The Funding of Higher Education: An Empirical Examination of the Cost of Education in Business Schools

By

Keith A Houghton
Nancy Bagranoff
Christine Jubb

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ABSTRACT

In late 2020, Australian university funding was profoundly changed by the ‘Higher Education Support Amendment (Job-Ready Graduates and Supporting Regional and Remote Students)’ Act. The Act is based on separate funding of education and research and relies heavily on estimates of education costs that are controversial. The Act increased tuition fees for domestic business students by 30 per cent. Using an empirical archival approach, this study examines three questions: (1) What are the costs of providing tertiary education to business students?, (2) Does research intensity impact the costs of education?, and (3) Is there evidence consistent with a cross-subsidy from education to non-teaching activities, including research? Unfortunately, sufficiently granular data for Australia is not publicly available, so we use data from business schools in US public universities as a proxy. The sample is partitioned between institutions professing a primary focus on either education or research. Results reveal that undergraduate degrees cost, on average, around AUD3,000 per annum per full-time student when regressed on university operating budgeted dollars, holding other factors constant; much lower than Australia’s increased business tuition fee under the Job-Ready Act. Significant differences for undergraduate, master and doctoral education costs exist between the education and research focused sub-samples. Master degrees are around triple undergraduate cost, on average. Both research (publications) and research training (doctoral degrees) are high cost, with ‘elite’ publications much more costly than other scholarly publications. We conclude that education costs are impacted by research intensity and that opportunities to cross-subsidize non-teaching activities exist.

Keywords: Costing, Education, Research, Universities
INTRODUCTION

In late 2020, the Australian Parliament passed the ‘Higher Education Support Amendment (Job-Ready Graduates and Supporting Regional and Remote Students)’ Act (hereafter ‘the Act’). The provisions of the Act profoundly changed the funding of Australia’s higher education system. A key principle in the Act is the funding of education as distinct from the funding of research – the joint key activities of universities. To a large extent, the Act relies on estimates of the cost of education across Australian university disciplines included in a Report by a consulting firm to the Australian Government, Deloitte Access Economics, entitled “Transparency in Higher Education Expenditure” (Deloitte, 2019) that was based on data provided by the universities.

The changes announced included significant adjustments to the student tuition fee component of total revenue generated by domestic undergraduate students (DESE, 2020b). Known as the Higher Education Contribution Scheme (HECS)1, this fee represents how much each student will, from 2021, contribute per annum per subject towards their education. This amount varies from a high of $14,500 for bachelor 3-year degrees in business, economics, management and four-year degrees for law2 to a low of $3950 for subjects in fields such as bachelor 3-year degrees in teaching, clinical psychology, English, mathematics, nursing, languages and agriculture (Bolton, 2020b). Previously, student contributions were much lower for some disciplines (such as business) and much higher for others (such as science). The then Minister said the reforms under the (then) Bill were based on university data from Deloitte and had better aligned “the cost to students and the taxpayer of teaching a degree with the revenue a university receives to teach that degree” (Bolton, 2020e).

Given the importance of the cost estimates in the funding arrangements, the focus of this study is on estimating the cost of education in combination with research as the jointly produced outputs of a

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1 The Higher Education Contribution Scheme HECS is the most well-known acronym but it is the Maximum Student Contribution Amount (SCA) that is the technical term for this contribution.

2 Law, economics, commerce and management were previously priced at $11,155, representing a 30 per cent increase.
university. The study focuses on a single field; the field of ‘Management and Commerce’\(^3\). We focus on this field and the business students in it for two reasons. First, it is one of the few fields of education (FOEs) that experienced a significant change (increase) in student contribution toward the cost of their degrees and decreased funding from the Australian Government under the Act\(^4\). The second reason is that, by examining a single FOE, we eliminate possible confounding effects that examining multiple FOEs might have in estimating research and education costs.

**Background and motivation**

The Act was passed approximately nine months after the first effects of the COVID-19 pandemic on international student tuition fee income. Arguably no country’s student population has been more affected by the pandemic than Australia’s. In the 37 major Australian public universities, at the time of writing, the total student population as at late 2018, the most recent date for official Australian Government data, was around 1.1 million full-time equivalent (FTE) students, with more than 380,000 coming from overseas and some universities at higher risk than others in the proportion of these students. These proportions make Australia the most dependent on international student tuition income amongst OECD nations (OECD, 2019a,b). Estimates by Universities Australia, the university sector’s primary advocacy body, suggest that the financial consequence will be approximately $16 billion from 2020 to 2023 (Bolton, 2020a). Given the pandemic and the resultant border closures, the downturn in international tuition income has significantly heightened the consequences of changes to domestic funding mechanisms.

Within business schools, of particular interest is the total amount of funding per FTE student. In 2021, for economics and commerce, under the Act, this is $14,500 in the form of the student tuition fee (the HECS payment) and $1,100 in the form of Australian (Commonwealth) Government support (CGS) contribution, a total of $15,600. The consulting firm, Deloitte, estimated the average cost of degrees, such as in commerce and business, to be around $15,000 (Deloitte, 2019), and for 17 universities tracked their estimates of costs for 2015, 2017 and 2018 (Deloitte, 2016 and Deloitte 2019).

**Use of the Deloitte Report as the cost basis for funding**

When first presented as a Bill to Parliament, the Act was not without controversy and was sent for scrutiny by a select Senate Inquiry. In total, 280 submissions\(^5\) were lodged. Support for the Bill was

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\(^3\) The field of education (FOE) relating to business schools is formally know as Field 08 ‘Management and Commerce’ and the related Field of Research (FOR) that most closely matches is Field 15 ‘Commerce, Management, Tourism and Services’ – see Australian Research Council 2019.

\(^4\) The field of business includes law, economics, society and culture, humanities and communications.

\(^5\) Two of the present writers were co-authors of two of the submissions. These submissions were independent of each other.
expressed in some quarters, but many submissions were critical (see, for instance, Massaro 2020; Marshman and Larkins 2020; Warburton 2020). The Chief Executive of Universities Australia, the body representing 39 Australian universities (including the 37 major public universities), made a number of comments in respect of the costs of education and is quoted as saying: “it was difficult to work out the exact cost of teaching a course, given so many expenses are shared between faculties” (Bolton, 2020f).

The criticisms varied but included concerns in respect of the validity of the costing data⁶. In its submission, the Department of Education, Skills and Employment (DESE) stated that the consultant’s costings “informed” the calibration of the Commonwealth Government’s funding levels by field of study⁷. A question by (Opposition) Senator Kim Carr to the Department included the observation “The underlying data used to calculate [the] cost of provision [of education] far exceeds the limitations of the data identified in the Deloitte report (pp. 52-54) ….”, and then asked: “What further work has the Department conducted to ensure this policy change is based on reliable data?”. The Department’s response pointed the Senator back to the 2019 Deloitte Report as a whole, without any response to the issue of reliability of the cost estimates.

Criticism was also forthcoming from the media. In an editorial in the Higher Education section of The Australian newspaper, Tim Dodd stated, “The trouble is that few people in the higher education sector find the figures plausible (and to be fair to Deloitte, it did put caveats around the data). A common complaint is that the report over-estimates the cost to universities of delivering business, law and many humanities courses…” (Dodd, 2020a).

As acknowledged by many commentators, the consultant’s survey approach to gathering the data used, which was provided by a sample of universities, has methodological limitations detailed by the Report authors themselves. The Deloitte Report (2019) was published before the Act and therefore was not developed with the level of rigour that one might associate with the development of a multi-billion dollar funding program. Further, the Deloitte Report (2019) notes many caveats, including references to the effect of ‘research intensity’ and ‘research activity’ on teaching costs⁸. While not directly named, some readers will interpret these statements as referring to Group of Eight universities and potentially different costs in these universities versus others. It also noted concerns from universities, stating that certain universities found it “difficult to disentangle from research

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⁶ For example, the submission by Mark Warburton - Submission 25 to the Inquiry.
⁷ See DESE (2020a) at page 29. The submission raises no concerns about that calibration nor acknowledges the caveats discussed in the Deloitte Report providing these estimates.
⁸ The Deloitte Report (2019, p. 55) states “Universities with a greater focus on research activity may also have differential costs of teaching to other universities”. Other references to an effect from research activity or intensity can be found elsewhere in the Report, including pages viii and 65.
activities” (Deloitte, 2019, p65). The Report further noted that some universities reported the need for context, including such aspects as scale, ‘capital footprint’, international students, mode of delivery and ‘extent of research activity’, among others (Deloitte, 2019, p. 68).

