenditures remain an important element. In contrast to expenditure on teaching, expenditure on employment affects only a small proportion of active research workers. Academic staff - professors, lecturers and research fellows - constitute substantially less than a quarter of those who are active in research in the Faculties. The large majority of research workers is comprised of graduate students; coupling their numbers with the time they are able nominally to devote to research (masters students, 0.5 fte, doctoral students, 0.78 fte) indicates that they can be identified as directly responsible for two-thirds of expenditure on consumables. Inevitably, this significantly modifies the role of graduate students in their research work with respect to that in their taught courses.

Faculty research expenditures on a *per capita* basis are shown in Table 9. The figures clearly correspond to the conventional description of laboratory subjects as 'expensive,' though those for the average expenditures of the GS of Biomedicine do not identify this Faculty as obviously 'very expensive.' In contrast, the high expenditures for the GS of Education are not what would be expected for a discipline that is categorized as a social science in higher education systems in many countries, nor are they attributable to its ability to attract high levels of external funding. Overall, the high expenditures of doctoral students relative to masters' students, though intuitively appropriate, occur entirely from the greater proportion of their time devoted to research.

Research Institutes and Centres

Although the total expenditure on Institutes and Centres is small compared with that on the Faculties (Table 1), they contribute significantly to research productivity, prestige and costs. The data in Table 10 are restricted to the largest of them but include also some that for analytical purposes have been arbitrarily classified elsewhere: the Research Institute for Radiation Biology and Medicine (RIRBM) has been included in the analysis of expenditures of the GS of Biomedicine, for which it performs some teaching; and the Collaborative Research Centre is included for convenience with the University's Community Service provisions. For comparison, two teaching entities, which have no registered research students, are also included in the Table.

Both total research income and expenditure *per* professor are substantially greater in the Institutes and Centres than in the Faculties (*cf* Table 9). This identifies two aspects of their structures. First, they have few teaching responsibilities, although in the use-of-time surveys their professors identify significant time spent on teaching it is by no means clear where this takes place. Second, while their resources and facilities are committed to research, their contributions to research training are far from explicit: in particular, there is no indication of the numbers of graduate students engaged in work in the Institutes and Centres. In financial terms this makes it difficult to establish how their research expenditures are distributed; in operational terms it

Table 9. Research Funds and Expenditures by Graduate School and Category of Research Worker

Graduate Schools	Total Research Expenditure		Total Research Funds		Average Expenditure per capita less employment costs			
	per PAP	Yen (millions)	per PAP	Yen (millions)	PAPL*	Research Fellows	Masters Students	Doctors Students
Letters	9.40	1.02	1,196	262	174	272		
Education	9.94	0.99	1,165	697	465	725		
Social Science	9.17	0.76	329	201	134	209		
Science	15.70	4.74	2,294	1,204	803	1,253		
Biomedicine	21.12	6.64	2,323	1,049	1,049	1,637		
Engineering	16.86	4.80	2,189	1,004	670	1,045		
Applied Bioscience	16.66	5.28	3,394	982	654	1,022		
Advanced Science of Materials	19.96	7.48	2,288	923	615	960		
International Development Studies	13.43	2.92	2,446	352	235	366		

* Professors, Associate Professors and Lecturers

Table 10. Research Expenditures of selected Research Centres and Institutes

Research Centres and Institutes	Research Expenditure			Research Income		
	Total	Research Expenditure per PAP	Research Expenditure less employment per PAP	Total	Research Income per PAP	Research Income less employment per PAP
Research Institute for Radiation Biology and Medicine	893.19	42.53	18.31	12.92	96.35	23.22
Synchrotron Radiation Centre	627.01	125.40	110.29	34.54	33.94	15.49
Natural Science Centre	485.91	69.42	51.72	4.88	1.09	0.34
Research Centre for Nanodevices	417.60	59.66	48.16	33.94	33.94	15.49
Collaborative Research Centre	196.05	49.01	37.01	4.88	1.09	0.34
Centre for International Cooperation in Education	100.85	33.62	19.44	4.88	1.09	0.34
Institute for Waste Water Treatment	94.18	94.18	56.24	4.88	1.09	0.34
Faculty of Integrated Arts and Science	1113.04	7.27	1.57	1.09	1.09	0.34
Law School	160.00	10.00	3.39	0.34	0.34	0.34

Note. Figures in these Tables include external funding.

is equally difficult to perceive how, with their small staffs, the research work is performed.

