THE AUSTRALIAN NATIONAL UNIVERSITY
Centre for Economic Policy Research

DISCUSSION PAPERS

Paper 1:
POLICY PERSPECTIVES ON HIGHER EDUCATION
FINANCING: A COMPREHENSIVE PROGRAM OF
NATIONAL SCHOLARSHIPS
Peter Karmel

Paper 2:
COST FUNCTIONS FOR AUSTRALIAN UNIVERSITIES:
A SURVEY OF RESULTS WITH IMPLICATIONS
FOR POLICY
Chris Heaton and David Throsby

DISCUSSION PAPER NO. 360
February 1997

Canberra ACT 0200, Australia
Centre For Economic Policy Research

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Paper 1:
POLICY PERSPECTIVES ON HIGHER EDUCATION FINANCING:
A COMPREHENSIVE PROGRAM OF NATIONAL SCHOLARSHIPS*

Peter Karmel
Australian National University

Paper 2:
COST FUNCTIONS FOR AUSTRALIAN UNIVERSITIES:
A SURVEY OF RESULTS WITH IMPLICATIONS FOR POLICY**

Chris Heaton and David Throsby
Macquarie University

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*Peter Karmel*

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POLICY PERSPECTIVES ON HIGHER EDUCATION FINANCING

A Comprehensive Program of National Scholarships

PETER KARMEL

Over the past decade, higher education has undergone a massive expansion. Student numbers rose from 394,000 in 1987 to 631,000 in 1996 - an increase of 60 per cent, while the number of government funded institutions with the status of "university" increased from 19 to 36. As a result of this growth, and the way in which it has taken place, attention needs to be given to a whole range of issues. These include:

Scale of higher education: What proportion of the age cohort should be entitled to enrol in government-supported university places?

And of that proportion what fraction should be able to proceed to government-supported post graduate education?

If the current levels of participation in higher education are judged to be too great, in what manner should the system be scaled back?

Funding: What is the appropriate division of funding responsibility for university teaching between the students, as the private beneficiaries of university education, and the Government, in respect of the social benefits?

Should government funding be provided directly to institutions or through students by way of awards or scholarships?

How should the Government and the universities cope with the recurring problems of adjustments to salary scales?

University/government relations: Should institutions deal directly with the Minister and the Department or should there be a statutory body to act as a buffer between the institutions and the Government?

Should universities pursue centrally-determined national priorities or should they pursue their own priorities?

If universities are to pursue a mixture of their own and national priorities, what is the appropriate balance and how should it be achieved?

*This paper is based on one presented to a conference organized by the Centre for Economic Policy Research, The Australian National University, 25 June 1996. I wish to acknowledge the role of Mr R. H. Arthur in the development of the ideas in it and his assistance in spelling out details.
Research: What is the appropriate balance in Government funding between teaching and research, both in the system as a whole and in individual institutions?

Within the total of research funding, what is the appropriate balance between the support of research infrastructure, in the form of physical resources and personnel, and competitive research funding?

Should research funding be spread throughout the system or should it (and research training) be concentrated, perhaps on a disciplinary basis, in a lesser number of institutions?

Diversity: Should diversity in the missions, values, goals and strategies of universities be promoted? And if so, how?

Quality: How should quality in higher education be defined? What measures should be taken to enhance and monitor quality in universities?

Higher education and vocational education and training Should the different modes of funding of, and access to, higher education and vocational education and training be maintained or should post-school education be approached in a more holistic manner?

This paper outlines an approach to the funding of universities for their teaching activities through a comprehensive program of national scholarships. Such a program would involve the universities in receiving government funds through the funding of students rather than through direct government grants to institutions. It would contribute to the resolution of many of the issues set out above.

NUMBER OF SCHOLARSHIPS

Scholarships should be available to students commencing higher education for the first time.

The number of scholarships could be related to the proportion of a cohort that is deemed appropriate for entry to higher education. For example, between 1989 and 1994 the number of Australian students enrolling for the first time hovered around 100,000. More recently the figure has risen to about 110,000. This number constitutes about 40 per cent of a cohort: i.e., at current levels of access, 40 per cent of people enrol in higher education either shortly after leaving school or at some time later in their lives—of the 40 per cent about 70 per cent enrol within several years of completing school.

Alternatively, the number of scholarships might be determined in relation to students' tertiary entry (TE) scores. For example, scholarships could be provided for all those wishing to enter higher education with TE scores at or above, say, the 50th percentile, with an appropriate provision for mature-age students.
Access to higher education is reflected in the number of students enrolling in higher education for the first time. Thus access could be maintained, expanded or reduced by modifying appropriately the number of scholarships. The accompanying expansion or contraction of individual institutions would reflect student demand.

**AWARD OF SCHOLARSHIPS**

Suppose the number of scholarships was to be 110,000. How might those be awarded?