Confusingly, the Report also asserts that research intensity (measured as PhD enrolments rather than research publications or a range of other more conventional measures including research grant activity, ERA-ratings or the like) was not statistically significant in the modelling and that any cost effect of research can be explained by variation in fields (such as science or arts). Specifically, the Deloitte Report states (2019, p. 52): “Research intensity (level of HDR research) correlated with higher costs, however this effect disappeared after controlling for fields of education. This may suggest that research intensities are partly reflecting systematic differences in costs across fields”. The Report (p. 52) also asserts that certain other factors (external delivery (including online education) and international student enrolment) are not statistically significant in explaining variation in the cost of education. The nature of the statistical testing used to support these three conclusions is not disclosed. There is no reference to the possible effects of multicollinearity.

**Potential for cross-subsidization**

On 12 April 2020, the then Federal Minister of Education, Mr Dan Tehan, announced an $18billion guarantee program focused on domestic students (DESE, 2020b). Subsequently, two major policy announcements relating to education funding (DESE, 2020c) and research funding (DESE, 2020d) were made. Despite the probable historical existence of cross-subsidization, these statements can reasonably be taken to mean that cross-subsidies were not part of the future funding regime in respect of government financing.

However, there has long been speculation of a significant channelling of revenue from education towards the costs of research (see, for example, Bolton, 2020c). One estimate of the annual surplus on government-subsidized courses is reported as being more than $1bn (Dodd, 2020b). It has been claimed that $4.7 billion of the $12 billion (i.e., 39 per cent) that universities spent on research in 2018 came from a cross-subsidy from education fees (both domestic and international) (Bolton, 2020d). Business schools, in particular, are believed to heavily cross-subsidize other disciplines within Australian universities (Appleby, 2011; de Lange and Watty, 2011; ABDC, 2016) since they graduate more than half of Australia’s international students (OECD, 2019a; ABDC, 2020) and approximately one-third of Australia’s domestic students (ABDC 2020). Wilson and Thomas (2012) note that, in the US context, research is funded directly through grants or is ‘cross-subsidized’ by teaching.
Research questions

The core issue addressed in this paper focuses on the estimates of the cost of providing education in the field of business. In doing so, we seek to determine whether the tuition fees paid by individual university students reasonably reflect the ‘cost of education’ as reflected in the provisions of the Act. That is, is the Government’s claim that the base funding better reflected the cost of education supported? Also, given the potential impact of research on cost structures, we seek to assess the impact of research intensity on the cost of education.

Specifically, in the context of business schools, the two primary research questions are:

1. What are the costs of providing education to undergraduate (and other) students? and
2. Is there evidence that research intensity influences the cost of education (and research)?

Given the Australian Government’s policy position of separating the cost of education from the cost of research, the second question is of considerable importance.

A third research question that we cannot directly test due to data limitations but which we seek to shed light on is: Is it plausible that a cross-subsidy from tuition payments is used to support non-teaching activities, including research?

Put another way, this paper examines whether it is plausible to reasonably conclude that the annual cost of educating a full-time domestic business student is $15,600 (the student Higher Education Contribution Scheme (HECS) fee being $14,500 and the Commonwealth Government Support (CGS) funding of $1,100)? Alternatively, is it plausible that this amount is an overestimate of the underlying cost? If so, this may allow the opportunity for funding use as a cross-subsidy to research in business-related fields or other non-business activities.

The remainder of this paper is structured as follows. The first section examines what we already know about the cost of education and research and discusses some theoretical underpinnings. Next comes an explanation of the methodology employed and a description and discussion of the results. Also, we examine the variability of costs of education and research across two types of business schools – those with an education focus and those with a research focus. The final sections provide limitations and concluding remarks that draw out the implications of the results.

CONCEPTUAL UNDERPINNING AND REVIEW OF THE LITERATURE

The university and college sector in the Western world is a major economic and social enterprise with governments, students, philanthropic trusts, and others injecting billions of dollars into higher education activities each year. At the same time, these institutions are under pressure to perform as
efficiently as possible given funding (income) constraints (Martin, 2016; Coupet, 2017), rising costs and competition for students (Ashwin 2012; Berman and Paradeise, 2016). Hearn and Holdsworth (2002) refer to the ‘iron triangle’ of access, quality and efficiency that must be universities’ aim in delivering the societal responsibilities with which they are charged.

Universities, colleges and other higher education institutions (hereafter ‘universities’) deliver two primary outputs – education and research\(^9\). These two outputs are different but related: dissemination of knowledge through education and creation of knowledge through research. Income streams to support these activities include tuition fees, endowment returns, executive education fees, government funding, research grants, and philanthropy of various types. By far the largest expenditure is salaries. Typically, ‘academic staff’ or faculty\(^10\) members’ salary costs represent around 75 per cent of total university expenses (Wilson and Thomas, 2012, p. 370). We place no preference or bias on the weighting of the relative importance of or preference for education or research.

**Production costs of education and research**

This section summarises some of what is known about universities’ production of education and research outcomes\(^11\) and, in particular, in those academic units generally referred to as business schools. Historically, business schools focused on an education mission. Over time there has been a shift to adopting a scientific scholarship model involving research activity (Bennis and O’Toole, 2005). This model emphasizes scholarly research rather than the type of scholarship produced in some other professional schools, including medicine, where practice-led research is not universal but more common and strongly valued. University and school prestige through university rankings are often tied to knowledge production represented by publication in journals that value scientific rigour versus practical applicability.

Within business schools, it is rare to have ‘research only’ academic positions. Universities mostly, if not universally, are provided with funding to hire business school academic staff to teach, though they may be seeking academic staff with research skills and potential. The salary paid to a new hire will

\(^9\) It is acknowledged that universities and schools can have other secondary objectives beyond teaching and research, including service to the university or outside communities, provision of corporate or professional training outside the normal academic structure and the like. We argue that, although these activities have an element of interest, they are aside from the overall primary activities of education and research.

\(^10\) Here we use the terms ‘faculty’ and ‘faculty member’ to refer to persons employed to provide academic outputs for a university. Outside of the US, the term used is often ‘academic staff.’

\(^11\) We recognize that the actual underlying production costs of research, and to a lesser extent education, may not be contemporaneously expended in the same time period as measured here. We concede there is the possibility of measurement error. This may be mitigated by the presence of strong intertemporal correlation of the levels of both costs and outputs from one year to the next.
likely vary depending on the scholarly credentials and potential to produce quality scholarly research outputs.

Further, business schools rarely attract major external research grant funds compared with many other disciplinary areas, such as medicine and science. Data from the Australian Research Council (ARC), the most prestigious and competitive source of research funding for fields other than for medical research, show that the number and scale of research funding grants for FORs relating to business schools is less than 1 per cent of those relating to science and technology. That is, relatively little direct revenue is produced by research activity. On the other hand, educational activities contribute directly to revenue through tuition fees paid for education. The indirect benefit of research generally is seen as primarily reputational. The creation of research, it is argued, is a reputationally important outcome and significantly affects almost all university rankings (e.g., QS University Ranking, 2021), which, in turn, are seen to attract future students (both domestic and international) and their tuition fees. Together, these structural arrangements will, we argue, result in the presence and extent of research impacting and interacting with the cost of education in business schools.