The ability to obtain competitive research funding by the Institutes and Centres is high: overall it amounts to almost half of their total costs. Inevitably this proportion is notably higher than is achieved in the Faculties. It is though at least arguable that explicit affiliations between Institutes and Faculties could yield mutual benefit.

Community Service

Discussions of the responsibilities of universities in serving the wider local and national communities frequently imply that this is a new and emergent function. It is true that demands on the university have increased, as has awareness of the scope of community service inside the university, but the performance of external commitments has been long established. Nationally, service to professional associations - for historians and sociologists as well as for dentists and engineers - and advice to governments have been long-standing requirements. And locally, support for the community embraces a wide variety of advisory, educational, clinical and social activities. Over a now lengthy period, requests for technical; and professional advice have grown. The estimated total of expenditures on these and related activities is significant, amounting to some 9% of total university expenditure. Demands that the levels of activity be extended carry significant costs.

Defining both the expenditure and the extent of current community service involves arbitrary assumptions. The attributed total of ¥2,644 million includes expenditure by the explicitly designated Community Cooperation centre (¥58.4 million), the Community Collaboration Office (¥164.7 million) and the Collaborative Research Centre (¥249.6 million). The vast majority (80%) though derives inevitably from the Faculties in accord with the professorial commitments identified in the use-of-time surveys: not unexpectedly, the GS of Biomedicine alone accounts for one-third of the total expenditure. It is indeed the professors who directly and individually provide most of the university contributions to community service. Undoubtedly, the Faculty estimates will include activities that extend the 'community' internationally and academically through international agencies, conferences and discussions. But equally it becomes increasingly difficult to distinguish services to organisations and consultancies from research commissions and collaboration. Moreover, initially philanthropic service may well develop into formal and funded research - indeed it may even be planned to do so. The notion of 'doing well by doing good' serves both the reputation and the academic achievement of the University.

There is though no quantitative basis for assessing the benefits. As funding constraints, awareness of intellectual property, full-cost recovery, and entrepreneurial initiatives evolve, the opportunities to contribute fully to community service may become difficult to sustain without more detailed accounting of the use of professorial time and university facilities.

Central University Facilities and Academic Services

These two areas of expenditures are similar in that their functions are undertaken on behalf of or are available to the whole academic community. They differ in the ways that they serve personal, academic and managerial needs essential to operation of the University. Together they account for some 7% of total university expenditure. Table 11 provides a summary of their expenditures.

To the extent that the functions do actually embrace the whole academic community, the expenditures can be distributed appropriately on a *per capita* basis. While Academic Services clearly meet this requirement, there could be some query in relation to the others. Thus, the International Student Centre could be viewed as serving only a small sub-set of the academic community: its major function is to provide language classes to overseas students and to all students within the liberal arts programme. Even so, the benefits do appear to be available to the whole community. More substantial doubts may attend the managerial Facilities. Use of the conventional alternative, of locating these as part of Administration expenses, would reinforce the fallacy that management is an administrative function. While management determines administration policy, it also determines academic policy. In practice as well as in principle, the functions of the President's Office and the Board affect all members of the academic community. Similarly, the Audit Office is an important tool in ensuring that academic as well as administrative policies are sound and effective.⁴⁾

It would be possible to consider distributing the expenditures on both Facilities and Academic Services differentially according to the various demands of the components of the academic community: academic disciplines, research/teaching, academic staff/students. While this might be useful in identifying charges for external users, no adequate data for such differentials exist. Accordingly, a simple *per capita* figure is used for the whole academic community as indicated in Table 11.

Table 11. Central Academic Services and University Facilities

	Academic Services	University Facilities (personal)	Yen (millions) University Facilities (management)
University Library	562.93		
Information Media Centre	723.87		
University Archives	23.00		
International Student Centre		123.04	
Health Service Centre		154.07	
Centre for Intellectual Property			163.75
President's Office & Board			145.21
Audit Office			64.91
Medical Policy Office			71.15
Others			20.50
Totals	1309.80	277.11	465.52
Expenditure per capita			
Professors & Associate Professors	1.247	0.264	0.443
Students	0.086	0.018	0.031
Academic Community	0.078	0.016	0.028

Central Administration

The five major Offices in the Central Administration are responsible for some 12% of total University expenditures. The activities of the Offices constitute an integral part of the academic work of the University, both teaching and research⁵⁾. It is therefore important to estimate how these expenditures relate to the academic functions. This presents two problems: first, estimating the amounts of administrative expenditure due to the separable teaching and research activities; and second, identifying how these expenditures relate to the differing quantities of these activities in the academic areas.

