MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

Analysis of the impact of the PBRF

Interim findings

New Zealand Government

Research and knowledge creation

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Author
Warren Smart, Principal Research Analyst
Email: warren.smart@minedu.govt.nz
Telephone: 04-463-8035

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FIGURES

TABLES

1   INTRODUCTION

Between 2004 and 2016, the Performance-Based Research Fund (PBRF) will allocate around $2.7 billion in funding to participating tertiary education organisations (TEOs). This represents a substantial investment by the Government in tertiary education. This interim report examines the quantitative evidence on the impact of the PBRF in a variety of areas ranging from research impact to completion rates of higher research degrees. One of the purposes of this report is to contribute to the review of the PBRF.

This interim report does not include results or staff data from the PBRF Quality Evaluations. When the 2012 PBRF Quality Evaluation data becomes available in early 2013, additional analysis will look at changes in research quality over time, as well as analysis of staffing trends.

This report has the following structure:

- In Chapter 2, we present a brief history and overview of the PBRF. This includes the current aims of the PBRF and describes how the three component measures of the PBRF work.

- In Chapter 3, we examine government funding of research in tertiary education organisations. This includes examining the share and size of funding allocated via research top-ups and the PBRF over time.

- In Chapter 4, we analyse bibliometric data to show the academic impact of research produced by New Zealand tertiary education institutions both before and after the introduction of the PBRF.

- In Chapter 5, data on postgraduate research training is examined. We look at participation rates in postgraduate research degrees and examine trends in research degree completions over time.

- In Chapter 6, we explore data on external research income, particularly for the universities.

- In Chapter 7, we examine teaching performance indicators and surveys of student/graduate satisfaction.

- In Chapter 8, we examine trends in the designations of university academic and research-only staff.

- In Chapter 9 we present summaries of previous Ministry of Education analysis of commercialisation data from the University Commercialisation Offices of New Zealand (UCONZ) and the Research and Development Survey.

- In the Appendix we present a detailed description of the three components of the PBRF (Quality Evaluation, Research Degree Completions, and External Research Income).

2 THE PERFORMANCE-BASED RESEARCH FUND

Background

Before reforms in the 2000s, tertiary education institutions received funding based on equivalent full-time students, adjusted by weighting for different course costs. This funding covered capital and operating costs, as well as tuition and research.

The Tertiary Education Advisory Commission (TEAC) was established by the Government in April 2000 to devise a long-term strategic direction for the tertiary education system. The overall aim of the strategic direction was to make New Zealand a world-leading knowledge society by providing all New Zealanders with opportunities for lifelong learning.

The TEAC concluded that there was a strong case for a greater concentration of research effort within the tertiary education system in the interests of enhancing quality and building research capacity. Specifically, it recommended the introduction of a performance-based research fund for tertiary education providers.

The PBRF was established in 2002. It is intended to ensure that excellent research in the tertiary education sector is encouraged and rewarded. This entails assessing the research performance of tertiary education organisations (TEOs) and then funding them on the basis of their performance. Only degree-granting TEOs are eligible to participate in the PBRF. All universities and some polytechnics, wānanga, and private training establishments participate in the PBRF.

Aims of the PBRF

The Government's aims in introducing the PBRF were to:

- increase the average quality of research

- ensure that research continues to support degree and postgraduate teaching

- ensure that funding is available for postgraduate students and new researchers

- improve the quality of public information on research outputs

- prevent undue concentration of funding that would undermine research support for all degrees or prevent access to the system by new researchers

- underpin the research strength in the tertiary education sector.

The three components of the PBRF

The PBRF funding formula is based on three indicators (described in more detail in the Appendix, which together assess both quantity and quality of research:

a. **Quality Evaluation**: the assessment of the research quality of TEO staff, based largely on peer review of a researcher's Evidence Portfolio (EP) of research outputs, accounting for 60 percent of the fund

b. **Research degree completions**: the number of postgraduate research-based degrees completed in the TEO, accounting for 25 percent of the fund

c. **External research income**: the amount of income for research purposes received by the TEO from external sources, accounting for 15 percent of the fund.

Detailed explanations of how each of the components works can be found in the Appendix.

The first Quality Evaluation took place in 2003, followed by a partial round in 2006. The third Quality Evaluation was undertaken in 2012 and results will be reported in 2013.

3   ANALYSIS OF FUNDING ALLOCATIONS

KEY POINTS

- The PBRF represents a significant item of government funding to tertiary education organisations.

- The size of the combined research top-ups/PBRF pool increased from $100 million in 2000 to $250 million in 2010. The increase was due mainly to significant extra appropriations into the PBRF by Government.

- A Budget 2012 decision will increase the size of the PBRF pool from the current value of $250 million in 2012 to $300 million in 2016.

- The PBRF is a greater source of total operating revenue for the universities, but of a lesser proportion for other types of TEO. This reflects the more research-intensive profile of the universities.

- The share of the combined top-ups/PBRF funding pool earned by tertiary education organisations has shifted due to the introduction of the PBRF. The university subsector dominates research funding and increased its share of combined top-ups/PBRF funding from 94 percent in 2003 to 97 percent in 2011. The polytechnic, wānanga and PTE subsectors all lost share and funding, with one of the factors in this fall being the decision by a number of non-university TEOs not to participate in the PBRF.