About 70 per cent of new students enrol shortly after, or within several years of, leaving school on the basis of their tertiary entrance results. Tertiary entrance is currently administered on a State basis, but from 1997 there is a capacity to convert State and Territory rankings to a national standard which could be used to allocate national scholarships. Thus some 75,000 to 80,000 of the 110,000 scholarships could be allocated to students who wish to enrol in a university course in accordance with the national rank order of their TE results. This has the incidental advantage of allocating places among States and Territories on a fair basis (i.e., in accordance with student demand) without the involvement of politics of the kind seen in recent years in the arguments over State participation rates in higher education.

The other 30,000 or so places would be available for mature-age or special entries. A portion of these could be allocated nationally on the basis of candidates’ results in the Special Tertiary Admissions Test. The STAT is a test, administered by the Australian Council for Educational Research, which is already widely used for admitting mature age entrants.

The remaining scholarships might be allocated direct to universities for award to special cases or to meet regional needs.

**TENURE OF SCHOLARSHIPS**

The scholarships should be for a limited tenure, say, for a maximum of five or six years of successful full-time university study or the equivalent of part-time study. Beyond these, students would be expected to pay for their studies. Six years would cover all bachelor degrees (including double degrees and most graduate study); five years would be less generous but would cover all bachelor degrees (including some double degrees and some graduate study) except medicine.

**VALUE OF SCHOLARSHIPS**

At present the government subsidy to higher education courses amounts to, on average, some 60 to 65 per cent of the cost of offering the courses - the balance being covered by the HECS arrangements. The average amount per enrolment involved is approximately $6,500 per equivalent full time student per annum. In valuing the scholarships, account would need to be taken of the differential costs of university courses in order to promote an efficient allocation of resources. According to the Relative Funding Formula, which was used to influence...
recurrent grants to the universities after 1990, the cost of undergraduate courses varies in the ratio of 1:2.7 from the least to the most expensive. It would be necessary for the Commonwealth Government to classify courses (or components of courses) into several categories according to cost. The value of a scholarship would vary according to the course (or components) in which a student enrolled, and at current cost levels would average about $6500, ranging from about $5000 to $13,500.

FEES
In an arrangement for scholarships of the kind outlined above, the individual universities should be free to determine tuition fees to be charged for their various courses (against which the scholarships would be an offset) and to admit full fee paying local students who have not received scholarships.

Fees might be expected to reflect relative costs of courses as do the values of the scholarships, although cross-subsidisation of less popular or more expensive courses would be for individual universities to determine.

The current HECS arrangements (which do not prejudice access and are equitable in their impact) should continue to stand for a level of fees at least up to a specified margin above the value of the scholarship - on the basis of current HECS arrangements this margin would be about 60 per cent. If an institution charged fees beyond this margin, the excess would need to be the student's responsibility, either to pay up-front or by way of a loan.

Students would apply for admission to institutions in exactly the same way as at present. Universities would decide which students would receive an offer of a place.

Full fee paying local students should be eligible to receive a later year scholarship on the basis of successful university performance.

TRANSITIONAL ARRANGEMENTS
Since scholarships would be awarded to students commencing higher education for the first time, it would take some years before university students in all years of their courses were covered by the new scholarship program. In the interim, either institutions would need to be directly funded by the Commonwealth for those students (within an approved student load) who were continuing their courses or continuing students would need to be provided, in the year in which the program was introduced, with transitional scholarships for the uncompleted years of their courses.

ADMINISTRATION
The program should be managed by an independent statutory body (a Higher Education Commission), with appropriate membership and an adequate staff and at arms length from the Government, to advise the Commonwealth Government on the number and value of
scholarships and on broad Government policies for higher education, and to report regularly on the condition of higher education in Australia. Given the nature of its responsibilities the Commission and its secretariat would not need to be large.

The number and value of the scholarships would require updating from time to time. Triennial revisions to numbers and the value of the scholarships would be appropriate. These would involve agreement between the Government and the universities through the Commission.

UNIVERSITY FUNDING

The universities would derive all their government funding for teaching, including funds to meet continuing capital needs (i.e. the capital roll-in), through the scholarships. The funding of research constitutes a separate issue.

The Government would need to continue direct funding of institutions for research by way of research quantum grants and other grants for research infrastructure. The Institute of Advanced Studies in The Australian National University would continue to require direct funding.

The question arises whether the balance of government funding for teaching and for research is appropriate, that is, whether the number and value of scholarships is appropriate in relation to the investment in research facilities in the institutions. There are also the issues relating to whether there ought to be concentration of research and research training in a limited number of universities, possibly on a disciplinary basis. The case for the concentration of research and research training (at least on a disciplinary basis), related to periodic evaluations of performance, is persuasive. The Higher Education Commission would be expected to advise on these matters.

Competitive research funding would be expected to continue under the aegis of the Australian Research Council and of the National Health and Medical Research Council. The balance between competitive funding and infrastructure funding would need to be kept under review.

New institutions might require special Commonwealth capital funds, although this could be left to State Governments or private initiatives.

Postgraduate awards for research would need to be administered separately from the national scholarship program.

AUSTUDY need not be affected.