Trying to measure the cost of teaching and research may raise the broader threat of “underproduction of public goods” (Cantor and Courant, 1997) and is steeped in risk (Hearn et al., 2006). Those with experience in university administration suggest that rarely if ever, do university administrators have clear evidence of the actual cost of research by discipline (or even in total) within academic units (Kenny and Fluck, 2018). Historically, the literature has focused on the cost of delivering education rather than research (Robst, 2001). However, overlooking the cost of research overstates the cost of providing higher education and creates biases across types of institutions (James, 1978).

**Cost of delivery of education and production of research**

Cost-effectiveness is rarely promoted as the highest of university priorities; however, it is likely to be an important underlying characteristic of university management. With the university sectors’ funding environment perpetually ‘tight’, especially in the circumstance of dependence on governments and government agencies for funding, cost-effectiveness has a constant presence in university managers’ lives (Garrett and Davis, 2011). In recent years, this phenomenon has attracted the attention of researchers and policymakers examining university productivity or efficiency (see, for example, Thanassoulis et al., 2011, and Moradi-Motlagh et al., 2016) but little by way of attention to costs or

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12 For example, the number of ARC Discovery grants in Round 1 in 2019 was, for business fields of research, 3 grants and a total of 469 for science and technology. The total funding for Management and Commerce was around $939,000 from a total funding pool of $262,590,367 (or around one third of one percent). See ARC 2019.
relative costs of education and research. The literature on efficiency recognizes the ‘trade-off’ of one outcome (say, research) at the cost of an equivalent quantity of the other (say, education). For instance, Houghton (2018) demonstrated the use of efficiency estimation techniques to calculate the relative cost (or ‘exchange rate’) between the cost of education and the cost of research.

Previous research on university production costs and efficiency notes that a challenge exists in identifying valid and reliable measures of education and research outputs. For example, Verry and Layard (1975) estimated costs for undergraduate and postgraduate teaching and research, finding it much more costly to educate postgraduate students than undergraduates. They used undergraduate and postgraduate enrolments and academic staff member’s hours spent on research as output measures. Student enrolments or hours spent on research may not be optimal proxies as they do not account for quality. Even when research costs are tied to output measures such as academic journal articles, quality is not considered. While student enrolment is an input measure, degrees granted is problematic as a measure of teaching for several reasons, including the cumulative effect of teaching and teaching students who do not graduate.

**Theoretical lens**

There are multiple theoretical lenses through which the consumption of scarce resources can be examined. These include production theory (Wolman, 1921), new public management (Canhalil et al., 2016), resource dependence theory (Berman and Stivers, 2016), institutional theory (Gehman et al., 2016), or institutional logics theory (Berg and Pinheiro, 2016).

Each can provide a perspective in examining the relative costs of research and education and the operational management and policy settings in universities. One can also bring into consideration core theories in economics on comparative advantage.

We conjecture that comparative advantage may affect the cost of the production and delivery of education and research. The theory would suggest that one would expect lower costs for the production of research (and likely research training – doctoral degrees) where a school professes a focus on research – that is, universities that might be labelled ‘research-intensive’. The Group of Eight peak body often argues that research-intensive universities contribute more productively to the Australian economy. This argument was recently put in a sponsored consultancy report by a professional services firm (London Economics, 2020).

Similarly, one might expect that there would be lower costs for education where an institution is more education-focused, other things being equal. The most obvious example of where things are not equal relates to the quality of teaching or the quality of research. We return to this issue later in the development of the model to be tested.
RESEARCH APPROACH AND DATA

The research issues for which we are seeking to provide evidence in the context of business schools are: (1) an estimate of the cost of delivery of education and the cost of the production of published research, and (2) the variability of these costs that can be explained by research intensity or differing foci (research or education). Thirdly, we also seek to assess the plausibility of cross-subsidization from teaching revenues to expenditure on research or other activities but acknowledge that data limitations mean we cannot directly test this as a hypothesis.

As noted above, the second question involves dealing with the potential confounding effect that research activity has on the cost of teaching in any given FOE. Recall that the Deloitte Report (2019) asserted that the effect on the cost of education in the presence of research was not statistically significant when controls for differing FOEs were applied. Privately, some in the university sector are sceptical of this assertion. The Deloitte Report (2019) acknowledges this when it states: “There continue to be challenges for many universities in separating the costs of teaching and scholarship from research activities. This is because resources are often shared between different activities and collecting data on how those resources are shared poses practical difficulties. This is particularly the case for staff time……” (p. vii). The Report goes on to state: “...although the use of regular staff time surveys can help provide a more accurate measure” (Deloitte, 2019, p. vii). It can be argued that staff time surveys face several challenges in capturing accurate data, and it is not clear they provide ‘a more accurate measure’. In some ways, this issue also motivates this present study which uses an empirical archival approach.

The Deloitte Report (2019) implies that the effect of research activity on cost is explained (and captured) by controlling for the disciplinary field, and this is tested in this study. If the assertion is correct, then holding the disciplinary field constant should result in research intensity not impacting education cost. When seen from this perspective, we strongly dispute the validity of this assertion. We conjecture that, unless and until research costs are measured and accounted for separately, in any particular disciplinary field, the cost of education is influenced by the presence and extent of research intensity.

**Production costs: Research design and method**

The analysis uses OLS regression with an intercept included in the model\(^\text{13}\). The dependent variable is the cost to the school of the production of academic outcomes measured as the school expenditure (Operating Budget). The independent variables are (1) education output measured as FTE student load

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\(^{13}\) As noted below, we also use OLS regression without an intercept to further examine this issue. See below for a discussion of the structural implications of this for interpreting the costs of education and research.
for undergraduate, master and doctoral students, and (2) research output measured as the number of unique-authored research publications, both in ‘elite’ journals and a more comprehensive set of scholarly journals.

Specifically, we use the following model to test the first research question:

\[
\text{Expenditure}_{it} = \beta_{1,3}\text{Student Load} (\text{UG}_{it}, \text{Master}_{it}, \text{Doctoral}_{it}) + \beta_{4,5}\text{Research Publications (Elite}_{it}, \text{Other}_{it}) + \epsilon_t \tag{1}
\]

Where for university \(i\) at time \(t:\)

**Dependent Variable**

Expenditure = School operating budget data

**Independent variables**

Student Load = Full-time equivalent (FTE) students (Undergraduate (UG), Master and Doctoral)

Research Publications = Total equivalent Elite and non-Elite (Other) unique authored publications

This same modelling approach is used to answer the second research question concerning the impact of ‘research intensity’ by partitioning the full sample of business schools into two groups reflecting differences in research focus. To answer research question 2, we test for differences in costs between these two sub-samples.

Before explaining the measures adopted for the dependent and independent variables, it is necessary to describe the data used to test Equation 1.

**Data**

While DESE makes publicly available a range of relevant data (other than research publication data\(^{14}\)) for all Australia’s public universities and a range of private institutions, these public data are generally at ‘whole of institution’ level.

A request for access to more granular data was first made in 2018 to the then Department of Education and Training (DET). While certain assurances were received over an extended period of time, by the latter part of 2020, no written approval to access data had been received. At this time the Bill, the basis of the current Act, had been introduced into Parliament. Further, although some data are

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\(^{14}\) For some years prior to 2016, DESE collected research publication data which was referred to as the Higher Education Data Collection (HEDRC). This dataset now does not include publications data.
available on the Quality Indicators for Learning and Teaching (QILT) website\textsuperscript{15}, these data are de-identified and not useable for this study\textsuperscript{16}.

Therefore, while the question of the cost of education at each of the undergraduate, master and doctoral levels and the cost of research and the interrelationship between the two is of particular interest in the Australian context given the Act’s passage, directly relevant data are not being made available by the bureaucracy.

However, data are available for US universities and, in particular, US business schools. Hence, this study utilizes data available for AACSB\textsuperscript{17} accredited business schools in public universities (often also referred to as colleges) in the US to estimate the cost of education and the cost of research as a proxy for the Australian setting\textsuperscript{18}.