There is little information on how the work of the Central Administration is structured. No use-of-time study has revealed the relative demands made by teaching and research. In the absence of any explicit guidance, some simple but crude assumptions have been made. It is assumed that the work in the Education Office is predominantly focussed on teaching; and in the Finance Office on the multiplicity of accounts associated with research funding. Elsewhere, in the Academic, Information, and Personnel & General Offices, it is assumed that teaching and research impose similar demands. On this basis, a rough estimate of the expenditure between teaching and research can be made (Table 12). The errors in this will undoubtedly be large; but in total the errors are unlikely to exceed +/- 3% of attributed expenditures at Faculty or student level.

Table 12. Central Administration Expenditures

Offices	Consumables, Operations, Maintenance	Employment	Total Expenditures	Yen (millions) Distribution	
				Teaching	Research
Education Office	274.20	446.45	720.65	720.65	
Academic Office	118.10	778.38	896.48	448.24	448.24
Information Policy Office	213.57	123.10	336.67	168.34	168.34
Finance Office	365.18	790.48	1115.66		1115.66
Personnel & General Affairs Office	122.52	379.61	502.12	251.06	251.06
Totals	1093.57	2518.02	3571.58	1588.29	1983.30
Expenditure per PAP			3.40	1.51	1.89
Expenditure per fte Student				0.126	
Administration Expenditure per Yen of					
	Total Research Funds expenditure				¥ 0.29
	External Research Funds expenditure				¥ 0.15

Note. Figures are adjusted to allow for Central Administration contributions to hospitals, schools and other activities.

In principle, identifying how these Administration expenditures are to be related to Faculty and student academic programmes presents similar problems. In practice, at least superficially rational bases exist for both teaching and research. For teaching, the expenditures can be linked to the academic loads of their course

requirements. On the assumption that the administrative burden is similar for all Faculties, the academic teaching loads lie in the ratios of 1: 0.5: 0.22 for undergraduate, masters and doctoral students respectively. When aggregated across the University, this identifies an expenditure of ¥126,000 for a full-time equivalent (fte) student (*i.e.* an undergraduate and proportionately less for masters and doctoral students). For research, the administrative expenditure might be distributed on the basis of numbers of research projects, but more accessible is the amount of Faculty research expenditure. Two figures for this are available: for total research funds (grants-in-aid, donations and contracts *etc.*); and for external funds only. The former can be seen as an appropriate indicator of the actual costs of research administration, while the latter offers a guide for an effective marginal cost of providing additional research contracts. The expenditure on research Administration on the basis of total research funding is then ¥0.29 *per* ¥1.0 of research expenditure.

Degree Programmes

By combining the estimates of Faculty and University expenditures identified in the preceding sections it is possible to derive figures for the average expenditures incurred annually in providing degree programmes. For undergraduates the expenditure is on liberal arts courses, Faculty courses, Central Facilities, Services and Administration; for graduate students the components are Faculty courses and research together with the appropriate Facilities, Services and Administration expenditures. The calculation is complicated by opportunities for students to select courses offered in Faculties other than those in which they are enrolled. The necessary data to accommodate this are available by using appropriately weighted average course expenditures from the other Faculties. No attempt is made to adjust the expenditure on liberal arts courses in this way: in principle it would be inappropriate, as the purpose is to provide an estimate of average expenditure; in practice the data are not available. A uniform figure is used, adjusted only to reflect differing Faculty requirements for the number of courses to be completed.

Table 13. Annual Average Expenditure on Undergraduate Students by Faculty

Faculty	Academic Expenditures			Central Expenditures (b)	Yen (thousands)	
	Faculty Courses	Liberal Arts (a)	Total		Total	Academic Expenditure %
Int Arts & Science	310	84	394	248	642	61.4
Letters	230	77	307	248	555	55.3
Education	181	74	255	248	503	50.7
Social Science	84	84	168	248	416	40.4
Science	251	72	323	248	571	56.6
Biomedicine	412	58	470	248	718	65.5
Engineering	153	80	233	248	481	48.4
App.BioScience	264	77	341	248	589	57.9

(a) Requirements for liberal arts courses vary between Faculties

(b) Facilities, ¥44,000; Services, ¥ 78,000, Administration, ¥126,000.

