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How Australian universities fund the student experience

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An investigation of the relationship between total expenditure, research outputs and education outputs for Australian universities 2004–2007 reveals an intense correlation between expenditure and research outputs. The analysis is consistent with the expenditure of approximately \$20,000 per student completion and \$220,000 per Higher Education Data Collection publication point in 2007, with comparable values in three earlier years. It is suggested that public policy drives Australian universities to direct the maximum expenditure towards the generation of research outcomes, raising serious questions about the adequacy of funding for the student experience.

Keywords: expenditure, education, research

Introduction

This paper investigates the relationship between the total expenditure and the volume of educational and research outputs from Australian universities. While the quantitative approach may appear to brand the analysis as *performative* in the classification proposed by Skelton (2005), the intent is *critical* analysis of the student experience, resting on an *evidentiary base*.

The paper explores the conjecture that the public policy settings for Australian universities drive the per-student expenditure related to the provision of education to low values. It suggests that the settings offer almost no incentive for positioning an institution differentially by increased expenditure on the student experience, or for increasing the proportion of expenditure on education in the pursuit of improved educational outcomes. Rather, the policy settings provide an irresistible incentive to maximise the proportion of expenditure on activities correlated with the production of research outputs. If correct, these findings have important implications for the topic of the 2009 HERDSA conference: *the student experience*.

The report draws on economic approaches to the analysis of productivity and efficiency in higher education (see Salerno, 2003; Trewin, 2003). However, the emphasis here is not of itself economic. Rather, the paper is located at the intersection of public policy relating to higher education, and issues relating to the academic self-governance of higher education. In effect the paper asks whether the public interest in higher education is well-served by current public policy drivers, and whether the institutional academic enterprise has been side-tracked from its central purposes by an imbalance of attention on research at the expense of education.

The genesis of the current report lies in the implications of the most recent Higher Education R&D statistics reported by the Australian Bureau of Statistics (ABS). As explained below, the statistics reveal that a significant part of university reported expenditure on R&D is sourced from revenues relating to education fees or general purpose funds. The report looks into this finding in greater detail by using a statistical model to estimate per-university expenditure in

research and education outcomes. The paper investigates the correlation between total expenditure and the volume of research and education outputs, derives an estimate of the expenditure on per-student educational output (and per-article research output), and points towards a method for determining what applied economists would term the ‘efficiency’ of universities in their use of revenue to produce education and research outcomes.

The study suggests that public policy settings have created a higher education system in Australia where all Australian universities are potentially subject to the criticism levelled by the Boyer Commission at the relatively small proportion of research universities in the USA, namely that they

“fail their undergraduate populations ... (insofar as) ... tuition income from undergraduates is one of the major sources of university income, helping to support research programs and graduate education, but the students paying the tuition get, in all too many cases, less than their money’s worth” (Boyer Commission, 1998)

Aggregated data

Research-related income and expenditure of Australian higher education institutions was last reported to the Australian Bureau of Statistics in 2006. The 2006 data, *aggregated* by the Bureau (Australian Bureau of Statistics, 2008) to preserve anonymity, reveal an expenditure of \$5.045B on university research related activity (R&D activity) against revenue sources that include government R&D funding of \$0.979B as explicit Australian Government Competitive (AGC) grants and \$3.196B of non-explicit General University Funds (GUF). Of the \$3.196B GUF amount, \$1.275B corresponds to explicit Government research block grants (principally the Research Infrastructure Block Grant, Institutional Grants Scheme, Research Training Scheme, and the ANU National Institute Grant). The difference between the total research-related GUF and the Government block grants (\$1.924B) represents one estimate of the *cross-subsidy* of research expenditure from revenue provided to universities under the Commonwealth Grant Scheme (CGS) of the Higher Education Support Act (HESA) to support the of higher education places *as a benefit to students* (HESA Part 2-2, Subdivision 30-A, compilation of April 2009)

The level of cross-subsidy derived in this way is far higher than the level discussed in the ‘full funding of research’ debate (Cutler, 2008; Bradley 2008; Allen Consulting 2008). To avoid confusion, it should be pointed out that the large difference reflects the inclusion of institutions’ reports of a proportion of chief investigator salaries and all overheads in the ABS analysis, while the full funding of research debate is directed at full funding for the far smaller component relating to the direct overheads of government funded research (i.e. approximately \$300M per annum).