The AACSB periodically administers a Business School Questionnaire that discloses general information about each school, including demographic data, enrolment data, programs offered, number of faculty members (academic staff), expenditure information and self-nominated school focus (education or research). We use this publicly available data for 283 US business schools in public universities as reported in the AACSB 2016-7 survey, the most recent data we have. We use this US AACSB business school data, converting to Australian currency for expenditures, in the absence of appropriately granular data from Australia\textsuperscript{19}.

**Justification of variables and variable measures in Equation 1**

Consistent with Verry and Layard (1975), we use student enrolment as a proxy for measurement of teaching, though it fails to consider teaching quality, and using degrees granted is problematic due to the cumulative effect of teaching and teaching students who do not graduate. We also note that master degrees in business in Australia and the US are predominantly coursework master rather than master by research. Regarding the cost of education programs, we expect that PhD programs will be more expensive than master-level degrees; and in turn, master-level degrees will be more expensive than undergraduate degrees.

Finding a suitable measure for research also has challenges. Using research grants obtained takes quality into account in that grant applications successfully awarded may reflect academic staff track

\begin{itemize}
  \item \textsuperscript{15} www.quilt.edu.au.
  \item \textsuperscript{16} In response to a draft of this paper, DESE referred to the *Higher Education Support Act 2003*, s180-25, claiming that it precludes making the requested data available.
  \item \textsuperscript{17} Association to Advance Collegiate Schools of Business.
  \item \textsuperscript{18} We do not include business schools in private universities given the absence of private universities amongst the 37 major universities in Australia most clearly affected by the Act.
  \item \textsuperscript{19} The exchange rate used to convert to Australian dollars is as at August 2017 being AUD1.26781 for each 1 USD.
\end{itemize}
records and the importance and potential contribution of their ideas. However, for business, research grant income is minimal in both the US (Kaplan, 2018) and Australia. Instead, we draw on data relating to research publications to measure research. To provide some measure of differential research quality, we use a measure of ‘elite’ and ‘non-elite’ journal publications.

The ‘elite’ research publications data are taken from the listing of publications in the University of Texas, Dallas Research Collections public dataset for the relevant year (mean of calendar years 2016 and 2017). The research publication score is measured as the mean number of unique authored publications in business journals in this dataset over two years, 2016 and 2017. The journals included are shown in Table 1 and include 24 of the most academically prestigious journals relevant to publications authored by scholars affiliated with business schools. The list of other (i.e. non-elite) publications is drawn from the journal listing used to construct the Research and Education Efficiency Frontier (REEF) Index and includes over 3,000 journals relevant to business schools. The more general ‘Other’ publication measure involves excluding all elite publications from the wider set of publications.

The measure used is ‘unique authored publications’, which we define in the following way. Where a paper is single-authored, we measure this as one unique authored publication. Where two co-authors are named, we measure this as 0.5 of a publication for each author and their affiliated institution. Three co-authors represent one-third of a publication, and so on. In rare cases, where faculty members are affiliated at two institutions, we credit both schools. With the data from the study period, we observe a mean number of a little over 2.5 co-authors per publication.

PLACE TABLE 1 HERE

We anticipate that each of these two independent variables will be positive in their association with the expenditure represented in the operating budget expenditure. We postulate that research, measured as publications amongst ‘Elite’ and ‘Other’ categories, will be a significant cost for business schools, and thus, research intensity will significantly impact the costs despite limited research funding. Further, we expect the school’s (self-nominated) focus (research or education) to be an

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20 As noted earlier, the number of ARC Discovery grants in Round 1 in 2019 was, for Management and Commerce, 3 grants and a total of 469 for science and technology. The total funding for Management and Commerce was around $939,000 from a pool of $262,590,367 (or around one third of one percent). See ARC 2019.

21 We acknowledge that this list of elite journals is limited in scope compared with the full range of research outlet options used by the population of faculty members. However, it does represent a cross-section of the elite scholarly research outlets used by US faculty members.

22 See www.REEF-Index.com

23 This number of journals is somewhat larger than the 2019 list of relevant scholarly journals issued by the Australian Business Deans Council.
important mediating variable in estimating both research and education costs. We argue that the cost of research per publication in education-focused schools will be greater than in research-focused schools. The expertise, infrastructure, and environment, amongst other related factors, in research-focused schools are likely to be less readily available in education-focused schools. We also expect that expenditure on doctoral-level education will be significant for research-focused schools since, unlike Australia, many US business schools (including a proportion of research-focused schools) choose not to offer PhD programs.

Validation and robustness checks

We conduct two analyses as validation and robustness checks. First, we force all costs from Equation 1 to be distributed among teaching and research costs by estimating the regression without the constant. Since the intercept in all regressions, where significant, can generally be thought of as a fixed cost over the relevant range of observations (Bazley, Hancock and Robinson 2014), omitting the constant can provide a clearer picture of the cost relativities between teaching and research and also of what might be considered sunk compared with marginal costs.

Second, we replace Operating Budget as the dependent variable with the number of FTE faculty or academic staff (that is, academic staff time) as a robustness check since a considerable proportion of university expenditure is on salaries and related expenses (Wilson and Thomas, 2012, p. 370).

COSTS IN US PUBLIC BUSINESS SCHOOLS:

Descriptive statistics

For the 283 public business schools with all data, 147 (52 per cent) declare themselves as including a research objective, and 136 (48 per cent) see their role as education-focused. Descriptive statistics are shown in Table 2, together with a breakdown by school focus. For the full sample, an average business school has 77 faculty members, an annual expenditure (Operating Budget) of AUD19

\[ \text{Equation 1} \]

24 There is also a methodological advantage to using faculty time as it is less prone to differences in budgeting processes. That is, some universities might record in school expenditure budgets only direct costs, others might include capital works. One faculty member is a more constant measure adding to its reliability as an independent measure of resource usage.

25 Certain business schools, including some high-profile schools, did not provide all data, in particular costing data, and therefore are not included in the analysis.

26 While the AACSB permits multiple combinations of foci, for this research, we classify schools into two categories; those that include research as a primary focus and those where education is the exclusive primary focus.

27 In the AACSB data, the measure of FTE faculty members does not include other resources used in education and research. In some business schools, a proportion of classes are taken by graduate (often PhD) students who may not be included in the measure of faculty. If this is true then, in part, this represents a misspecification of the total academic time spent on the education effort in such schools.
million\textsuperscript{28} and 2,020 FTE undergraduate students\textsuperscript{29}, 287 master students and 15 doctoral level students. Total unique-authored publications average 54, broken down as two on average in elite journals and 52 on average in the other (non-elite) publications category. There is high variability in these measures, both between and within the two groups of business schools.

All variables noted above are significantly different between education and research-focused schools. The mean number of faculty members is 51 and 101, respectively (t=6.390, p<.001). The mean expenditure levels are AUD8.8 million for education-focused schools and AUD28.4 million for research-focused schools (t=7.967, p<.001). Education-focused school FTE undergraduates number on average around half of that for research-focused schools, with 1,295 compared with 2,691, (t=5.030, p<.001); whereas master students number, on average, around one-third, with 144 compared with 418 (t=5.539, p<.001). Doctoral students number less than one, on average, for education-focused schools and 29 for research-oriented schools (t=6.888, p<.001).

Elite publications average 0.22 per year for education-focused schools, and this average is significantly different from the 4.49 for research-focused schools (t=4.794, p<0.001). The non-elite or ‘other’ publications are also significantly different; for education-focused schools numbering 16, on average, and 85 for research-focused schools (t=7.698, p<0.001). An important point to note is that although a particular business school may not include research as a focus or interest, individual faculty members in that school may seek to publish research.

PLACE TABLE 2 HERE

The Pearson correlation matrix reveals many significant relationships at p<0.05 between the independent variables, and some of the raw correlations are at levels that may create concerns over multicollinearity. For instance, the highest correlation at 0.742 is between the number of doctoral students (FTE Doctoral) and the number of unique-authored other publications (Other Pubs). The correlation between the number of undergraduate students (FTE UG) and the number of unique-authored other publications (Other Pubs) is 0.629. Given this, multicollinearity is monitored in the OLS regressions through variance inflation factors (VIF).