The results for undergraduates (Table 13) show annual expenditures for degree programmes that vary from about ¥400,000 to ¥700,000. The range lies somewhat lower than might have been expected. Similarly, the variations between Faculties differ from expectations. While programmes based in GS of Social Sciences are indeed the least expensive, and those in GS of Biomedicine the most expensive, in other Faculties the expenditures do not fall neatly between the literary and laboratory disciplines.⁶⁾

Expenditures in Letters are similar to those in Bioscience and Science, and expenditures in Education are greater than in Engineering. Of considerable interest also is the proportion of the total attributable to direct

Table 14. Annual Average Expenditures per Graduate Student by Faculty

Faculties	Masters' Students							Yen (thousands)	
	Courses	Academic Expenditures			Central and Administration Overhead Expenditures			Total	Academic Expenditure
		Supervision	Research	Total	Overheads				
					(teaching)(a)	(research)	Total		
Letters	625	66	174	865	185	42	227	1,092	79.2
Education	658	86	192	936	185	56	241	1,177	79.5
Social Science	553	37	134	724	185	28	213	937	77.3
Science	622	45	802	1,469	185	201	386	1,855	79.2
Biomedicine	864	104	1,049	2,017	185	277	462	2,479	81.4
Engineering	307	63	670	1,040	185	168	353	1,393	74.7
App. BioScience	512	47	655	1,214	185	165	350	1,564	77.6
Adv.Sci.	595	43	616	1,254	185	153	338	1,592	78.8
Materials									
Int Dev.Studies	627	25	235	887	185	60	245	1,132	78.4

(a) Facilities, ¥44,000; Services, ¥78,000; Administration (teaching, fte 0.5), ¥63,000.

Faculties	Doctoral Students							Total	Academic Expenditure %
	Courses	Academic Expenditures			Central and Administration Overhead Expenditures				
		Supervision	Research	Total	Overheads				
					Admin (teaching)(a)	Admin (research)	Total		
Letters	297	66	272	635	150	66	216	851	74.6
Education	463	86	725	1,274	150	89	239	1,513	84.2
Social Science	369	37	209	615	150	43	193	808	76.1
Science	503	46	1,253	1,802	150	313	463	2,265	79.6
Biomedicine	536	104	1,637	2,273	150	419	569	2,842	80.0
Engineering	1,407	63	1,045	2,515	150	265	415	2,930	85.8
App. BioScience	408	47	1,022	1,477	150	238	388	1,865	79.2
Adv. Sci.Materials	945	43	960	1,948	150	238	388	2,336	83.4
Int Dev. Studies	720	25	366	1,111	150	93	243	1,354	82.1

(a)Facilities, ¥44,000; Services, ¥78,000; Administration (teaching, fte 0.22), ¥ 28,000

teaching expenditures: this varies inversely with the total Faculty expenditure from as little as 40% in GS of Social Science to more than 67% in Biomedicine.

Expenditure on graduate degree programmes (Table 14) conforms more closely to expectations. Conventional wisdom holds that graduate study is more expensive than undergraduate, and this is confirmed. But the results provide only partial confirmation that doctoral programmes are more expensive than masters: the expectation is sustained only for doctoral programmes in the laboratory disciplines. As the conventional wisdom is based on the pattern of graduate programmes widely found in America and Europe, where fully taught masters' degrees dominate the academic schedules, the difference is perhaps not surprising. The expectation of high expenditures for graduate courses in the laboratory disciplines is confirmed, though the differences become clear only at doctoral level. University overheads for Facilities, Services and Administration are higher in the laboratory disciplines by virtue of their much greater research funding, but overall constitute a less variable and lower proportion (16% -25%) of total expenditure than in undergraduate programmes.

The ratio of expenditures for undergraduate, masters, and doctoral programmes vary from 1: 2: 2 in the literary Faculties to 1: 3: 4 in the laboratory Faculties; the GS of Engineering provides a striking exception with ratios 1: 2.9: 6.1 due to its relatively low number of doctoral students.

Comments and Conclusions

Two familiar generalisations determine the overall pattern of expenditures in the university: first, that the costs of academic employment dominate university finances; and second, that in Japan professors attach a high priority to research. One consequence is that nominal student/staff ratios remain low; another is that expenditure on teaching is also low. A less obvious development is the way in which provision of teaching is balanced between undergraduate and graduate courses. This may be a direct - and perhaps unintended - consequence of creating Graduate Schools. Their success in enhancing graduate education, linked as it is to research studies and funding, benefits from a professorial bias in favour of research. Provision of undergraduate courses by extending the responsibilities of the Graduate Schools may have suffered from this bias. The outcome is that with an overall ratio of undergraduate to graduate students of 2.6:1, relative expenditure on teaching undergraduate students appears to be low (*cf.* Bowen, 1980).