ADVANTAGES

University/government relations

Higher education would be largely deregulated. Political and bureaucratic intervention would be greatly reduced as would bilateral dealing between institutions and government officials.
The grant assessment and profile negotiation functions of DEET would be removed; the number of enrolments would be a matter for each institution to determine. The universities would become patently responsible for their affairs; they would not be underwritten by the Government. The Commonwealth Government would not be directly involved in assessing/monitoring the quality of institutions, except, perhaps, in relation to research. There would be economies in public administration.

At the same time, the Commonwealth would be in a position to control its expenditure on higher education teaching through the three dimensions of the quantum, value and length of tenure of scholarships and through the conditions under which HECS operates. The Commonwealth could still influence the development of higher education through the quantum of scholarships and their value, and through the provision of capital to establish and foster new institutions. The quantum of scholarships and entry standards would be clearly linked. Governments could also influence access for special groups by the quantum and distribution of special scholarship schemes. It would remain open to the Commonwealth to provide funding to particular institutions for specific purposes under contractual arrangements.

Accountability would be assured through the statutory reporting requirements of the institutions and the periodic reports of the Higher Education Commission as well as through the market mechanisms provided by the scholarships program.

A comprehensive scholarship program of this kind would enable universities to set their own priorities rather than be required to conform to national priorities laid down centrally. Universities are involved in preparing students for a lifetime’s activities in a future which is unknown and uncertain. There is a powerful argument that the pluralist approach of institutions’ determining priorities in relation to their particular strengths and their perceptions of the future is more in the long term interests of society than forcing conformity to a single set of priorities laid down by the central government. It is a case of decentralised decision making versus central planning.

*Market orientation*

Higher education would become market oriented. Effective market orientation of the provision of higher education services would be introduced by empowering institutions to offer services at prices and in quantities determined by them having regard to costs, and by allowing students to weigh services offered against fees charged - a shift from a producer dominated system to a consumer sensitive market. The power of students as consumers would almost certainly lead to some reorientation of university priorities towards teaching and would impose a discipline that would promote the quality of the courses offered. The relative costs of courses would probably reduce the relative weight of higher degree enrolments which have increased markedly since 1987 (higher degree enrolments increased by 181 per cent between 1987 and 1996, compared with 51 per cent for other enrolments).
The proposed arrangements would also have positive results from the point of view of equity. The cost of higher education would be shared explicitly between the two beneficiaries—society and the individual student. The student would be able to balance the benefit received from enrolment against the cost incurred, including the cost of enrolling in institutions charging higher fees.

Diversity among universities would be promoted as each strove to find a market for its services. Product differentiation would occur in the nature of courses, the levels at which they are pitched, the size of the institutions, the facilities available, the emphasis and ethos of the institution.

All courses would be treated similarly with respect to fees: different categories of courses would be unnecessary. To the extent that graduate study can be encompassed within the five or six year tenure of the scholarships, problems with access to courses currently subject to graduate tuition fees would be avoided. Invidious distinctions between full fee paying overseas students and other students would be eliminated. Public and private universities could be treated on an equal footing. Full fee paying (non-scholarship) domestic students could be catered for. On the assumption that institutions would determine a maximum level of enrolments for entry to each course and a minimum tertiary entrance score, such students would normally be able to gain entry to courses only with entry levels below the minimum level gained by students with scholarships—unless, of course, institutions were willing to set entry standards at lower levels for full fee paying students than for students with scholarships.

The establishment of a market in higher education services would accord with the emphasis currently being given to a competitive market orientation of the Australian economy.

Financial Viability of Institutions

Institutional efficiency and effectiveness would be improved by avoiding the rigidities imposed on university management through the present publicly known, and thus unavoidably determinative, relative funding formula. Institutions would have greater control over budgets through fee structures.

Universities would be able to balance costs against revenues. Having greater control over their budgets through the level of fees, they would be able to adjust the educational services they provide to the revenues they are able to earn. Financial responsibility would be promoted. Some institutions, but probably not all, would be able to allocate part of their revenue to supporting scholarly activities and research infrastructure.

The greater control over revenues would enable institutions to respond to labour market conditions in employing staff. It would facilitate moves to enterprise bargaining in the determination of salaries and conditions - indeed, it is difficult to conceive of successful enterprise bargaining in universities without their having greater control over their revenues. The present dilemma of how to fund salary increases would be resolved.
Universities would be free to reorganise themselves in any way they chose. Undoubtedly, there would be some splitting of institutions, but there might also be combining and collaborating.

Vocational education and training

The comprehensive scholarships program set out in this paper is designed for higher education students and the institutions they attend. However it could be generalised to cover vocational education and training (VET) students pursuing award courses (usually of one to three years duration) in approved VET institutions. The criteria for the award of scholarships might need to be different for some categories of VET students, as would the value of the scholarships. However, there would be advantages in putting access to higher education and VET institutions and their financing on a more equal footing, and in establishing a market for post-school education with a wide range of institutions aiming to meet the diverse needs of the community. A comprehensive scholarships program for all post-school students would assist in sorting out the balance between university studies and those embraced under the rubric of vocational education and training.