- The increase in PBRF pool size has offset a fall in share by some of the universities so they did not experience a fall in funding.

- The per unit funding of the RDC and ERI components has fallen in the last four years due to an increase in the volume of RDCs and ERI.

- There was broad correlation between performance on the ERI, RDC and QE measures (suggesting that they are all robust measures), but sufficient variation to confirm that none of the measures is redundant.

Introduction

In this chapter, we present an analysis of government funding for research via tuition subsidies for study at degree level and above (called research 'top-ups') and the Performance-Based Research Fund (PBRF) in the tertiary education sector. Research is integral to teaching at the degree level or higher, which by law must be research informed, and the PBRF is the main vehicle for the Government's research funding to tertiary education organisations (TEOs).

The structure of this chapter is as follows:

- We begin with an overview of government funding for TEOs, to get a sense of the scale of PBRF funding in relation to other funds.
- We then look at trends in research funding from the start of the research top-ups in 2000 onwards.
- We then examine the various components of the PBRF to see how funding has shifted as a result of the PBRF.
- We also analyse the scale of the incentives for TEOs.
- We then examine how significant the PBRF is in terms of funding for tertiary education institutions.

Government funding of tertiary education organisations

The PBRF is a major component of the Government's expenditure on tertiary education. In Figure 1, we present government expenditure on tertiary education organisations in 2010 (excluding funding for industry training, adult and community education and targeted training). This represented around $2.6 billion in government expenditure. The largest item of government expenditure was the Student Achievement Component (77 percent). The PBRF ($250 million) was around 10 percent of government expenditure on TEOs, and is clearly a significant expenditure item for the Government.

Figure 1

Government funding to tertiary education organisations in 2010
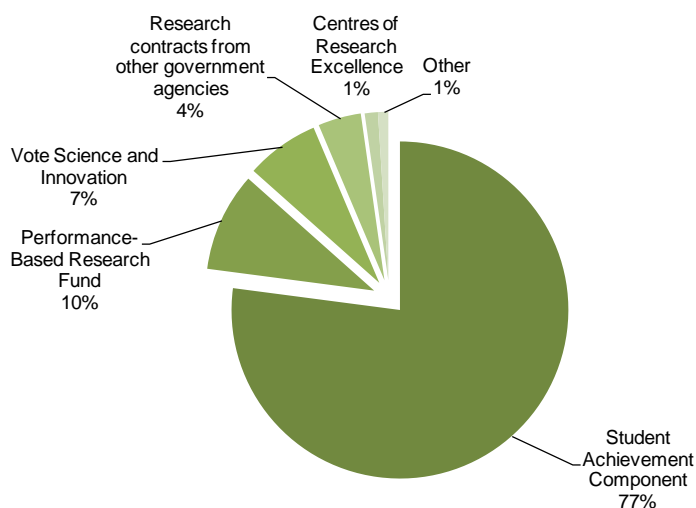
Note: The Student Achievement Component includes funding via the Tertiary Education Organisation Component (TEOC). The Vote Science and Innovation funding includes funding distributed via the Foundation for Research, Science and Technology, the Marsden Fund and Health Research Council.

Source: Ministry of Education, Ministry of Science and Innovation and Statistics New Zealand

Research top-ups and PBRF funding allocations

Between 2000 and 2003, bulk funding to support research-informed teaching via Vote Tertiary Education was delivered through research top-ups. The 'top-ups' were bulk funded to TEOs as part of tuition subsidies and were based on the number of domestic enrolments at the degree level or higher. The value of the top-ups varied by the level of course, with postgraduate study funded at higher rates, especially research-based courses. The top-ups also varied by funding category, with courses with a higher base funding rate attracting a higher top-up.

When first introduced in 2000, the value of the research top-ups was around $100 million. By 2003, the year before the phase-in of the PBRF began, the value of the top-ups had increased to $118 million. This increase was a result of increased funding rates and increased domestic enrolments at the degree level or higher.

Funding allocated via the PBRF began in 2004 and was phased in over four years. In 2004, 10 percent of the research top-ups was diverted to the PBRF, 20 percent was diverted in 2005 and 50 percent in 2006. In 2007, the top-ups were completely phased out. During the phase-in period, the PBRF pool size was around $17 million in 2004, $40 million in 2005, $122 million in 2006 and $206 million in 2007. PBRF funding is split into three components. These are: the funding allocated via the Quality Evaluation (60 percent of the PBRF funding pool), the research degree completions component (25 percent of the PBRF funding pool) and the external research income component (15 percent of the PBRF funding pool).

Between 2004 and 2007, the size of the PBRF pool was determined by the size of the research top-ups and supplemented by additional appropriations by the Government. These additional government appropriations had a significant cumulative effect on the PBRF pool size. In 2007, the year the phase-in of the PBRF was completed, around $60 million of the total PBRF pool size of $206 million was due to additional appropriations by the Government. From 2008, the determination of the PBRF pool size was disconnected from the funding for tuition, with the value of the PBRF pool set by the Government in the annual Budget process.

Figure 2 presents total funding, both actual and forecast, via research top-ups and the PBRF between 2000 and 2016. The phase-in period of the PBRF can be seen between 2004 and 2007.