The appearance could deceive. The estimates of expenditure (Tables 8, 13, 14) assume similar resource implications for both undergraduate and graduate courses. It is possible that there are greater demands from the larger undergraduate classes, for example due to preparation of lectures, grading student work, tutorials and seminars, and examinations: these would increase their relative costs. There are though other factors that impose demands on graduate courses - frequent extension and renewal of material, lengthy formal and informal discussion. A lack of data precludes any rational basis for modification of the results.

The figures for expenditure *per* student entailed in providing degree programmes raise an interesting

issue. For undergraduate students, the estimated annual expenditures (Table 13) are close to the current level of the fees charged (*ca.* ¥500,000), and well above the direct expenditure on teaching. It appears that the use of the American term 'tuition fee' could be seen as inappropriate; the alternative European usage of 'student fee' might be preferable. The designation 'student fee' could pre-empt any argument that fees for graduate students should be increased in proportion to the relative expenditure on their courses, although cross-subsidy from undergraduate to graduate courses is well established in universities internationally (Clark,1995).

The ability to cross-subsidize teaching and research internally is a major benefit of block funding and corresponds to the way in which expenditures on all academic and administrative activities interact. The virtues of this flexibility may become evident in changes to the relative expenditures on graduate and undergraduate students in the future. Increased demands on the university from the so-called 'knowledge society' are likely to expand external research funding and to remedy the neglect by Japanese companies of the economic value of graduate students.^{7, 8)}

Growth of external funding for research and other purposes holds consequences for administrative as well as academic functions. As this source of funding increases it imposes greater costs on the Administration. What was once a trivial addition to the workload has become a substantial task. The additional administrative costs could be covered in one of two ways: they could be taken either from the block grant or by taxing the external funds. The former is an administratively simple bureaucratic but inequitable solution that may conform to managerial policy and appears to be current practice; the latter constitutes a transparent, appropriate but academically painful response. Either method impinges on academic expenditure. Tacit reduction of funds for academic infrastructure either selectively or generally should properly be regarded as inappropriate; moreover to do so ignores an essential requirement that such costs should be explicitly identified.

Grants, contracts and donations for specific purposes should be negotiated with clear recognition of the total institutional costs.⁹⁾ Experience shows that many professors, hitherto unaware of these costs, regard their inclusion as an administrative barrier to successful discussions with external organisations. Yet conversely, companies and businesses are well aware of the scale of organizational overheads that accompany all undertakings; government agencies tend to be less aware of such costs and more resistant to providing them. Unfortunately this adds to the problem: most external funding for contracts and collaborations in Japan is derived from government agencies (three-quarters for contracts and almost two-thirds overall). In other countries it has been helpful for universities jointly to negotiate with government to obtain an acceptable solution.

Consideration of overheads identifies a problem unique to a university in transition to a corporate organisation. Previously, as a bureaucratic institution, a principal role of the Administration was to ensure full observation of the requirements of the supervisory ministries. Now its essential purpose is to facilitate the academic work of the university. In the specific instance of overhead costs, a bureaucracy assumes that

these are to be covered by a 'top-cut' of available funds; in a corporate environment, overheads are regarded as a tax on production - they need to be justified and minimized. The current estimate of ¥0.29 per ¥1.0 of research funding for the costs of Central Administration ought to be subject to scrutiny by the Audit Office so that both sceptical professors internally and experienced directors externally can be convinced that the costs are justified.¹⁰⁾

More generally, similar scrutiny of administrative activities will form a continuing part of the regular duties of the Audit Office. If, as expected, further savings in University expenditures are required in academic areas, it needs to be evident that administrative expenditures are tightly controlled.¹¹⁾ Equally it becomes part of planning for new developments that similarly careful study identifies the implicit costs, care not always apparent even in recent entrepreneurial decisions. Analysis of expenditures as reported here provides essential information for both academic and administrative plans. In addition to the data summarised in the tables, the analysis also provides access to a range of performance indicators that are regularly required by external bodies or are helpful in descriptions of university achievements. But to remain useful, the analysis needs to be revised and refined by incorporation of fuller and better data.