OTHER CONSIDERATIONS

Deregulation of the kind proposed might result in some universities growing at the expense of weaker institutions. No doubt there would be shifts in enrolments among institutions. However, the possibility of substantial growth of one institution at the expense of their neighbours is fairly limited. The scarcity of land and capital and the high cost of servicing capital would be inhibiting factors. Moreover, it can be assumed that institutions will not wish to grow without limit. Nevertheless, deregulation may mean that some weaker institutions would not survive, especially if the Government were to reduce the number of scholarships in the face of a declining demand for university places or as a matter of policy. But should such institutions be protected? If protection is judged desirable, the Commonwealth Government could, through its Higher Education Commission, seek agreement with expanding institutions to limit their size. It would also be possible for the Commonwealth to assist the survival of an institution (for example, a regional university) by the payment of lump sum subsidies on the recommendation of the Higher Education Commission.

The proposed arrangements do not envisage any formal coordination of the activities of the various institutions. Indeed, the essence of deregulated arrangements, such as those implied in a comprehensive program of scholarships, is that there should be no central coordination. Some might fear that in these circumstances there would be a proliferation of specialised courses involving "unnecessary duplication". It seems unlikely, however, that in a market situation institutions would rush into new courses unless there was a clear demand for them at fees which covered costs. Medicine might be a special case, but the creation of a new medical school or the expansion of an existing one would require commitments from State and hospital
authorities and could not occur without their approval and support. It might be noted in passing that, although the Commonwealth Department of Employment, Education and Youth Affairs (and its predecessor Department) has been involved in detailed discussions with institutions on course offerings and student numbers, it has not exercised the coordinating role that had been excised by the Commonwealth Tertiary Education Commission and its predecessors up to 1987: the doubling of the number of law schools since 1988, the proliferation of MBA courses and the spread of PhD programs in the post 1987 universities testify to this. The present system of higher education is a regulated but uncoordinated system.

A comprehensive program of national scholarships implies that the distribution of enrolments among the various cost categories of courses would be determined by the interaction of student preference with institutional provision. In these circumstances the Commonwealth Government might fear that relatively more scholarships would be directed to the more expensive courses. This is unlikely since the more expensive courses tend to be those with strict quotas. Moreover they would probably impose a larger HECS liability on students.

There is also the possibility (perhaps, likelihood) that some universities, which are high in the pecking order, might raise fees for some courses above the levels for which HECS would be available. On the other hand, other institutions might decide to charge relatively low fees to attract students. If a university were to charge fees beyond the HECS level, it should be required to implement a scholarship scheme in order to maintain access for less affluent students.

That fees should reflect costs is sometimes disputed on the grounds that it would discriminate against students wishing to enter expensive courses like science and engineering and reduce the output of graduates in these fields. However, a shortage of such graduates would be reflected in their remuneration; this would make the fields attractive in spite of their higher fees. But quite apart from this, universities could always cross subsidise expensive courses if they wished (higher fees for law, lower fees for science); or, if need be, the Commonwealth could provide direct subsidies, preferably higher value scholarships, for particular courses.

**CONCLUSION**

Confrontation of the issues set out at the beginning of this paper is a matter of urgency. The universities, after the amalgamations and conversions of 1988 and 1989 and having expanded rapidly for a decade, are now facing contracting real resources and some decline in student demand. The future appears uncertain. Questions relating to the diversity among, and the quality of, the 36 publicly-funded universities need to be addressed.

The implementation of a comprehensive program of national scholarships, and the deregulation of higher education and the establishment of a market for educational services that
would go with it, will not provide a solution to all the problems universities are at present facing, but it will make a major contribution to addressing many of them. The alternatives are to do nothing, in which case most of the institutions will fall into deeper disrepair, or to return to the pre-1987 situation which is simply not feasible. The approach outlined in this paper offers the greatest hope for maintaining and enhancing the quality of Australian higher education as a diverse system capable of meeting the multifarious needs of the community. The approach may also be able to be extended to cover all post-school education.
COST FUNCTIONS FOR AUSTRALIAN UNIVERSITIES: A SURVEY OF
RESULTS WITH IMPLICATIONS FOR POLICY

Chris Heaton and David Throsby

1. Introduction
The reforms that have occurred in the Australian higher education sector in recent
years, and those that are currently being considered, have renewed interest in the
contribution that economic analysis can make to educational policy-making. From the
economic perspective, the benefits of higher education include the increase in incomes,
taxation, and labour productivity that are believed to result from education, and the
costs include the income, taxation and labour services that must be forgone during the
period of study, and the resource costs of providing the tuition to the student. This
paper considers the last of these costs. Since most university resources are shared
between a number of uses, the impact on resource costs of changes in student load of
various types is not obvious. In order to understand more fully the relationship
between university costs and teaching output, a number of studies have been
performed in which empirical cost functions are estimated for Australian universities.
The purpose of this paper is to use these cost functions to estimate the marginal and
average costs of tuition at Australian universities, and to use this information to shed
light on some current policy issues in higher education. Section 2 of the paper
provides a brief overview of the magnitude and composition of higher education
expenditure in Australia. In sections 3 and 4 the average and marginal cost estimates
are derived. Section 5 provides a discussion of the policy implications.