Figure 2
Research top-ups/PBRF funding allocations in nominal terms
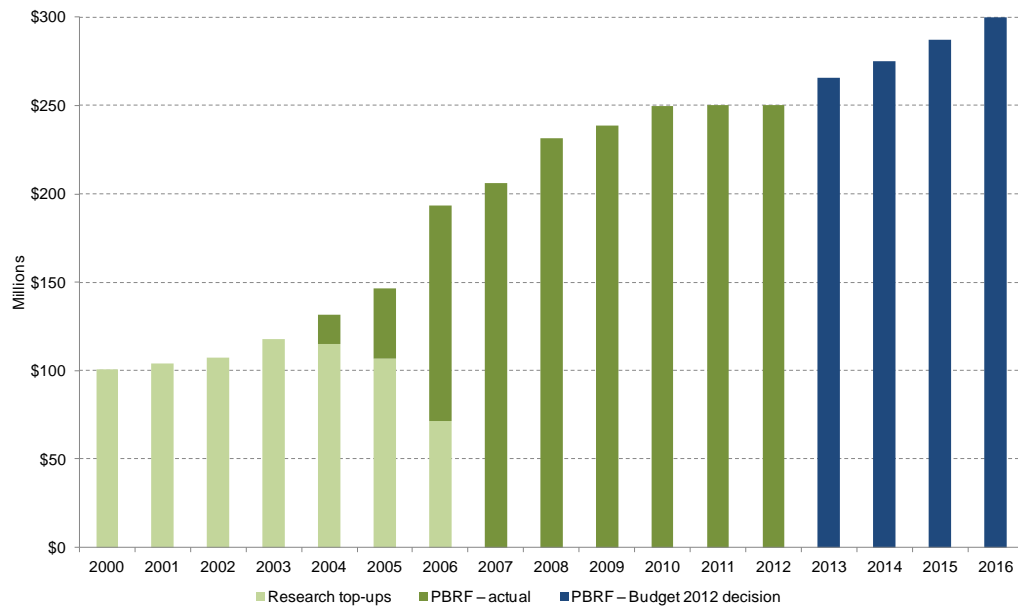
Source: Ministry of Education and Tertiary Education Commission

The combined research top-ups/PBRF funding allocation between 2000 and 2016 is presented in nominal and inflation-adjusted terms (real) in Figure 3. In inflation-adjusted terms, the size of the combined pool increased by 92 percent between 2000 and 2010. However, with the PBRF pool size remaining constant in nominal terms in 2011 and 2012, there has been a fall of around 2 percent in the value of the PBRF in real terms since 2010. As a result of a Budget 2012 decision, the size of the PBRF pool will increase from $250 million in 2012 to $300 million in 2016. This represents an increase in real terms of around 9 percent.

Figure 3

Research top-ups/PBRF funding allocations in nominal and real terms (in 2000 dollars)
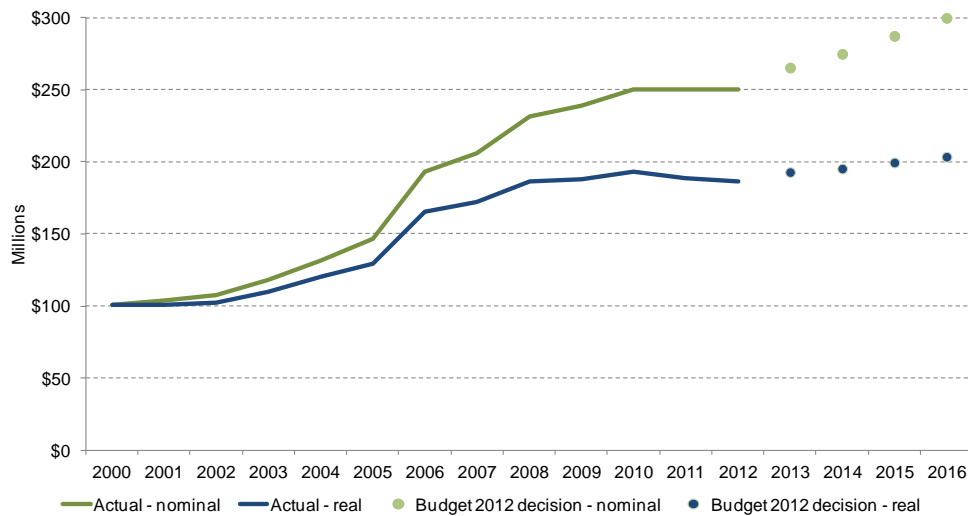
Note: Treasury forecasts of CPI inflation have been used to estimate inflation-adjusted funding between 2013 and 2016.

Source: Ministry of Education and Tertiary Education Commission

The combined research top-ups/PBRF allocations earned by individual universities and non-university subsectors are presented in nominal terms in Figure 4 and real terms in Figure 5. All of the universities had significant increases in funding between 2003 and 2011. The increases ranged between 126 percent in real terms for the University of Otago to 45 percent for the University of Canterbury.

The universities dominate PBRF funding because they are larger TEOs that are more research intensive and greater proportions of their delivery are at the bachelors level or higher. In 2011, the University of Auckland received the largest allocation from the PBRF (around $74 million), followed by the University of Otago (around $52 million). The combined funding of the polytechnics (just under $6 million in 2011) was less than each of the individual universities.