Universities in ABS returns hypothecate the component of academic salaries allocated to R&D activities (generally estimated at 30% of the time of an academic with teaching and research duties) and attribute uncertainly a number of campus-wide costs between education and research activities. It is therefore not necessarily true that higher education expenditure on education-related activities can be derived reliably from the difference between ABS total and R&D expenditure data. The current analysis represents an attempt to avoid the many uncertainties entailed in standardised ABS reporting or in the planned atomistic (bottom-up) costing methods envisaged as a consequence of the full-funding of research compact between

universities and government. The uncertainties are addressed by attending directly to the generation of output from expenditure.

In the 2006 aggregate data the scale of the cross-subsidy amounted to approximately 85% of the total HECS payments for that year, and more than 80% of the universities' gross income from international student fees. Clearly the balance of higher education expenditure between research and education was very different from the corresponding balance of revenue, a situation inviting further investigation especially from the perspective of expenditure on the student experience. The current report explores this situation at the level of the institution.

Methods and results

The analysis rests on the observation of a remarkable pattern in the correlations between the expenditure $T(i, j)$, education outcomes $E(i, j)$ and research outcomes $R(i, j)$ of Australian universities. Previous studies in this area (e.g. Horne & Hu, 2003) have adopted proxies for outputs (such as student load for educational output, or research income for research output) and appear not to have discovered these relationships. Here, I chose direct and readily available output measures, notably *completions* to measure educational output and *weighted publication points* of the Higher Education Research Data Collection (HERDC) to measure research output.

Specifically, the educational output $E(i, j)$ is the total number of *completions* across all levels of higher education award and all student classifications including international students, as published by the Department of Education, Employment and Workplace Relations (DEEWR, 2007). The research output $R(i, j)$ is the *HERDC weighted publication points* as aggregated and published by Universities Australia (UA, 2007). A detailed report on the components of revenue and expenditure of Australian universities is published annually by DEEWR within the context of the Higher Education Data Set of the ABS (Trewin 2003; DEEWR, 2007). The total expenditure input $T(i, j)$ is the reported component *Total Expenses for Continuing Operations*, including only the higher education component of expenditure for dual-sector institutions (currency units are \$A1000, unadjusted for inflation).

Table 1: Results of correlation analysis

	2004	2005	2006	2007
$X(T, E)$	0.813	0.808	0.813	0.805
$X(T, R)$	0.977	0.981	0.980	0.974
$X(E, R)$	0.722	0.721	0.728	0.714

Using the Microsoft package Excel, I have calculated the cross-correlation X between expenditure and completions, $X(T, E)$, expenditure and points, $X(T, R)$ and completions and points, $X(E, R)$. As shown in Table 1, over the four years 2004–2007 the cross-correlation for each pairing is stable, with a very strong correlation (>0.97) between expenditure and research output measured by DEEWR points.

Correlation does not mean cause, but with a correlation coefficient in excess of 97% and expenditure ranging over more than a decade, it is hard to see any interpretation other than the proposition inter-institutional variations in research output relate directly to corresponding variations in total institutional expenditure. The correlation between research and education

outputs is lower ($\sim 72\%$) suggesting that research outputs dominate university expenditure patterns with education outputs representing a less-significant residual.

The intense correlation between total expenditure and research outputs suggests that a linear relation exists between these two quantities – i.e. there is a cost-per-unit research output coefficient that is independent of the institution. To explore this intriguing possibility, I determine the statistical properties of the linear model

$$T(i, j) = C_E \cdot E(i, j) + C_R \cdot R(i, j) + C_Z \quad \text{Equation (1)}$$

fitting the relationship between expenditure $T(i, j)$, education outcomes $E(i, j)$ and research outcomes $R(i, j)$. The fit covers $i = 1,36$ Australian universities and is applied over each year 2004–2007. Equation (1) is a particular case of the general productivity Equation (1) of Salerno (2003), involving two outputs, one input, and equal weights for all. The coefficients C_E , C_R and C_Z , constants to be derived from the model, are, respectively, the estimated unit cost of production of education output and research output, and expenditure not related to either education or research outputs.