2. Overview of University Costs and Revenue
In 1994 (the most recent year in which published data on university expenditure are
available) there were 0 institutions in Australia that were subject to the Higher
Education Funding Act (1988). The expenditure by these institutions totalled $6.4
billion. Around 64 per cent of this expenditure was on staff salaries and related costs.
The distribution of this expenditure between activities is given in Table 1. Not
surprisingly, academic activities and administration account for most of the total
expenditure on higher education. Given that there were 452 thousand students enrolled
in these institutions in 1994, it might be said that the annual cost per student of higher
education is around $14 thousand. Such a figure is not an indication of the average

* Paper presented to the Symposium on Policy Perspectives on Higher Education Financing, Centre
costs of tuition. Universities produce both teaching and research and hence due allowance must be made for the proportions of total university expenditure which support both of these activities, with appropriate assumptions as to the allocation of joint costs. Of the $6.4 billion total expenditure in 1994, around 10 per cent is likely to have been devoted exclusively to research, and of the remainder, available evidence suggests around 60 to 70 per cent can be allocated to teaching. If these figures are correct, they would indicate that the average cost of providing tuition to students in the higher education system in 1994 is likely to have been around $7.5 to $9 thousand per student.

Table 1 - Composition of University Expenditure (1994)

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Activities and Research</td>
<td>62%</td>
</tr>
<tr>
<td>Libraries</td>
<td>5%</td>
</tr>
<tr>
<td>Other Academic Support Services</td>
<td>5%</td>
</tr>
<tr>
<td>Student Services</td>
<td>4%</td>
</tr>
<tr>
<td>Public Services</td>
<td>2%</td>
</tr>
<tr>
<td>Buildings and Grounds</td>
<td>6%</td>
</tr>
<tr>
<td>Administration</td>
<td>17%</td>
</tr>
</tbody>
</table>

Source: DEETYA (1996)

3. Estimates of Marginal Costs and Average Costs of Tuition at Australian Universities

Estimates of marginal and average costs derived from estimated cost functions are presented in Table 2. In each case the costs are estimated for the mean sized institution in the year in which the data were collected. All these estimates are derived from cost data from which identifiable research expenditure has been removed but which still include the resources used jointly for teaching and research. The ‘tuition-only’ component of the costs presented in Table 2 and subsequent tables is likely to be around 60 to 70 per cent of the figures quoted. However, since funding for the essential operations of universities (including joint teaching/research activities) are provided on a per student basis, which provides a convenient measure on which funding allocations can be determined, we use measures of the ‘full’ costs rather than ‘tuition-only’ costs throughout this paper.

It is interesting that different models, which have been estimated using data sets that are up to 12 years apart, give average cost estimates at the mean student load that vary by no more than a few hundred dollars in terms of constant prices. The increase in the estimated marginal cost over time is also interesting. Note in particular that only for the most recent estimate does the marginal cost exceed the average cost at the mean institutional size in the reference period.
Table 2 - Estimates of 'Full' Average and Marginal Costs

<table>
<thead>
<tr>
<th>Cost Function</th>
<th>Year of Estimation</th>
<th>Average EFTSU</th>
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<td>$9,843</td>
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<td>Lloyd, Morgan and Williams (1993)</td>
<td>1988</td>
<td>4,352</td>
<td>$12,137</td>
<td>$10,192</td>
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<tr>
<td>Heaton (1996)</td>
<td>1994</td>
<td>11,298</td>
<td>$12,042</td>
<td>$12,879</td>
</tr>
</tbody>
</table>

Source: Author's calculations based on cost functions presented in the respective papers. For the multiple-output cost functions of Lloyd, Morgan and Williams (1993) and Throsby and Heaton (1995) average and marginal costs were calculated holding the proportions of each type of output constant at the sample mean. All values are in 1995 dollars based on CPI adjustments.

4. Cost Variations Between Disciplines, Level of Study and Size of Institution.

The cost estimates in Table 2 apply only to the average student. However, empirical evidence suggests that there is considerable variation in costs between subject areas, between undergraduate and postgraduate study, and between research-based study and coursework-based study. Evidence also exists of scale effects, such that average and marginal costs vary with total student load.

Throsby (1986) estimated cost functions for three broad subject categories - Arts-type, Science-type, and Med-type. As seen in Table 3, on average Med-type courses are around twice as expensive as Arts-type courses.

Table 3 - Estimates of 'Full' Costs by Subject Area Derived from Throsby (1986)

<table>
<thead>
<tr>
<th></th>
<th>Arts-Type</th>
<th>Science-Type</th>
<th>Med-type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Cost</td>
<td>$8,992</td>
<td>$15,213</td>
<td>$17,918</td>
</tr>
<tr>
<td>Marginal Cost</td>
<td>$7,515</td>
<td>$10,827</td>
<td>$12,737</td>
</tr>
</tbody>
</table>

Source: Throsby (1986). The cost estimates have been inflated to 1995 dollars using the CPI.