PLACE TABLE 3 HERE

\textsuperscript{28} We convert US dollars to Australian dollars for the relevant year given the study’s purpose to elaborate on Australian universities’ costs to elaborate on our findings’ implications.

\textsuperscript{29} In the AACSB data, student numbers are reported as full-time and part-time. We made an assumption that a part-time student would carry 50 per cent of a full-time course load and that part-time faculty members would, on average, carry a half-time load.
Production costs and analysis: Results and discussion

The first model noted above focuses on the cost of education as well as the cost of research. We first estimate these costs in terms of the operating budget expenditure for each school, measured in Australian dollars, using the model in Equation (1). The results reported in Table 4 show that the model is significant (F=678, p<.001) and a good fit (Adjusted R square of 92 per cent) for the full sample of both education-focused and research-focused schools. Coefficients for FTE undergraduate, master and doctoral education are positive and highly significant (respectively t=11.208, t=6.417, t=8.814, all at p<.001). The elite and other publications measures are also highly significant and positive (t=5.427 and t=12.607, each p<.001). However, the highest VIF at 3.104 may indicate multicollinearity at a concerning level. Various ways of dealing with this issue are discussed below\textsuperscript{30}.

PLACE TABLE 4 HERE

The two sub-samples are analyzed separately, and results are shown in Panels B and C of Table 4. For the education-focused analysis, shown in Panel B, neither the elite publications nor doctoral-level education (research training) measures are significant\textsuperscript{31}. For the reasons noted previously, this is not unexpected.

Near identical results to the full sample for each of the independent variables are reported in Table 4 Panel C for the research-focused sub-sample (i.e. all independent variables are positively and significantly associated with the operating budget school expenditure). All coefficients are highly significant (p<.001).

Panels B and C report significant F-statistics and high Adjusted R squares (86 and 90 per cent, respectively). Notably, the regressions using the sub-sample data reveal VIFs markedly lower than that for the full sample, with the highest VIF for the education-focused sub-sample being 2.017 and the research-focused sub-sample being 2.469. These sub-sample results are likely to be more clearly interpretable, given the lower multicollinearity.

The results show that in the context of available data and averaged over the whole sample, the cost of educating an undergraduate business student is between AUD2,300 and AUD3,500. As indicated below under limitations, this cost excludes university-wide expenses, including infrastructure,

\textsuperscript{30} The VIF drops to no more than 2.3 where the full sample is reduced by eliminating around 18 of the institutions where the ratio of Expenditure per Faculty member is greater than $US500,000. The significance of the independent variables remains unchanged.

\textsuperscript{31} Note that if the regression includes only one (comprehensive) research variable (elite plus all other publications) in place of separate variables for each type of research publication, this single variable is significant for both the research and education sub-samples.
executive salaries and the like. However, it is markedly below the cost used to support DESE’s calibrations for business education in Australia.

These coefficients are estimated with the inclusion of an intercept in the model. Note that in all cases, the intercept is statistically significant. Given this, it is reasonable to interpret the significant independent variable coefficients as ‘variable costs’ and the intercept as the ‘fixed cost’ of a school. Thus, the coefficient or variable costs for the full sample can be described as follows: for each additional undergraduate student based on the full sample, the overall expenditure increases by around AUD2,700. Education-focused schools show a somewhat higher dollar value, and research-focused schools a somewhat lower dollar value, and these two dollar values are significantly different from each other ($\chi^2 = 4.13$, $p<.05$). Similarly, for master-level education, there is a significant difference ($\chi^2 = 4.30$, $p<.05$) between the sub-samples. The doctoral education variable is significant in the research-focused sub-sample and not in the education-focused sub-sample, so it is unsurprising that the difference here is significant also ($\chi^2 = 5.12$, $p<.05$). While acknowledge that the Deloitte (2019) estimate is an average rather than marginal cost per student, the discrepancy begs an explanation.

The average (mean) cost of providing master coursework postgraduate qualifications is approximately three times undergraduate education for the full sample. A doctoral-level degree, the primary tool used in research training, is many more times the cost of undergraduate education, reflecting considerable consumption of resources and the fact that doctoral programs in the US are small with little or none of the economies of scale that may be possible in many exclusively coursework programs.

As noted elsewhere, all of these cost levels do vary between the two sub-samples. For the research-focused schools, the results are similar to the full sample, with undergraduate education costing around AUD2,400 per annum, master students around quadruple the undergraduate cost and doctoral students over 70 times that cost.

For the education-focused schools, undergraduate education costs around AUD3,400, with master-level education being approximately AUD3,700. Note that there is no significant difference between the cost of undergraduate and master level education for education-focused schools, whereas for research-focused schools, there is (F=0.05, $p=.825$ and F= 16.36, $p<.001$, respectively). As expected, neither doctoral education (research training) nor elite research publications are significant in explaining school expenditure for education-focused schools.

As noted above, in respect to the comparison of research and education-focused schools, the cost of research published in non-elite journals is approximately forty per cent higher in education-focused
schools than the cost of those same research publications published by faculty members in the research-focused school sub-sample.

Re-estimation omitting the intercept (i.e. removing the partition between variable and fixed costs)

As noted above, a significant intercept (constant) can be thought of as the fixed costs within the school over the relevant range of teaching and research activity. The coefficients for each independent variable can be considered variable costs (be it for research or education). While this cost structure conforms with the research literature in management accounting and conventional wisdom in accounting practice, it is not consistent with the funding provided by the DESE mechanism for domestic students. This funding structure does not directly recognize the presence of fixed costs, and education funding attracts a fee per student. To accommodate this, we re-run the OLS regression omitting the intercept. The results (not tabulated) show an increase in the coefficients for both the undergraduate and master-level education variables. For the full sample, the undergraduate education coefficient rises to around AUD4,000, and the master degree coefficient to a little over AUD13,000. The coefficients for doctoral-level education and elite research publications reduce, with little change in ‘other’ publications. Given this study’s objective, the critical point is that the cost of undergraduate education does not approach the funding level specified in the Act of AUD16,000 for Management and Commerce, even in a model where the intercept or fixed cost is absorbed into the independent variable coefficients.

The impact of research on education costs

Given the importance of research in the life of universities and their faculty members and the implicitly asserted lack of impact on the costs of education in estimates used by DESE, we further test the impact of research on education costs directly in three ways. First, we re-run the OLS regression reported in Table 4, Panel A but remove both research variables (‘elite’ and ‘other’ publications) (see Table 5). The model remains significant (F=519, p<.001) but with a somewhat lower Adjusted R square (at 0.846). The Table 4 Panel A undergraduate education cost (with research variables) is significantly different from the results (Table 5 Panel A) without research variables (Chi² = 8.67, p<.01), as is the case for master-level education cost (Chi²= 10.66, p<.01) and doctoral-level cost (Chi²=34.23, p<.001). The undergraduate cost increases from AUD2,683 to AUD3,657. While this is a significant increase, it remains well below the cost estimate used to support the Act. Both master and doctoral costs rise significantly also.

We further test for the effect of research on education costs by re-running the regression with all three education variables and an indicator variable for school orientation (research or education) (Table 5 Panel B). The results show an increase in the Adjusted R square and the indicator variable
(education = 0 and research = 1) is significant \((t= 2.626, p<.01)\) with a positive coefficient. That is to say, research-focused schools have higher costs overall than education-focused schools. The coefficients reported in Table 4 Panel A compared with the coefficients for the education variables in Table 5, Panel B remain significantly different (undergraduate, \(\text{Chi}^2=7.28, p<.01\), master \(\text{Chi}^2=6.56, p<.05\) and doctoral \(\text{Chi}^2=32.54, p<.001\). The fact that the indicator variable is significant is consistent with the overall cost differences between the two sub-samples. Moreover, the fact that the three education-level variables remain significantly different is consistent with the need for a more granular measure of research to tease out the cost differences between the two school focus types.