Standard regression analysis has been conducted using the Microsoft Excel package with the results summarised in Table 2.

Table 2: Results of regression analysis
(Coefficient units are \$A1000)

	2004	2005	2006	2007
R^2	0.979	0.983	0.982	0.974
C_E	15.946	15.598	17.684	20.760
$\sigma(C_E)$	2.574	2.405	2.867	3.741
$t(C_E)$	6.196	6.485	6.168	5.549
C_R	200.718	196.950	208.954	219.891
$\sigma(C_R)$	8.922	7.670	8.669	10.859
$t(C_R)$	22.498	25.677	24.102	20.249
C_Z	19,386	22,327	10,199	401
$\sigma(C_Z)$	12,475	11,945	14,287	19,149
$t(C_Z)$	1.554	1.869	0.714	0.021

The year-on-year variation of the three fitted coefficients C_E , C_R and C_Z is only weakly statistically significant (C_E and C_R are both larger in 2007, reflecting the fact that 2007 was a ‘better year’ for Australia’s university’s staff and students). The fit accounts for 97.4% of the variance in $T(i, j)$ with a standard error of \$50M. The coefficients C_R and C_E respectively fit 95% and 2% of the total variance, and the $t(d.f. = 34)$ -values imply that both coefficients are highly significant. The constant term C_Z is small and significant only at the 1% level. Four universities with the highest expenditure exert high leverage on the regression, and the analysis has been repeated with these four institutions deleted. The fitted coefficients for 2007 are then C_E , C_R and $C_Z = 18.12, 206$ and 25700 , respectively; the leverage does not distort the derived values of the coefficients to a significant extent.

Table 3: Expenditure $T(i, j)$, Completions $E(i, j)$, HERDC Points $R(i, j)$ and normalised error for 2007. Monetary values are expressed in \$A1000.

Institution	2007						
	Exp	Comp	Points	Comp_\$	Points_\$	Error_\$	Error (%)
Australian Catholic University	\$145,639	3844	227	\$79,800	\$49,829	\$16,010	11.0
Central Queensland University	\$255,225	6595	314	\$136,909	\$69,024	\$49,292	19.3
Charles Darwin University	\$82,157	873	239	\$18,123	\$52,588	\$11,446	13.9
Charles Sturt University	\$263,722	7727	749	\$160,409	\$164,689	-\$61,377	-23.3
Curtin University of Technology	\$476,037	9842	1246	\$204,316	\$273,925	-\$2,203	-0.5
Deakin University	\$417,096	7617	1046	\$158,126	\$230,109	\$28,861	6.9
Edith Cowan University	\$246,696	5679	493	\$117,894	\$108,448	\$20,354	8.3
Flinders University	\$241,443	4141	904	\$85,965	\$198,790	-\$43,313	-17.9
Griffith University	\$475,315	8717	1322	\$180,961	\$290,595	\$3,759	0.8
James Cook University	\$229,852	2898	761	\$60,161	\$167,231	\$2,459	1.1
La Trobe University	\$435,016	7676	1096	\$159,351	\$240,897	\$34,768	8.0
Macquarie University	\$385,626	8156	1372	\$169,315	\$301,750	-\$85,439	-22.2
Monash University	\$1,093,315	15438	3422	\$320,486	\$752,442	\$20,386	1.9
Murdoch University	\$227,618	2913	453	\$60,473	\$99,590	\$67,556	29.7
Queensland University of Technology	\$503,240	9492	1361	\$197,050	\$299,282	\$6,908	1.4
RMIT University	\$458,189	8410	1213	\$174,588	\$266,663	\$16,938	3.7
Southern Cross University	\$123,756	2589	225	\$53,747	\$49,425	\$20,585	16.6
Swinburne University of Technology	\$199,221	3629	508	\$75,337	\$111,619	\$12,266	6.2
The Australian National University	\$689,516	4284	2896	\$88,934	\$636,699	-\$36,118	-5.2
The University of Adelaide	\$464,119	5245	1907	\$108,884	\$419,398	-\$64,163	-13.8
The University of Melbourne	\$1,245,642	13199	3909	\$274,006	\$859,569	\$112,068	9.0
The University of New England	\$186,153	3681	608	\$76,416	\$133,797	-\$24,060	-12.9
The University of New South Wales	\$932,650	9271	3505	\$192,462	\$770,755	-\$30,567	-3.3
The University of Newcastle	\$374,870	5616	1160	\$116,586	\$254,981	\$3,303	0.9
The University of Queensland	\$976,671	8681	3582	\$180,214	\$787,737	\$8,720	0.9
The University of Southern Queensland	\$166,614	5160	345	\$107,119	\$75,770	-\$16,275	-9.8
The University of Sydney	\$1,117,493	12269	4069	\$254,699	\$894,790	-\$31,997	-2.9
The University of Western Australia	\$590,749	4209	1695	\$87,377	\$372,759	\$130,613	22.1
University of Ballarat	\$138,316	3242	218	\$67,303	\$47,908	\$23,106	16.7
University of Canberra	\$139,027	2932	354	\$60,867	\$77,883	\$277	0.2
University of South Australia	\$389,724	8450	1148	\$175,418	\$252,430	-\$38,125	-9.8
University of Tasmania	\$300,470	4112	856	\$85,363	\$188,172	\$26,935	9.0
University of Technology, Sydney	\$392,421	8329	1124	\$172,907	\$247,098	-\$27,584	-7.0
University of Western Sydney	\$378,116	8180	936	\$169,813	\$205,899	\$2,403	0.6
University of Wollongong	\$292,499	5914	1376	\$122,772	\$302,622	-\$132,895	-45.4
Victoria University	\$217,477	4037	655	\$83,806	\$144,116	-\$10,446	-4.8