The multiple-output cost function estimated by Lloyd, Morgan and Williams (1993) may also be used to estimate marginal costs for different subject areas. The results of this are shown in Table 4. Again, wide variation is evident across subject areas. Two conclusions may be drawn from this.

---

1 Arts-type = Architecture, Arts, Economics, Education, Law
Science-type = Mathematics, Science
Med-type = Agriculture, Dentistry, Engineering, Medicine, Veterinary Science
Table 4 - ‘Full’ Marginal Cost Estimates Derived from Lloyd, Morgan and Williams (1993)

<table>
<thead>
<tr>
<th></th>
<th>Marginal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undergraduate</td>
<td></td>
</tr>
<tr>
<td>1. Accounting, Administration/Economics, Law, Other Humanities</td>
<td>$6,340</td>
</tr>
<tr>
<td>2. Behavioural Science, Education, Math/Stats, Social Studies</td>
<td>$4,862</td>
</tr>
<tr>
<td>3. Comp., Nursing, Health, Built Env., Languages, Visual/Perf. Arts.</td>
<td>$9,216</td>
</tr>
<tr>
<td>4. Engineering, Science, Surveying</td>
<td>$8,811</td>
</tr>
<tr>
<td>5. Agriculture, Dentistry, Medicine, Veterinary Science</td>
<td>$18,706</td>
</tr>
<tr>
<td>Other Postgraduate</td>
<td></td>
</tr>
<tr>
<td>1. Undergraduate fields 1, 2 and 3 excluding Behavioural Science</td>
<td>$10,213</td>
</tr>
<tr>
<td>2. Undergraduate fields 4 and 5 plus Behavioural Science</td>
<td>$30,553</td>
</tr>
<tr>
<td>Research Degree</td>
<td></td>
</tr>
<tr>
<td>1. Undergraduate fields 1, 2 and 3 excluding Behavioural Science</td>
<td>$78,012</td>
</tr>
<tr>
<td>2. Undergraduate fields 4 and 5 plus Behavioural Science</td>
<td>$80,699</td>
</tr>
</tbody>
</table>

Source: Author's calculations based on the cost function estimated by Lloyd, Morgan and Williams (1993). Estimates have been inflated to 1995 dollars using CPI.

Firstly, it is clear that the resource costs of university tuition vary greatly between subject areas. Secondly, it appears that the range of costs that are obtained from empirical cost functions depends on the way that individual courses are aggregated into broad subject groupings. As such, these estimates need to be interpreted with some care.

Evidence also exists of cost variations between different levels of degrees. Estimates of the magnitude of these differences may be found by using the cost functions estimated by Throsby and Heaton (1995) and Lloyd, Morgan and Williams (1993). These estimates are presented in Table 5.

Table 5 - ‘Full’ Marginal Cost Estimates for Different Levels of Study

<table>
<thead>
<tr>
<th></th>
<th>PG Research</th>
<th>PG Coursework</th>
<th>Undergraduate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lloyd, Morgan and Williams (1993)</td>
<td>$67,526</td>
<td>$13,087</td>
<td>$7,382</td>
</tr>
<tr>
<td>Throsby and Heaton (1995)</td>
<td>$86,037</td>
<td>$14,348</td>
<td>$5,930</td>
</tr>
</tbody>
</table>

Source: Authors calculations based on the estimated cost functions. Marginal costs are estimated at the mean student load for the year of the study (see Table 2). For the Lloyd, Morgan and Williams cost function, the marginal costs in this table are a weighted mean of the marginal costs presented in Table 4, where the weights are the mean proportion of students at each level in each subject area. All values are in 1995 $A based on CPI adjustment.
It should be noted that both studies yield fairly large standard errors for these estimates. Thus the differences in the marginal cost estimates of the two studies in Table 5 may be explained as statistical variation. Despite these differences, the broad orders of magnitude are similar. Undergraduate tuition is around twice as expensive as postgraduate coursework tuition, and postgraduate research tuition is around five or six times as expensive as postgraduate coursework tuition. The costs of postgraduate research training are quite high and warrant further comment.

Firstly, it should be noted that the marginal cost ratios are broadly consistent with those found in overseas studies. Furthermore, the cost ratios are understandable when viewed in terms of the resources used by research students. In particular, research student training involves one-to-one contact with the most senior academics, and involves vastly more intensive use of the university’s capital equipment, including libraries, computers, laboratory equipment, office space, etc., than does coursework-based tuition. Secondly, since academic research and postgraduate student research are similar, they are likely to be strong complements in production. Thus, it is difficult to separate expenditure on postgraduate research from expenditure on staff research. Indeed, rather than institutions incurring higher costs when they accept more research students, it may simply be the case that institutions with high expenditures on research equipment attract more postgraduate research students. Thirdly, any consideration of the relative costs of research- and coursework-based tuition should also take into account the substantial contribution to research made by postgraduate students. This is particularly the case in the physical sciences, where many departments rely on a steady supply of postgraduate students to support their own research programs.