Figure 4

Research top-ups/PBRF funding allocations for individual universities and non-university subsectors in nominal terms
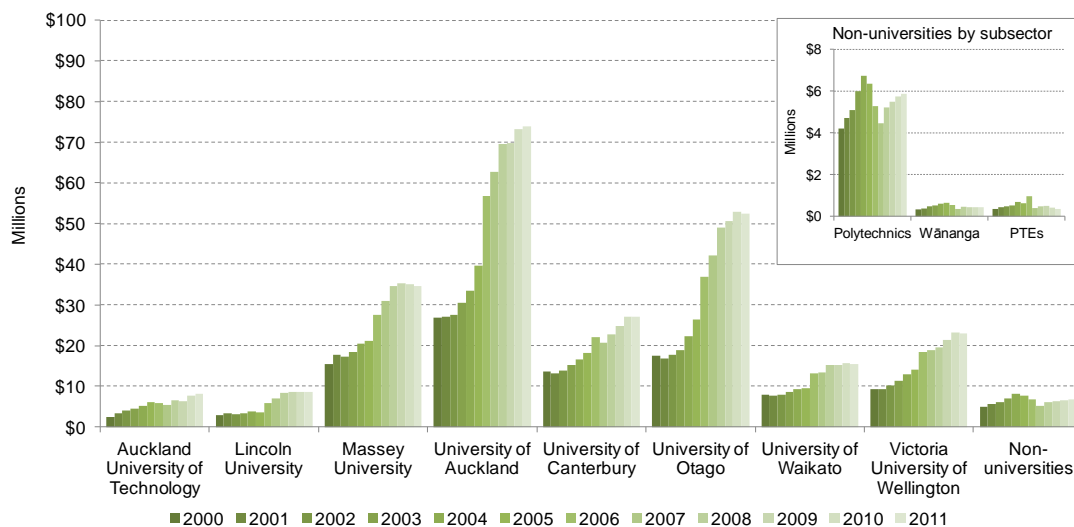
Source: Ministry of Education and Tertiary Education Commission

Figure 5

Research top-ups/PBRF funding allocations for individual universities and non-university subsectors in real terms (in 2000 dollars)
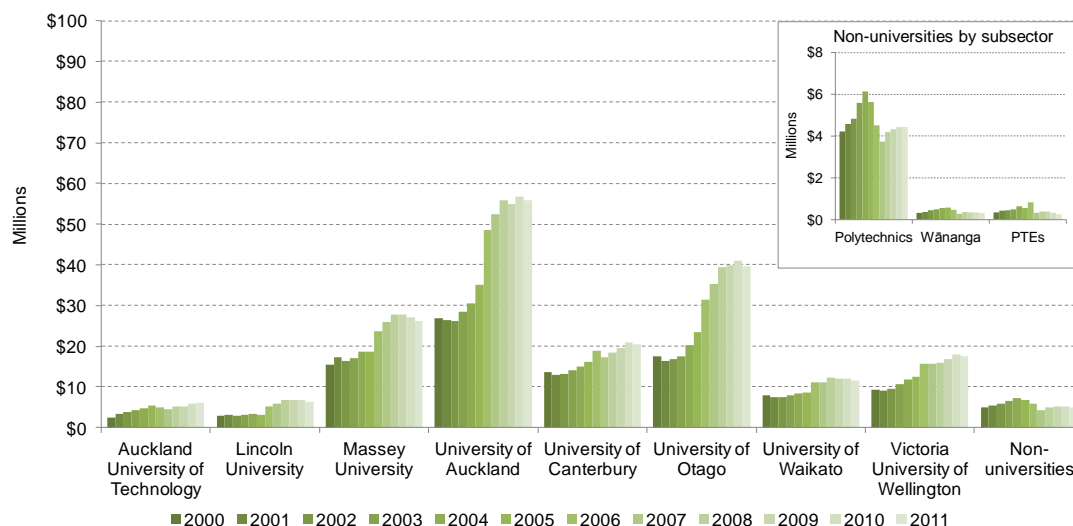
Source: Ministry of Education and Tertiary Education Commission

The share of the combined research top-ups/PBRF allocations by individual universities and the non-university subsectors is presented in Figure 6. Since the introduction of the PBRF, funding has been redistributed to the universities. In 2003, the universities received 94 percent of research top-ups, whereas in 2011 the universities received 97 percent of PBRF funding allocations.

Two universities in particular have increased their share of the top-ups/PBRF pool since the PBRF was phased in. The University of Auckland increased its share of the pool from 26 percent in 2003 to 30 percent in 2011, while the University of Otago increased its share from 16 percent to 21 percent. One of the factors behind this increase in share was related to the relatively high amount of ERI earned by these two universities.

Universities that exhibited a decrease in share of the combined funding pool between 2003 and 2011 were Massey University (16 percent in 2003 to 14 percent in 2011), the University of Canterbury (13 percent in 2003 to 11 percent in 2011), and the University of Waikato (7 percent in 2003 to 6 percent in 2011).

Although some universities' share of the total pool reduced, the increases in the size of the combined pool over time meant that the total funding to these institutions still increased. For example, the share of funding by the University of Canterbury fell from 13 percent in 2003 to 11 percent in 2011. However, the level of funding attracted by the University of Canterbury increased by 45 percent in real terms over that time. So the increase in size of the funding pool has been important in offsetting any potential funding reductions for universities that lost share.