The third further test is to include a (continuous) variable capturing all research publications (both elite and non-elite) and the focus (education or research) indicator variable. Again, the model is significant \((F=649, p<.001)\) with an increased Adjusted R square \(0.920\). The ‘all’ research measure is highly significant and positive \((t=15.685, p<.001)\) (Table 5 Panel C). The inclusion of this variable results in the indicator variable (education or research-focused school) becoming insignificant and, as expected, the coefficients for each of the education-level variables are much like those seen in Table 4 Panel A.

**PLACE TABLE 5 HERE**

Thus, we conclude that the inclusion of research measures is critical in modelling the cost structures in business schools and impacts the costs of education. Based on this evidence, we reject the assertion that research intensity’s impact can be assessed by controlling the disciplinary field. Within this single FOE, the costs of education are significantly impacted by research. One possible explanation for the difference between DESE’s consultant’s observations and the results here is that the consultant’s results are based on a sample of institutions using a survey methodology while the results reported in this study involve a population of schools and employ an empirical archival research approach.

**Robustness tests**

As a robustness test, we substitute FTE Faculty for Expenditure as the dependent variable. FTE Faculty measures academic staff time. The results of the OLS regression using FTE Faculty as the dependent variable (untabulated) show that the model is significant for both the full sample and the two education and research-focused sub-samples \((F=292, F=118\) and \(F=112\), respectively, each at \(p<.001\)) with a good fit (Adjusted. R squares of 0.805, 0.772 and 0.753, respectively). For the full sample, the coefficients for undergraduate, master and doctoral education are positive and highly significant \((t=16.254, t=5.482, t=2.654, \text{each at } p<.001)\). The publications measure (capturing all research publications) is positive and significant \((t= 3.953, p<.001)\). The coefficients for the three education
variables are 0.016, 0.030 and 0.126, respectively, for undergraduate, master and doctoral-level education.

For the research-focused sub-sample (untabulated), all three education level variables are positive and significant ($t=10.251$ and $t=3.756$, both at $p<.001$; $t=2.977$, $p<0.01$). The coefficients for the undergraduate, master and doctoral-level education variables are 0.014, 0.029 and 0.262, respectively. The single research variable (elite and other) coefficient is 0.076.

For the education-focused sub-sample (untabulated), the coefficients for undergraduate and master-level education are positive and significant ($t=13.998$, $p<.001$ and $t=2.291$, $p<.01$) and near identical at 0.020 and 0.022, respectively. The doctoral education (research training) variable is not significant for this sub-sample.

The intercept (fixed costs) for the research-focused sub-sample is highly significant and greater than double the value for education-focused schools. The research variable is only weakly significant for the research-focused sub-sample. This combination of results is consistent with the proposition that faculty members’ time in research schools is spent on research. That is to say; the FTE Faculty time variable is more akin to being a fixed cost (or non-changeable expectation) than a variable cost, remembering, of course, that reported results in Table 4 with ‘expenditure’ as the dependent variable capture a wide range of research expenditures, such as research assistants’ salaries and database subscriptions as well as faculty members’ salaries. Put another way, there is a ‘fixed’ expectation of a commitment to research and publication in research-focused schools that may not be present in education-focused schools.

Interestingly, education-focused schools consume more faculty member time on undergraduate education than their research school counterparts (2.0 per cent compared with 1.4 per cent per FTE undergraduate). However, this difference is only weakly significant ($\text{Chi}^2=2.69, p<0.101$).

The research publication variable (elite and other) is significant for both school sub-samples, with the coefficient markedly lower for research-focused schools (7.6 per cent of an average faculty members’ annual workload on each publication) than the education-focused counterparts (35 per cent of annual workload). This result is consistent with earlier observations relating to the results reported in Table 4.

Importantly, the results for both the analysis using Operating Budget Expenditure as the dependent variable (Table 4) and FTE Faculty member as the dependent variable are consistent. That is to say, the results tell a similar story. Removal of the intercept from this FTE Faculty regression analysis does not alter the conclusions drawn from the results described in this section.
Implications for Australian universities and business students

Extrapolating the untabulated results for the full sample using FTE Faculty as the dependent variable provides some useful insights. Comparing the coefficient for FTE UG of 1.6 per cent to the Australian tuition fee for business degrees under the Act equates to 62 undergraduate students per FTE faculty member, providing annual combined funding (HECS plus Government contribution) of AUD16,000 each or AUD992,000 per annum. The most common (senior lecturer) academic position in Australia is paid between around AUD123,000-AUD142,000 per annum. An appropriate surcharge for personnel on-costs (e.g., superannuation, payroll tax) used in ARC funding applications is 30 per cent, taking the highest of this range to AUD185,000. At full professor level, salary plus 30 per cent on-costs equates to around approximately AUD250,000 to AUD450,000 per annum – still significantly less than the HECS fee income for the estimated 62 students per faculty member.

Adding overhead and infrastructure costs (e.g. building depreciation, laboratory equipment and its depreciation, university-wide library and IT services, university executive costs and marketing budgets, among many others) would also add more to the total cost (if a charge is not imposed on business schools)\(^{32}\). However, to some, these costs might be considered sunk costs for a costing analysis. Given this, these results provide prima facie evidence that the US cost relativities transplanted to Australian values suggest the total contribution of AUD15,600 per annum per FTE undergraduate for a business degree is, potentially, an overestimate and includes a sum that may be used for other purposes including to cross-subsidize research expenditures or activities other than educating business students. Further, one could assert that the AUD14,500 individual student contribution (the remaining AUD1,100 is a government contribution) represents a potential overpayment for the services delivered if students are expected to pay only for the cost of their education.

We argue that the evidence is consistent with two key conclusions. First, given the absence of significant research funding in Australian business schools, we conclude that the funding provided for education (i.e., revenues to universities) likely is used to cross-subsidize research costs in the business field. It is also possible that these funds are used to support other non-business education or research activities. The policy question becomes, is it an unintended consequence of the Act that the tuition (HECS) contributions made by business degree undergraduate students (FOE ‘Management and Commerce’) provide funding for non-teaching activities including but not limited to research in business, research in fields other than business or teaching in fields other than business? If so, is it

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\(^{32}\) The first named author has been involved in whole of university finance functions in two major Australian universities over many years including central budgets committees and university and Council finance committees. Based on this experience, it does not seem plausible that these central costs would not result in a more than doubling of ‘frontline’ school or faculty level costs.
correct to say that this outcome is optimal for the Australian community? The second conclusion we reach is that the cost of research is high, and some would argue very high, as is discussed next.

The cost of research

We note that the cost estimate for research in each analysis may seem exceptionally high. However, it must be remembered that these estimates include more than just the marginal costs of research projects completed and published. The estimates capture all of the costs (including school level ‘overheads’) in the business schools that are associated (correlated) with published research production. We speculate that many researchers and university managers would struggle to fully appreciate or estimate this full cost (instead of the marginal cost) of research.

The research costs measured here include all costs in the development, execution and refinement of research, its publication, and all other costs associated with all research. These estimates also include the costs correlated with published research and include work on research never published, the costs of reviewing others’ research, journal reviewing tasks, research grant applications, and the contemplation of research ideas and reading of research. There are financial costs such as research assistants, data scientists, research infrastructure, including but not limited to data subscriptions and library services, amongst many other costs. These costs also include the differential salaries paid to research-successful staff over those who are not so research-prolific.

The estimates we generate include ALL the costs of having research activity ‘captured’ in the cost of elite and other publications. Put more directly, being a research-active institution with research-active faculty members involves considerable cost. Indeed, just one single non-elite unique authored publication represents the equivalent of teaching over 40 FTE undergraduates across a full year for the full sample. This relativity might be thought of as an exchange rate between education and research and illustrates the cost of research in scholarly journals in business graphically.