There exists strong evidence that the size of a university (in terms of total student load) is also a determinant of average and marginal costs. Lloyd, Morgan and Williams (1993) perform hypothesis tests which indicate the existence of scale economies for the average institution in 1988. The cost function estimated for 1978-1982 by Throsby (1986) suggests that institutions with a student load of less than 13 thousand EFTSU experience strong economies of scale, and that institutions with a student load of more than this experience diseconomies of scale. The work of Heaton (1996) suggests that the least-cost scale of university in 1994 was around 10 thousand EFTSU. Both the Throsby (1986) and Heaton (1996) studies find statistical evidence of diseconomies of scale for large institutions. Table 6 presents average and marginal cost estimates for various sizes of institution, derived from Heaton (1996).

\footnote{See Throsby and Heaton (1995) for a brief discussion.}
\footnote{See Powles (1984) for a survey on the contribution to university research made by postgraduate students.}
Table 6 - Estimated Marginal and Average Costs by Total Student Load

<table>
<thead>
<tr>
<th>Load (EFTSUs)</th>
<th>Marginal Cost</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,000</td>
<td>$9,847</td>
<td>$13,130</td>
</tr>
<tr>
<td>10,000</td>
<td>$12,090</td>
<td>$11,983</td>
</tr>
<tr>
<td>15,000</td>
<td>$15,418</td>
<td>$12,557</td>
</tr>
<tr>
<td>20,000</td>
<td>$19,457</td>
<td>$13,767</td>
</tr>
<tr>
<td>25,000</td>
<td>$24,202</td>
<td>$15,371</td>
</tr>
</tbody>
</table>

Source: calculated from estimated cost function in Heaton (1996). All values are in 1995 dollars.

5. Policy Implications
Any changes made to higher education policy should be based on a full cost-benefit analysis which considers all the social opportunity costs and benefits of higher education. Since this paper has only considered a single, albeit important, component of the total social costs of higher education, we are unable to derive hard-and-fast policy recommendations from the results we have discussed. However, the cost estimates presented above may be used to shed light on a number of current policy issues.

(a) Cuts in public funding
Cost data of the sort discussed in this paper are useful for assessing the impact of possible cuts in higher education funding, though as we point out further below, they are by no means the only consideration. Further, the issue is complicated by the fact that under present arrangements, decisions as to the allocation of funds for higher education are made both by the Commonwealth in pursuit of its higher education policy and by universities themselves in pursuit of their own institutional goals. These interests may not necessarily coincide. In this discussion we abstract from the practicalities of actual funding arrangements and look simply at overall effects.

The first matter to be determined is whether a reduction in the level of Commonwealth funding of universities could be accommodated without affecting student numbers, assuming there were to be no increase in student fees. Such funding cuts could be absorbed without concomitant reductions in student numbers under three circumstances. Firstly, if there were sufficient spare capacity in the system to allow reallocation of student numbers to areas or institutions where marginal cost was effectively zero, the net effect could be a reduction in overall funding levels with little or no change in aggregate student numbers. The studies discussed in this paper do not deal directly with the capacity issue. Nevertheless, it might be suggested that, whilst greater utilisation of fixed capital might be possible within universities (e.g. using teaching facilities year-round), the marginal recurrent costs of such strategies are likely
to be significantly greater than zero. In all, it seems very unlikely that there exists overall spare capacity in the system which would allow cuts to be absorbed without impacting on student numbers.

Secondly, if there are x-inefficiencies in the delivery of teaching services, it would be possible to reduce average costs at all levels of output by eliminating these inefficiencies. Again, the studies we have considered were not able to identify technical inefficiencies, a matter which in any case is difficult when quality is not able to be observed (since variations in unit costs at a given output level may be due to quality variations). Nevertheless, observation suggests that budgetary stringency across the entire university system over the last decade or more has probably got rid of most if not all of any x-inefficiencies that may have been present in more plentiful times. If it is true that there is little or no further scope for efficiency improvement given current production technology, it is likely that cuts to funding without reduction in student numbers could only be achieved through reductions in educational quality.

Thirdly, new teaching technologies could provide a means for reducing unit costs sufficiently to allow funding cuts to occur without altering student numbers. Not surprisingly, the studies considered above were confined to the existing educational production function, which can be assumed to be reasonably similar across institutions, and hence they shed no light on the opportunities for introducing new technologies. It should be noted, however, that the adoption of any such technologies, if they exist, would only be feasible in the medium to longer term, and provide no solution to the immediate funding problem in higher education.

Turning now to the likely impact of funding cuts, still assuming no variation in HECS to make up any funding shortfall, we can calculate the overall impact on student numbers by inverting the cost function to find the student load consistent with each level of cost. The impact depends on both the marginal costs experienced by each institution, and the proportion of total university revenue that is represented by Commonwealth funding (currently around 60 per cent over all institutions). Using the function from Heaton (1996), we calculate that Australia-wide, funding cuts of 5 and 12 per cent would reduce student load by around 11,700 EFTSUs (2.6%) and 28,500 EFTSUs (6.3%) respectively. Since the actual individual marginal costs and dependency on government funds vary widely between institutions, the specific impacts of funding cuts of these magnitudes also vary, from 0.5 to 4.8 per cent of student load in the case of a 5 per cent cut, and from 1.3 to 11.5 per cent of student load in the case of a cut in funds of 12 per cent.