The non-university subsectors have all experienced falls in the value of combined top-ups/PBRF funding over time (see Figures 4 and 5). Between 2003 and 2011, the funding allocated to polytechnics fell by 21 percent in real terms, by 32 percent in wānanga and by 45 percent in private training establishments (PTEs).

One of the factors influencing this fall in funding for the non-university sub-sectors was the decision not to participate in the PBRF Quality Evaluations by a number of TEOs that received research top-ups. Of the 17 polytechnics that received top-ups funding in 2004, just two participated in the 2003 Quality Evaluation and 10 in the 2006 Quality Evaluation. All three wānanga received research top-ups funding in 2004, but just one wānanga participated in the 2003 Quality Evaluation and two in the 2006 Quality Evaluation. Of the 13 PTEs that received research top-ups in 2004, just seven participated in the 2003 Quality Evaluation and nine in the 2006 Quality Evaluation.

The impact of participation is particularly noticeable in the wānanga subsector, where the combined research top-ups/PBRF funding of 2006 Quality Evaluation participants actually increased by 180 percent in real terms between 2003 and 2011.

Figure 6 shows that the share of the combined research top-ups/PBRF funding pool gained by the non-university subsectors essentially halved between 2003 and 2011. Between 2003 and 2011, the share of the pool won by polytechnics fell from 5 percent to 2 percent, the share gained by wānanga fell from 0.4 percent to 0.2 percent and the share by PTEs fell from 0.4 percent to 0.1 percent. Despite the rise in the size of the combined funding pool, the fall in share by the non-university subsectors was of such a scale that the funding received by those other subsectors still decreased.

Figure 6
Share of research top-ups/PBRF allocations for individual universities and non-university subsectors
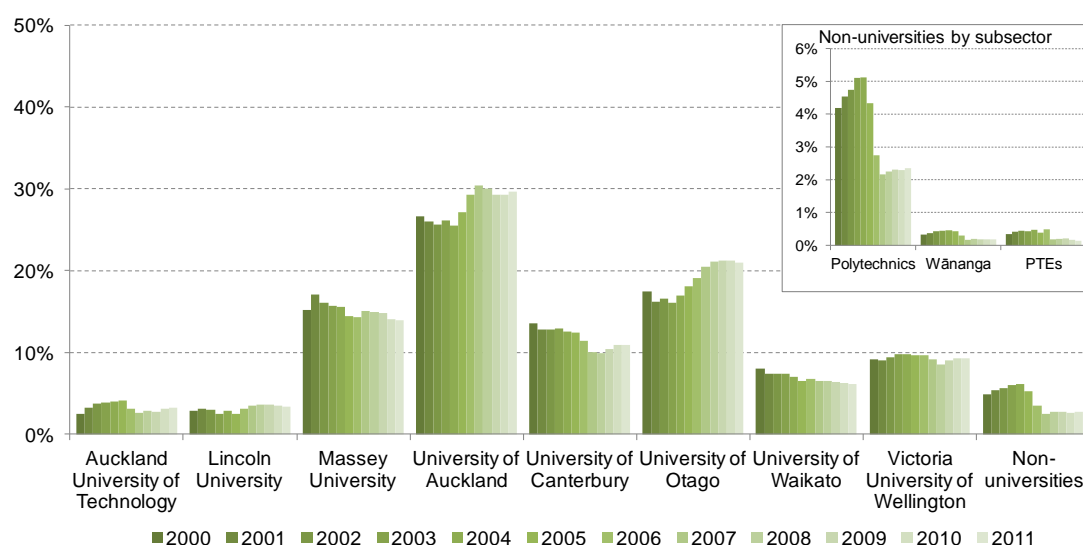
Source: Ministry of Education and Tertiary Education Commission

Part of the reason for the decrease in share by the non-university subsectors was the decision by some TEOs not to participate in the PBRF. In Figure 7 we disaggregate the share of research top-ups/PBRF for each of the non-university subsectors by whether or not the TEO participated in the 2006 Quality Evaluation. For polytechnics, the majority of the loss of share was due to the switch from top-ups to PBRF. Only around a third of the drop in share was due to non-participation in the PBRF.

For wānanga, the result is somewhat different. The drop in share of combined top-ups/PBRF funding exhibited by wānanga is due to the decision of one of the wānanga not to participate in the Quality Evaluation. In fact the share of funding achieved by the two participating wānanga increased from 0.11 percent in 2003 to 0.18 percent in 2011. For PTEs, around a third of the fall

in share of top-ups/PBRF funding was due to the change to the funding allocation system, rather than the decision by TEOs not to participate.