Table 3 exhibits the 2007 values of $T(i, j)$, $E(i, j)$ and $R(i, j)$ (*Exp*, *Comp*, *Points*, respectively), together with the conversion of completions and points to equivalent dollar values (*Comp_\$* and *Points_\$*). The model residual for each university is reported as *Error_\$* and a normalised residual is calculated as *Error_\$/Exp*. A negative residual corresponds to a higher actual expenditure than the model predicts, for the given outputs.

Discussion

It is important to emphasise that I have presented a *statistical model* for the relationship between expenditure $T(i, j)$, education outcomes $E(i, j)$ and research outcomes $R(i, j)$. The linear relationship in Equation (1) is a *hypothesis* (assumption) to be tested, and not more. The *actual* division of expenditure by an institution on education and research may be quite different from the values presented in Table 2, and indeed the idea of clean separation between education and research outputs is itself problematic (Trewin, 2003; p14). Nevertheless, the coefficients in the model are of high statistical significance, and the model

explains a high proportion of the expenditure. Conjectures derived from the model may therefore be of value in exploring Australian higher education.

Three findings raise interesting and perhaps disturbing questions about the funding of the student experience in Australian universities.

First, the high correlation (0.98) between expenditure and research outcomes is quite remarkable given the perception of considerable variation among universities in the ratio of (a) education to research activity (hereinafter the education intensity) and (b) humanities-arts-social science (HASS) to science-engineering-technology (SET) activity (hereinafter the HASS intensity). The model is consistent with the finding that, irrespective of education intensity or HASS intensity, an expenditure on research output of approximately \$200,000 relates to the production of one HERDC point. The independence of this unit cost from education intensity reflects to some extent the dominance of expenditure on research for most universities, combined with a homogeneous ('unified') higher education system. I conjecture that the independence on HASS intensity arises from the tendency for high-cost SET disciplines (i.e. high in expenditure-per-researcher) to entail publication practices that produce more research output units (HERDC points) per researcher.

Secondly, the value of approximately \$20,000 per completion is unexpectedly small, particularly since university education expenditure is related to the stocks-and-flows of equivalent full time student (EFTS) load rather than a completion. To illustrate, note that in 2007 total completions were 247,000 and total (EFT) load was 691,000, a ratio of approximately 3 EFTS to 1 completion (these number refer to all Higher Education providers, not just the 36 universities used in the study, but the ratio is not significantly altered) as model-derived expenditure per completion translates to actual expenditure per EFTS, the model thus yields an expenditure of less than \$7,000 per EFTS.