The policy problem might now be framed in terms of the following question: if costs are important in the decision as to how to spread funding cuts across the system
under the assumptions noted above, what do the cost relationships tell us about possible ways to allocate the funding reductions? We can point to three potential strategies suggested by the cost functions considered in this paper.

Firstly, universities could seek to save resources by cutting postgraduate programs where costs at the margin exceed fee revenue, rather than by reducing undergraduate numbers, since the cost savings per student place reduced would be greatest by this strategy. The data given earlier indicate that a postgraduate research student, for example, may cost around ten times more at the margin than an undergraduate, so that even after allowing for loss of fee income, the impact of funding cuts on actual student numbers might be considerably reduced if the axe fell in the postgraduate area. However, such a conclusion would ignore the important interactions between postgraduate and staff research that have been noted earlier. In addition, such a conclusion illustrates the pitfalls of basing adjustment strategies on cost considerations alone; in particular, decisions affecting relative number of postgraduate and undergraduate places would have to have regard to the relative social benefits generated by each level of education. In this case, reducing postgraduate numbers simply to save costs might well be a misguided strategy in terms of the overall objectives of Australian higher education.

Secondly, at the specifically undergraduate level, targeting numbers in the more expensive faculties such as agriculture, engineering and medicine would appear to enable a given level of withdrawal of funding to be absorbed with smaller reductions in aggregate student numbers than would occur with across-the-board cuts. However, such a conclusion would again ignore considerations of relative social benefits deriving from the output of graduates in different fields. Furthermore, indications from the cost studies discussed in this paper are that the gap in costs between disciplines may be narrowing over time (for example, the use of computers in subjects such as economics appears to have raised the unit costs of delivery of teaching services in this area). Thus attempts to target reductions in numbers of places on particular disciplines on cost-saving grounds may be misplaced.

Thirdly, reductions in numbers of places might have regard to the size of universities where cuts could be effected. Here the cost data do give some clearer indications. As noted earlier, the largest universities in the national system appear to be operating under significant diseconomies of scale, suggesting that a given decrease in student load (assuming quality and discipline mix are similar for universities of similar size) will provide greater savings if effected in the largest size group than if spread across the system or more especially if concentrated in average-sized or smaller institutions. Indeed the relative marginal costs reported in Table 6 above suggest that the cost
saved through a decrease of one EFTSU in a university of 25,000 EFTSU would be about twice that saved through a similar reduction in a university of 10,000 EFTSU.

(b) Student fees
The results from the cost studies also throw some light on the determination of student fees both for domestic students (through HECS) and for overseas students. In the former case, the existence of some variation between marginal tuition costs for different areas of study might suggest that differential pricing through HECS might be justified, subject to considerations of equity and of social and individual benefits. At the same time it should be noted that the marginal cost of undergraduate tuition is relatively low, such that at present the average undergraduate student pays more than half of the marginal costs of their tuition via the HECS system. Depending on whether marginal or average cost pricing is appropriate with respect to the student contribution to the costs of tuition, policy makers considering increases in HECS should have regard to these costs; it is quite possible, for example, that fees could rise above the marginal tuition costs of the cheapest undergraduate degrees.

In regard to full-fee-paying overseas students, similar remarks can be made. Since universities have discretion over fee levels, the fee structures for overseas students at Australian universities do appear to reflect the cost differentials noted above.

(c) Optimal university size
If we turn attention away from the current preoccupation with possible contraction in the higher education system, and consider instead the potential for expansion, the cost results considered in this paper throw some light on the question of whether to create new universities or to expand existing ones. If economies in tuition costs are considered decisive, the exiting empirical evidence suggests that the current average university size of around 11,500 EFTSU is about right. The program of amalgamations over the last five years or so has had both good and bad effects on sector-wide average costs. On the positive side, prior to amalgamations the majority of higher education institutions had student loads below 10,000 EFTSU and there were significant scale economies to be exploited. Amalgamations eliminated many of the very small institutions. On the negative side, the process created a number of very large institutions which, as noted earlier, are experiencing scale diseconomies. Thus, based purely on tuition-cost considerations, any expansion of higher education should be accommodated within the smaller institutions, or even by creating new ones, rather than by further expansion of existing large universities.

6. Conclusions
This paper has used cost functions to estimate the marginal and average costs of tuition in Australian universities and used these estimates to shed light on some
current policy problems. In particular, we have shown that cost considerations can have some relevance for determining appropriate strategies to deal with possible cuts in higher education funding, especially in terms of the distribution of such cuts amongst universities of different sizes. It should be remembered, however, that the resource costs estimated here represent only part of the total social opportunity costs of higher education. Policy needs to be based on an analysis of all costs and benefits, and the policy discussion presented in this paper needs to be interpreted in this light.

References


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