Figure 7

Share of research top-ups/PBRF funding by subsector and whether or not a TEO participated in the 2006 Quality Evaluation
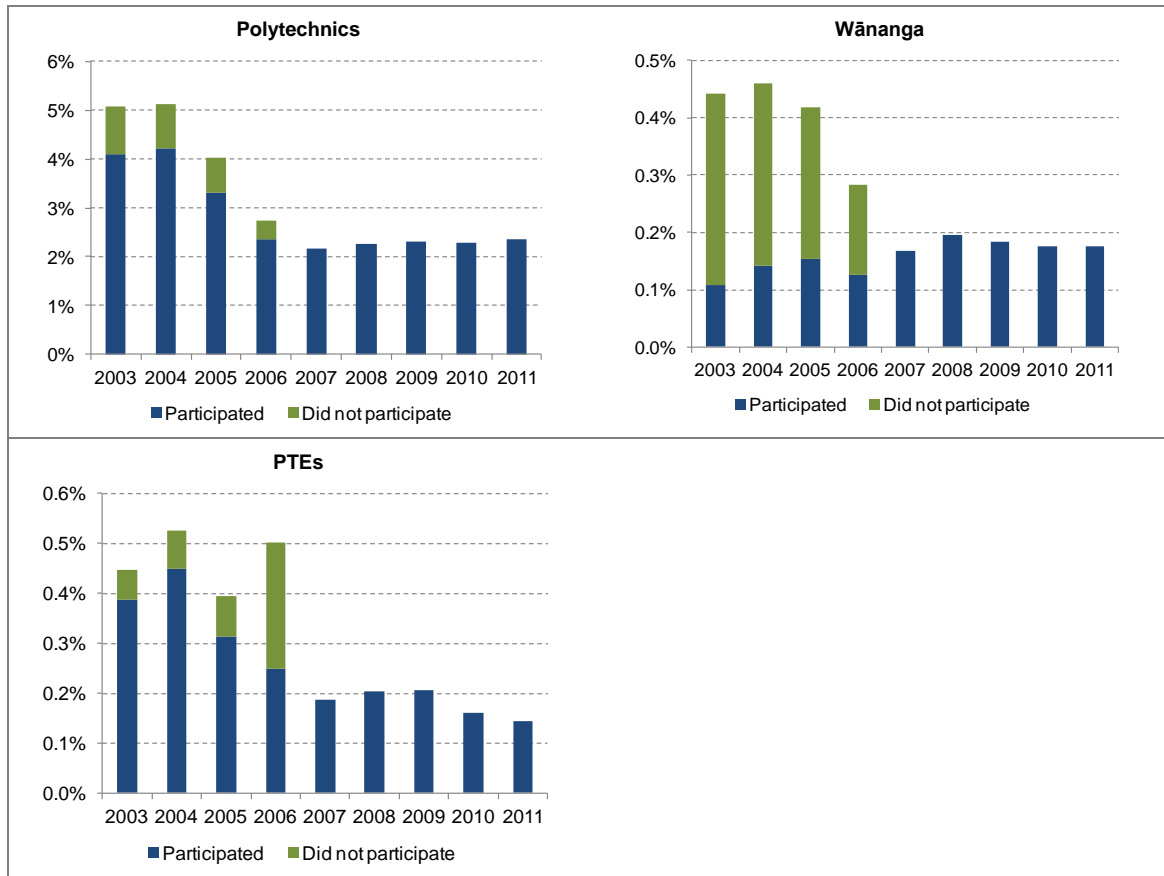
Another way of examining how the PBRF has shifted funding is to compare the actual PBRF 2011 allocation of $250 million with an estimated allocation based on TEOs' share of research top-ups in 2003, the last year before the phase-in of the PBRF began.

Under this scenario, the University of Otago receives $13 million more under the PBRF and the University of Auckland $9 million more. Universities that receive less under the PBRF in this scenario are the University of Canterbury ($5 million) and Massey University ($4 million). The polytechnic subsector also receives less under the PBRF, with lower funding of around $7 million under the PBRF. Wānanga ($0.7 million) and PTEs ($0.8 million) also receive less under the PBRF in this scenario.

By including Student Achievement Component (SAC) funding we can take a wider view of how the introduction of the PBRF has shifted tuition and research funding for TEOs. Table 1 compares the total funding from the SAC and the actual PBRF allocation in 2011 with total funding from the SAC and PBRF if the 2003 top-ups share had been used to allocate PBRF funding.

The University of Otago shows the largest increase in combined SAC/PBRF funding as a result of the introduction of the PBRF (4.8 percent), followed by Lincoln University (3.7 percent). For the polytechnic, wānanga and PTE subsectors, although under this scenario their share of PBRF funding halves, the impact on the combined SAC/PBRF funding pool is relatively small, given

the lower amount of degree teaching in these subsectors. The polytechnics see their share of combined SAC/PBRF funding drop by 1.2 percent, wānanga drop by 0.4 percent and PTEs by 0.5 percent. Although the share of the PBRF pool by the non-university subsectors halved (see Table 1), the actual change in funding under this scenario is relatively small. For polytechnics, the fall in funding was around $7 million, for wānanga the fall was around $0.7 million and it was around $0.8 million for PTEs.

In terms of the impact on those that did or did not participate in the 2006 Quality Evaluation, the main impacts are in the wānanga and PTE subsectors. Wānanga that participated in the 2006 Quality Evaluation received slightly more funding under the actual PBRF than in the scenario using the 2003 top-ups share. In terms of PTEs, those TEOs that participated received more under the scenario using the 2003 top-ups share to distribute PBRF funding.

One of the main aims of the PBRF is to prevent 'undue' concentration of funding. Although the term 'undue' is undefined and can be interpreted in a variety of ways, the scale of the funding shifts evident in Table 1, although significant for some TEOs, appear to be relatively modest.