Is it plausible that Australian universities expend on average less than \$7,000 per EFTS? To explore this question, let us consider a two-component costing model for the provision of education by coursework, one component being class size and the other the cost of academic staff.

Class size is modelled in two parts, lectures with (nominally) 100 students per teacher and tutorials/laboratories with (nominally) 20 students per teacher. There are large variations in the class-time requirements corresponding to full-time load, particularly between HASS and SET, and undergraduate and postgraduate, modes of instruction. For illustrative purposes, I adopt a load of 8 courses of 12 weeks duration, with each course involving (nominally) 2 hours of lectures and 2 hours of tutorials/laboratories per week. This model corresponds to 192 class-hours of lectures and 192 class-hours of tutorials/laboratories for an EFTS.

Total expenditure on academic salaries in 2006 is reported in the Higher Education Data Set as \$3.837B, and the full time equivalent (FTE) number of non-casual academic employees as 36,592. There are additionally a total of 14,661 FTE of casual employees, not allocated to academic and non-academic categories. I assume that casual academic staff contribute 12,000 FTE, for a total of 46,592 FTE academics. The average salary is \$82,353 per annum or \$58.82 per work-hour (assuming 1400 paid work-hours per year). Direct salary costs are 24.1% of total expenditure, so the *full cost* of an academic work-hour can be taken as \$244. Academic work does not comprise only in-class time; I allow 3 work-hours for each work-hour of actual lecture class time and 2 work-hours for each work-hour of actual tutorial/laboratory class

time. This implies that the total expenditure for an hour of class time is \$732 for a lecture and \$488 for a tutorial.

The teaching cost model described above leads to an estimate of the expenditure on one EFTS as:

$$Cost / EFTS = \$1,405 \left(\frac{100}{N_L} \right) \left(\frac{L}{2} \right) + \$4,685 \left(\frac{20}{N_T} \right) \left(\frac{T}{2} \right) \quad \text{Equation (2)}$$

where N_L, N_T are the numbers of students per lecture class and per tutorial/laboratory class, and L, T are the number of lectures and number of tutorials/laboratories per week. The ‘default’ values yield a cost of approximately \$6,000 per EFTS.

The teaching cost model reveals that it is plausible that Australian universities expend less than \$7,000 per EFTS. Note also that some educational activities will reveal themselves as research output in the model adopted here. These include completions of research higher degrees, which are frequently related to the production of HERDC points, and research outputs that relate to education outputs (e.g. journal articles on pedagogical matters).

The third finding concerns the *difference* between the reported expenditure and the prediction based in the model. Consider for example, the University of Wollongong (UoW) in 2007. The model provides support (in a statistical sense) for the hypothesis that Australian universities expend on average \$220,000 to produce a HERDC point and \$20,000 to produce a completion. With outputs of 1185 HERDC points and 5615 completions, the model predicts that UoW would expend approximately \$123M for completions and \$303M for points, for a total of \$425.4M. The reported expenditure is however \$292.5M. According to Salerno (2003), it can be said that the UoW is *efficient*. Flinders University, Charles Sturt University and Macquarie University also stand out as *efficient* in this sense in 2007. Murdoch University, the University of Western Australia and Central Queensland University were not as efficient in 2007 by this measure of efficiency.

The use of the term efficiency to describe ranked measures of productivity (Salerno, 2003) can be offensive to important academic values. Consider the University of Melbourne (UM) in 2007 as an example. The model predicts expenditure of \$971M against reported expenditure of \$1,245M, suggesting a degree of *inefficiency*. However, the University of Melbourne reports high levels of expenditure on scholarships, grants and prizes. Such expenditure is of exemplary academic value but relates weakly to completions or HERDC. Economists’ ideas of *inefficiency* can be questioned.

How do Australian universities fund the student experience?

The analysis presented here suggests that *rational* behaviour in Australian universities appears to lead to the following approach to funding educational outcomes:

1. Negotiate an agreed level of domestic student load and its related revenue with the Australian government.
2. Establish and deliver teaching and learning programs that minimise the revenue committed to these activities while satisfying accountabilities. These entail meeting load targets, satisfying the National Protocols and other contractual obligations, and

undergoing academic process audits by the Australian University Quality Agency (AUQA) and academic standards audits by other accreditation bodies.