The theoretical position partly supporting an AUD15,600 cost for undergraduate business education

Re-analyzing the data but treating both research and research training as ‘worthless by-products’ starts to reveal costs that approach the Deloitte Report (2019) survey-based estimates. That is to say, if the presence of research and research training (doctoral students) is ignored in the model then the cost of both undergraduate and master-level education rises markedly. When the OLS regression is re-run (untabulated) with the intercept suppressed (that is, the fixed costs are apportioned to the ‘variable’ costs) and research and research training variables are removed, then the teaching cost per FTE undergraduate student is between AUD5,000 and AUD10,000 per annum. This outcome holds for the full sample and both sub-samples. In each case, the models are significant (F=520 or more, each model at p<.001) with a good fit (Adjusted R square > 0.8).
Allowing for the costs of university-wide infrastructure and other costs, this result may provide some support for the estimates used to underpin the tuition costs applied in the Act; however the Deloitte data collection did include these costs and they are likely to comprise a reasonably large component of the cost. However, treating research and research training as valueless by-products cuts across the notion that these activities are an integral part of the life of a university and its faculty members and central to its operations.

**LIMITATIONS**

This study is not without limitations. The data used are for business schools in public institutions in the US. Data from Australia was sought but was not made available at the required level of granularity. Therefore, US data is used as a proxy. There are both similarities and differences in the Australian and US higher educational systems. Many of these differences relate to funding mechanisms rather than costs, as both US and Australian business schools seek to contribute by way of education and research outcomes. Additionally, we would argue that a major difference between the US and Australia is controlled for by including public institutions only in the sample. Institutions such as the elite private business schools (e.g. Harvard, Stanford, Wharton, Chicago and others) are not included in the analysis. We also acknowledge a greater level of reliance on philanthropy to fund US universities compared with Australian universities. This difference, while significant, directly impacts funding (i.e. revenue inflows) rather than costs incurred, and it is costings that is the focus of this study. Other differences include the more limited presence of doctoral programs in the US compared with Australia. However, the US is not a low-cost education provider, which is the key reason US data is used as the preferred proxy for unavailable Australian data. The extent to which these differences result in dissimilar cost structures between institutions in Australian higher education and those in the US limits the generalisability of the results to Australia.

We define ‘elite published research’ by reference to the 24 journals selected by the University of Texas, Dallas as high quality. This measure of research has limitations. Other listings, such as the Financial Times list of 50 journals or the journals rated as A* by the Australian Business Deans Council, are alternatives. The fact that we use a limited (and arguably highly elite) set of publications data relevant to the US market biases the cost of research (per unique-authored publication) in these journals upwards.

A further limitation involves issues relating to quality. The use of any list of publications results in the measurement of a wide range of quality research; we have attempted to control for quality by incorporating two journal levels, but this too is imperfect. In respect of teaching quality, there is no
equivalent measure. We do not know whether teaching employed at any of the schools was of exceptional quality or something less than that. The issue of quality also relates to the dependent variable, FTE Faculty. That is to say, one person-year of a novice assistant professor is measured as equal to a Nobel Laureate-winning full professor. Without granular data on the quality of individual faculty members, this measurement issue is unavoidable. We report averages across the population of US business schools providing all data requested in the AACSB survey.

This quality issue is also relevant for teaching. Different modes of teaching (e.g., online, face to face) have different costs and teachers deliver varying teaching quality levels, but there is no attempt to delineate these differences in this study. We use reported school expenditures that may not (and likely do not) incorporate all the overhead and infrastructure costs of a university but are likely to capture a majority of the salaries of the academic community involved in teaching and research, which, in most cases, is likely to be the greater proportion of all costs involved in teaching and research within business schools. Importantly given how the estimates are made, there is no direct measure of overhead, infrastructure and fixed costs (and the like). This absence means that the measures underestimate the total cost.

As with other studies using an empirical archival approach, there are potential endogeneity issues. Endogeneity occurs when an explanatory variable(s) is(are) correlated with the error term. We accept that there are instances where endogeneity cannot be controlled. For example, in this study, simultaneous causality may apply. While we propose that the dependent variables – the expenditure and the consumption of faculty members’ time, respectively, is explained by teaching and research, possibly the existence of spare capacity may give rise to added teaching and research activity. Faculty members, for example, generally do not simply sit idle. The existence of time might cause them to spend time on a research project or additional class preparation. It is also possible that the model has omitted variable(s), the most significant of which is service to the university or other stakeholder groups. With little (or no) comprehensive valid and reliable data on service, this remains a limitation of the study and limits the model’s explanatory power.

We also acknowledge that, despite the presence of a good fit for the model, future research might benefit from the inclusion of a range of possible control variables. For instance, these might include factors such as the university’s age, global ranking or the extent of philanthropic donations as just three examples. Perhaps another control could be the workload expectations or incentive structures within which faculty members work. Accessing reliable data on some possible control variables may need to be considered.
We acknowledge that the issues identified here limit the authority of the conclusions. That said, this study is a useful first step in examining the cost of the production and delivery of education and research in business schools and extrapolating to the Australian situation. We hope to stimulate interest by others to work on the many questions raised here.

**CONCLUDING REMARKS**

Universities consume scarce resources to generate essentially two different, but related key outcomes – education and research (Cram, 2011), and the Act passed in 2020 sought to separate the costs of these two crucially important activities. This study focuses on costings and seeks to determine the cost, as measured by expenditure and faculty person-years, consumed in generating these two outputs, recognizing the joint supply of these products. In doing so, and in the context of business schools, we seek to estimate the costs of providing undergraduate education and advanced degrees (including research training). We also seek to examine the cost of research and, importantly, assess the possibility and even likelihood of a cross-subsidy from the revenues from education to the costs of revenue. Finally, we seek to examine whether research intensity impacts the cost of education.

Cost differences are observable between schools that self-identified as having differences in focus (education or research), including differences in the cost of undergraduate education – where there is a separate recognition of the cost of research.

Fine-grained Australian data will be needed to fully resolve the estimation of undergraduate education costs to provide support (or otherwise) of the estimates used to support the Act. Further, we would argue that, despite the assertions of DESE-appointed consultants, research intensity affects costs and ignoring it will impact the estimated cost of degrees.

These results highlight several key elements; relative to undergraduate education activities, they show just how expensive research is and how expensive research training (doctoral education) can be for universities. Of particular interest is that whether measured as expenditure or cost in academic staff time, undergraduate education per FTE student appears to be a fraction of the estimated $16,000 per annum estimated for these degrees in the FOE of Management and Commerce and even a fraction of the $14,500 per annum HECS (tuition) payment required of individual students.

We do **not** seek to evaluate whether the cost of any single activity, including undergraduate education or the execution of elite-level research, is too cheap or too expensive. Nor do we seek to be drawn into a debate on whether funding can or should be based on marginal (variable) or full costings. Further, we do not want these results to be seen as a call for cost minimization in universities. Instead,
we would support policymakers and university leaders considering the implications of these cost estimates. AACSB accredited US business schools are not low-cost providers, so we would argue that these estimates are not an irrelevant proxy for Australian business schools. Whether measured in academic staff time, dollar values or as substitutes between research and education, the estimates here point to important questions concerning the cost estimates used to support the Act.

In this study, we demonstrate that neither of the key activities of business schools (and universities more generally) – education and research - are costless. The analysis provides some support for the argument that the HECS payment by business students of $14,500 per annum may be in excess and potentially significantly in excess of the costs incurred in providing an undergraduate education per FTE domestic student. Some support is present only if one accepts the proposition that research and research training is a valueless by-product of universities. Perhaps most importantly, we would conclude a compelling argument exists for detailed, granular and contemporary Australian data to be made publicly available for future research. As noted, several important caveats and limitations apply.

33 This also provides a strong motivation for a further study that looks at a larger dataset over multiple FOEs/FORs using Australian DESE and other data.
References:


Australian Research Council (ARC) (2019), RMS Scheme Round Statistics for Approved Proposals - Discovery Projects, round 1.