An obvious omission from the present study is consideration of capital expenditures. For a corporate body, investment of capital is a key component of planning, as is capital depreciation. Both of these, largely irrelevant for budgetary purposes in the past, may well become important issues for a corporatized university. More generally, improvement of the quality of the study could be achieved in a number of ways. A new use-of-time survey would appear to be justified by the rapid change in the university following incorporation; this could well be augmented by a limited 'diary' exercise.¹²⁾ Minor changes to the clarity and format of the data collected by the university would be useful; particularly valuable would be advice and comment from Faculties, Centres and Offices on the validity of the assumptions used. Extension of the analysis to other universities would provide not merely helpful information for planning elsewhere but also illuminate the way interaction between teaching, research and administration expenditures varies with different mixes of subjects and of levels of work.

This study has relied on contributions from many people. Takashi Hata has been an enthusiastic supporter and provider of both data and advice; Satomi Ito and Masayo Daikoku have enabled the author to comprehend the material; and students and members of the central administration have been generous with their comments and time. The errors, misconceptions and omissions that remain are entirely the fault of the author.

Notes

- 1) Academic work is organised through units variously designated as Faculties or Graduate Schools. For convenience, when describing these units collectively they are referred to as Faculties; where comments refer to specific units, the appropriate title of Graduate School (GS) or Faculty is employed. Since the

data used in this report were compiled, all the Faculties have become Graduate Schools.

- 2) For the purposes of this paper, a course comprises a series of 90 minute classes given each week throughout a semester. It contributes two credits to the requirements for a degree.
- 3) Two centres appear anomalous in committing a high proportion of their expenditure to administration.
- 4) In terms of identifying expenditure on degree courses, there is little difference between regarding this expenditure as due to a Facility or to Administration.
- 5) It is assumed that their contribution to Community Service is explicitly identified in the Community Collaboration Office.
- 6) The values quoted for GS of Biomedicine are for a weighted average of students studying 4-year and 6-year programmes. While the data distinguish between the numbers of students and courses for the two degree structures, they do not provide separate financial information for their expenditures.
- 7) The reluctance of Japanese companies to pay holders of advanced degrees more than the standard age-related salaries is changing as new pay structures are introduced. At present the trivial differentials paid to recruits with masters' and doctoral degrees lag well behind those provided in America and Europe. With increased competition for well qualified and valuable recruits, higher potential rewards will be required not just as a short-term effect in a growing economy but as a long-term response as international competition for skills intensifies. This in turn will encourage more students to seek graduate courses and enable the university to meet expanded demands for contracted research work.
- 8) Better awareness of the value of graduate study could result from recognition that 40% of the members of the boards of directors of the top 200 companies in Germany hold doctorates (Enders, 2006). This may contain messages for both companies and universities.
- 9) In principle, grants-in-aid should also be included in the arrangements. Provision for 'overheads' in JSPS grants-in-aid has been extended from 2007. It should be necessary that all applications for grants-in-aid include realistic estimates of the institutional overhead costs.
- 10) Full overhead costs for externally sponsored research will of course amount to substantially more than the Administrative overhead.
- 11) It is always easier to seek economies - and academic reform - in peripheral matters. A solemn campaign to economise by reducing heating costs addresses expenditure of the order of 0.2% of the total.
- 12) To be useful in analysis, the survey would need to obtain data covering the whole year, *i.e.* including both periods of scheduled teaching and the rest of the year. It could also be useful to seek more detailed data on time expended on community service and clinical activities.

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教育経済学（パート10）

—大学における経費の分析—

キース・J・モーガン*

国立大学における経費を分析するということは、大学及び大学院で実施される教育・研究に係る費用を特定する事を意味する。その経費は学部や大学院によって大きく異なり、また、その教育コストのかかる学科か、あるいはどのような教育段階（学部・大学院）かという一般的な認識と単純に一致しているわけではない。学部レベルでは、学生の教育に係る全体的な年間経費は40万～70万円となっている。一方、修士及び博士課程の学生の教育・研究に係る年間経費はそれぞれ、90～190万円、90～290万円となっている。これらの額には、大学全体として共通的にかかる経費（大学の管理的経費、各種サービス経費、施設設備関連経費）が含まれる。合算するとこれらの経費は、学部教育に係る費用全体の3分の1から2分の1に、また、大学院生の費用では、全体のおよそ5分の1を占めている。この他、研究に関する管理的経費は、研究費に当てられる全経費の29パーセントに相当している。

*広島大学高等教育研究開発センター客員教授（平成19年9～12月在職）
ランカスター大学（英）・ニューカッスル大学（豪）名誉教授