Table 1
2011 Actual PBRF and Student Achievement Component funding allocations compared with a scenario where the share of research top-ups in 2003 was used to allocate PBRF funding

TEO/subsector	Participated in 2006 PBRF Quality Evaluation	Allocation using actual PBRF ($m) (1)	Allocation using 2003 top-ups share ($m) (2)	Difference (1-2)	% change
Auckland University of Technology	Yes	$134.7	$136.1	-$1.4	-1.1%
Lincoln University	Yes	$36.5	$35.2	$1.3	3.7%
Massey University	Yes	$177.9	$182.1	-$4.2	-2.4%
University of Auckland	Yes	$352.4	$343.4	$9.0	2.6%
University of Canterbury	Yes	$142.6	$147.7	-$5.1	-3.5%
University of Otago	Yes	$259.6	$247.1	$12.6	4.8%
University of Waikato	Yes	$84.5	$87.3	-$2.8	-3.4%
Victoria University of Wellington	Yes	$149.7	$150.8	-$1.1	-0.7%
Total universities		**$1,337.9**	**$1,329.7**	**$8.3**	**0.6%**
Polytechnics	Yes	$379.7	$384.0	-$4.4	-1.1%
	No	$173.7	$176.2	-$2.5	-1.4%
	Total	**$553.3**	**$560.2**	**-$6.8**	**-1.2%**
Wānanga	Yes	$151.3	$151.2	$0.2	0.1%
	No	$10.2	$11.0	-$0.8	-8.2%
	Total	**$161.5**	**$162.2**	**-$0.7**	**-0.4%**
PTEs	Yes	$10.8	$11.4	-$0.6	-5.6%
	No	$155.5	$155.6	-$0.1	-0.1%
	Total	**$166.3**	**$167.1**	**-$0.8**	**-0.5%**
TOTAL		**$2,219.1**	**$2,219.1**		

Source: Ministry of Education and Tertiary Education Commission

The share of the PBRF funding allocations received by TEOs

In this section, we switch the focus to funding distributed solely via the PBRF between 2004 and 2011. We examine the share of total PBRF funding, as well as the share of each of the three PBRF components – Quality Evaluation (QE), research degree completions (RDCs) and external research income (ERI). The purpose of examining each of the individual components is to see which of them shows the most variation over time. The share of total PBRF funding is presented in Figure 8 and the share of funding allocated to TEOs under each of the three components is presented in Figure 9.

Figure 8

Share of total PBRF allocation by individual universities and non-university subsectors
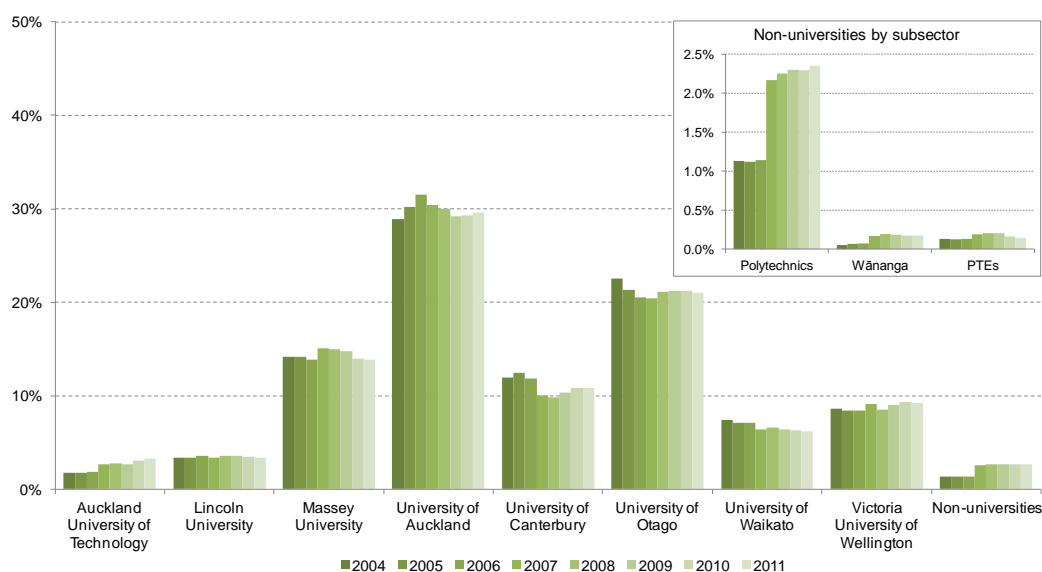
Figure 8 shows that the share of total PBRF funding allocated to each university was relatively stable over time, especially over the last three or four years. The non-universities have exhibited more variation in their share of total PBRF funding, but this was off a low base. And, rather than being a result of improved performance, the increase in share of the polytechnics and the wānanga was due to more polytechnics and wānanga participating in the 2006 QE and hence attracting PBRF funding.

In terms of QE funding share, the University of Auckland exhibited the largest shift in share after the 2006 QE started to be used to allocate funding in 2007. Its share dropped from 30 percent to 27 percent. The non-university subsectors gained share, as more TEOs in those subsectors participated in the 2006 QE.[1] Polytechnics increased their share of QE funding from 1.6 percent in 2006 to 3.1 percent in 2011, while wānanga increased their share from 0.1 percent to 0.2 percent in that period.