3. Recruit international students who experience teaching and learning almost identical to domestic students, and who pay fees significantly above the cost of the education programs.
4. Use the revenue that is not expensed on education in these ways to stimulate intense, single-minded pursuit of research output. High research output directly generates additional revenue through the research block funds, and indirectly generates additional revenue through contract research. The strategy is *rational* because there is no advantage in expending any less revenue on research-related activities.

The effect of this dynamic is that slightly less than 1/3 of expenditure by Australian universities leads to educational outcomes, and 2/3 to research outcomes. If a research intensive university is defined as one that spends more than 50% of its revenue on activities that produce research output, then there are 30 research intensive universities in Australia.

Is education in Australian universities adversely effected by the current incentives? The connection between expenditure per completion on the one hand, and standards and quality of education on the other, is not well understood. However, Bradley (2008, p74) mentions what appear to be significantly lower levels of satisfaction reported by graduates from Australian universities than UK and US universities. The UK and the US higher education jurisdictions have public policy settings that are less prone to drive single-minded pursuit of research activity in all universities. The UK achieves this through a policy of research concentration, the US though highly diverse institutional roles. For example, the academically elite liberal arts, four-year colleges in the US do not concentrate the attention of their academics towards research activity; rather they maintain high levels of per-student expenditure on a rounded education including curricular and extra-curricular activities. The Boyer Commission (1998, p8) reports that

“it is obvious that not every student should, or would wish to, attend a research university...the requirements of daily living may be taxing, and sorting out the opportunities and finding like-minded individuals may be difficult...the rewards...however can be immeasurable”.

It does not appear to be difficult or risky to adjust public policy to weaken the drivers for intense research activity. The urgent policy requirement is to stimulate new and rational reasons for universities not to dedicate minimum expenditure to education and maximum expenditure to research. The boundary conditions to policy adjustments are traditional (e.g. university autonomy) and political (e.g. no losers). The following two steps might be considered:

1. Set aside a large proportion of the Commonwealth Grant Scheme to be allocated for university education renewal (non-capital) priorities. In one approach, each university would bid for a proportion of CGS funds to renovate and renew coursework curricula, educational technologies, and student experiences. The scale would be sufficiently ambitious to displace the attention on research activities – targeting say an expenditure of \$25,000 per completion over a 5-year program. Renovation of a Bachelor of Arts program with 500 completions, say, would attract an ‘education improvement’ grant of \$12.5M to be spent with minimum accountability by the Faculty concerned. The university would enter into a compact with the government that would guarantee not to redeploy academic

renovation funding to research-related activity. Selection criteria would be designed not to create winners and losers, but rather to focus attention on educational rather than research activity.

2. Replace the AUQA evaluation approach with a greater focus on standards and quality outcomes, managed at the university level through a system of national and international *academic visitors* funded within the CGS for the explicit purpose of linking the standards of Australian higher education to international standards.

Conclusions

The statistical analysis described in this paper suggests that expenditure patterns in Australian universities are shaped primarily by imperatives arising in government research funding policy. The findings are consistent with ubiquitous institutional expenditure allocation strategies that homogenise and minimise the average expenditure per student for educational purposes, and deploy the remaining expenditure in pursuit of highly leveraged research funding.

Insofar as increased per-student expenditure on education in universities improves educational outcomes, the public policy settings that shape the operating environment of Australian universities requires large scale renovation. There is an urgent need for timely and readily accessible data on system performance, and for stronger non-government institutional assessment capacity, to support far deeper analyses than presented in this report. Shifting public policy away from attending to the quality of educational processes, and towards the standards of educational outcomes, would encourage far greater attention by universities to their relative investment in education and research. Building new kinds of educational funding programs and winding back the wasteful and excessively competitive elements of current research funding programs would shift the balance of incentives to provide a greater proportion of investment in educational outcomes. It may even be possible to reduce sharply the private cost of university education in Australia without compromising educational outcomes or the working conditions of university staff.

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