TABLE 1: University of Texas Dallas Journals List: Research Score

The Accounting Review
Journal of Accounting and Economics
Journal of Accounting Research
Journal of Finance
Journal of Financial Economics
The Review of Financial Studies
Information Systems Research
Journal on Computing
MIS Quarterly
Journal of Consumer Research
Journal of Marketing
Journal of Marketing Research
Marketing Science
Management Science
Operations Research
Journal of Operations Management
Manufacturing and Service Operations Management
Production and Operations Management
Academy of Management Journal
Academy of Management Review
Administrative Science Quarterly
Organization Science
Journal of International Business Studies
Strategic Management Journal
TABLE 2 Descriptive Statistics

AACSB Accredited US Public Business Schools for Academic Year 2016-7

Expenditure = Operating Budget in AUD, FTE Faculty = Full-time equivalent (FTE) faculty members (academic time) measured in person-years for the academic year 2016-7 from the AACSB survey. FTE UG = Full-time equivalent students at undergraduate level – as reported in the AACSB survey, FTE Master = Full-time equivalent students at masters level – as reported in the AACSB survey, FTE Doctoral = Full-time equivalent students at the doctoral level – as reported in the AACSB survey. Publications (Elite) = Total equivalent unique authored publications as reported in the University of Texas Dallas Publication dataset for the relevant year (mean of the calendars years: 2016 and 2017), Publications (Other) = Total equivalent unique authored publications except those reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017), Total Publications is the sum of Elite and Other Publications.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Full Sample (N=283)</th>
<th>Education-Focused (N=136 [48%])</th>
<th>Research-Focused (n=147 [52%])</th>
<th>Between Sub-samples Test of difference (t-test)</th>
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<td>Mean</td>
<td>Min</td>
<td>Max</td>
<td>Mean</td>
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<td>1.59M</td>
<td>43.59M</td>
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<td>51.28</td>
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<td>0.00</td>
<td>978.00</td>
<td>144.43</td>
</tr>
<tr>
<td>FTE Doctoral</td>
<td>15.20</td>
<td>0.00</td>
<td>48.00</td>
<td>0.62</td>
</tr>
<tr>
<td>Total Pubs</td>
<td>54.63</td>
<td>0.00</td>
<td>181.00</td>
<td>16.43</td>
</tr>
<tr>
<td>Elite Pubs</td>
<td>2.44</td>
<td>0.00</td>
<td>5.33</td>
<td>0.22</td>
</tr>
<tr>
<td>Other Pubs</td>
<td>52.25</td>
<td>0.00</td>
<td>175.92</td>
<td>16.26</td>
</tr>
</tbody>
</table>
### TABLE 3 Pearson’s Correlations

**AACSB Accredited US Public Business Schools for Academic Year 2016-7 (N=283)**

*** = p<.001, ** = p<.01, * = p<.05, Expenditure = Operating Budget in AUD, FTE Faculty = Full-time equivalent (FTE) faculty members (academic time) as measured in person-years for the academic year 2016-7 from the AACSB survey, FTE UG = Full-time equivalent students at undergraduate level – as reported in the AACSB survey, FTE Master = Full-time equivalent students at master level – as reported in the AACSB survey, FTE Doctoral = Full-time equivalent students at the doctoral level - as reported in the AACSB survey, Publications (Elite) = Total equivalent unique authored publications as reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017), Publications (Other) = Total equivalent unique authored publication except those reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Operating Budget</th>
<th>FTE Faculty</th>
<th>FTE UG</th>
<th>FTE Master</th>
<th>FTE Doctoral</th>
<th>Elite Pubs</th>
<th>Other Pubs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Budget</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTE Faculty</td>
<td>.856**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTE UG</td>
<td>.770**</td>
<td>.846**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTE Master</td>
<td>.702**</td>
<td>.635**</td>
<td>.487**</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTE Doctoral</td>
<td>.849**</td>
<td>.710**</td>
<td>.635**</td>
<td>.599**</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elite Pubs</td>
<td>.746**</td>
<td>.539**</td>
<td>.663**</td>
<td>.480**</td>
<td>.629**</td>
<td>1.000</td>
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</tr>
<tr>
<td>Other Pubs</td>
<td>.886**</td>
<td>.727**</td>
<td>.742**</td>
<td>.519**</td>
<td>.610**</td>
<td>.703**</td>
<td>1.000</td>
</tr>
</tbody>
</table>
TABLE 4

OLS Regression of Expenditure as explained by Education (Undergraduate, Master and Doctoral) and Research (Elite and Other Publications)

Grey shaded results are not significant, *** = p<.001, ** = p<.01, * = p<.05, Expenditure = Operating Budget in AUD, FTE UG = Full-time equivalent students at the undergraduate level as reported in the AACSB survey, FTE Master = Full-time equivalent students at master level – as reported in the AACSB survey, FTE Doctoral = Full-time equivalent students at the doctoral level – as reported in the AACSB survey, Publications (Elite) = Total equivalent unique authored publications as reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017), Publications (Other) = Total equivalent unique authored publications except those reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017).

<table>
<thead>
<tr>
<th>Dependent Variable: Expenditure (Op Budget)</th>
<th>Full Sample (N=283)</th>
<th>Education-Focused (N=136)</th>
<th>Research-Focused (N=147)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Std. Error</td>
<td>t</td>
<td>B</td>
</tr>
<tr>
<td>Constant</td>
<td>2,019,847.520</td>
<td>521949.261</td>
<td>3.870***</td>
</tr>
<tr>
<td>FTE Master</td>
<td>8,620.324</td>
<td>1343.448</td>
<td>6.417***</td>
</tr>
<tr>
<td>Elite Pubs</td>
<td>417,982.935</td>
<td>77019.380</td>
<td>5.427***</td>
</tr>
<tr>
<td>Other Pubs</td>
<td>109,505.890</td>
<td>8685.878</td>
<td>12.607***</td>
</tr>
<tr>
<td>F-Stat</td>
<td>678.511***</td>
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</tr>
<tr>
<td>Adjusted R²</td>
<td>0.923</td>
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<td></td>
</tr>
<tr>
<td>Highest VIF</td>
<td>3.104 (Other Pubs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 5

OLS Regression of Expenditure as explained by Education (Undergraduate, Master and Doctoral) and Research (All Publications)

Grey shaded results are not significant, *** = p<.001, ** = p<.01, * = p<.05, Expenditure= Operating Budget in AUD, FTE UG = Full-time equivalent students at the undergraduate level as reported in the AACSB survey, FTE Master = Full-time equivalent students at master level – as reported in the AACSB survey, FTE Doctoral = Full-time equivalent students at the doctoral level – as reported in the AACSB survey, Publications (Elite) = Total equivalent unique authored publications as reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017), Publications (Other) = Total equivalent unique authored publications except those reported in the University of Texas Dallas Publication dataset for the relevant year (mean of calendar years: 2016 and 2017).

<table>
<thead>
<tr>
<th>Dependent Variable: Expenditure (Op Budget)</th>
<th>Full Sample with Inclusion of Education Variables Only (N=283) Panel A</th>
<th>Full Sample with Inclusion of Indicator Variable for Research or Education Focus (N=283) Panel B</th>
<th>Full Sample with Inclusion of Indicator Variable for Research or Education Focus and Continuous Variable for All Research Publications (N=283) Panel C</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Std. Error</td>
<td>t</td>
<td>B</td>
</tr>
<tr>
<td>Constant</td>
<td>2,669,006.900</td>
<td>725620.341</td>
<td>3.678***</td>
</tr>
<tr>
<td>FTE Master</td>
<td>15,059.825</td>
<td>1820.893</td>
<td>8.271***</td>
</tr>
<tr>
<td>Education or Research Focus (0,1)</td>
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<td></td>
</tr>
<tr>
<td>All Research Pubs</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>F-Stat</td>
<td>518.414***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.846</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest VIF</td>
<td>2.054 (FTEDoctoral)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>