Figure 9 shows that of the three components, the one that exhibits the greatest variation over time is the RDC component, where there have been significant swings in shares between years. For example, the University of Auckland increased its share of RDC funding from 21 percent in 2004 to 34 percent in 2007. The RDC component is influenced by the number of enrolments in postgraduate research courses, the subject area they complete in, and qualification completion rates.

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[1] The number of polytechnics participating in the Quality Evaluation increased from two in 2003 to 10 in 2006. The number of wānanga participating in the Quality Evaluation increased from just one in 2003 to two in 2006.

Figure 9

Share of PBRF funding by components for individual universities and for non-university subsectors
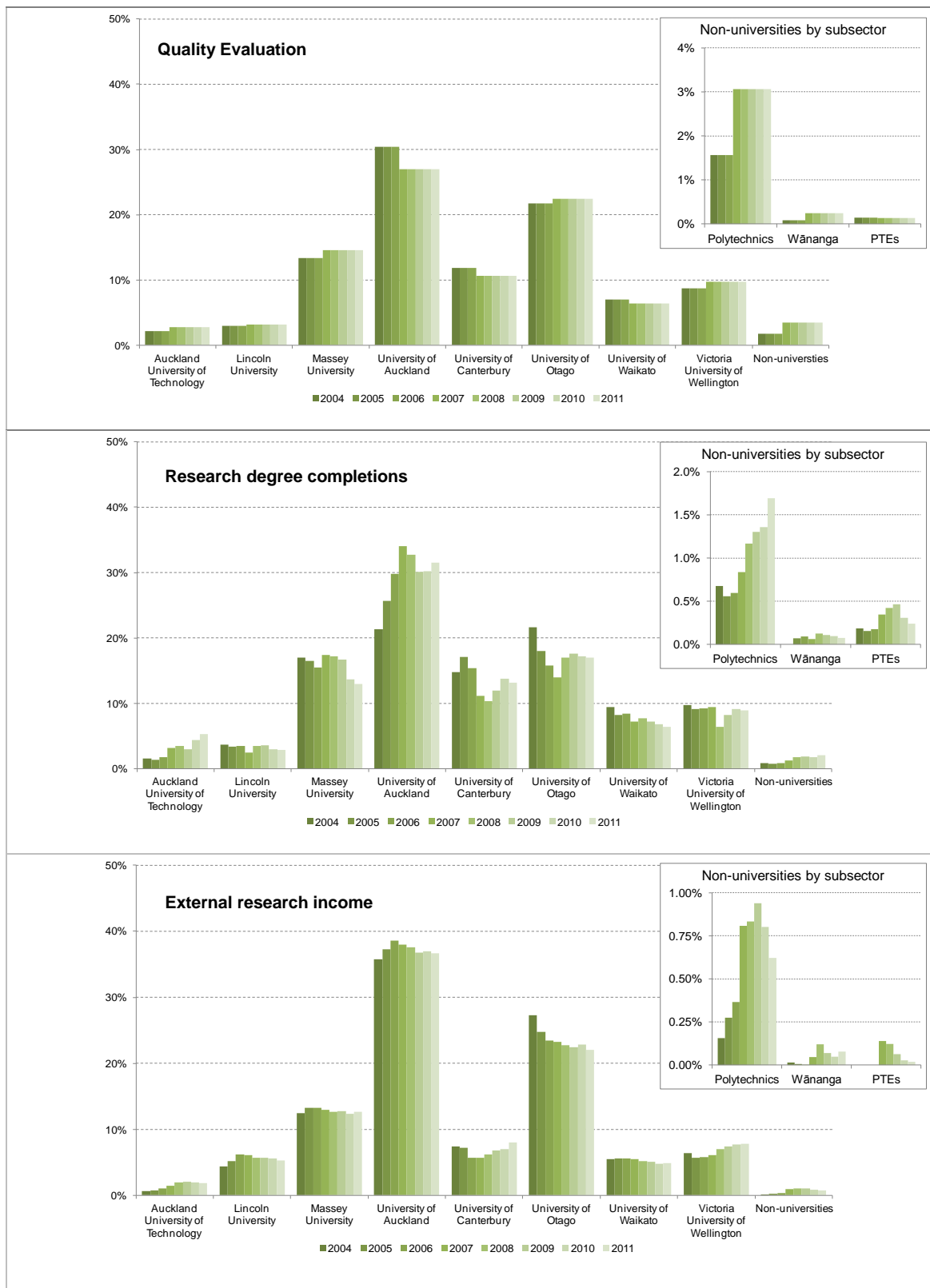
The polytechnic subsector also increased its share of RDC funding over time from 0.7 percent in 2004 to 1.7 percent in 2011. Once again, this increase comes off a low base and with greater participation of polytechnics in the PBRF.

The share of ERI funding among TEOs also shows variation, but the changes between years are generally much smaller than is the case for the RDC funding.

Distribution of PBRF funding to TEOs by component

The distribution of the PBRF allocations in 2011 for participating TEOs is presented in Figure 10. This illustrates the difference in research profile between the subsectors. Almost half of participating TEOs receive no RDC funding as they don't offer postgraduate research degrees, with these being exclusively non-universities. The larger, research-intensive universities exhibit a more balanced profile of component funding, with significant contributions from both RDC and ERI allocations.

Figure 10

Distribution of PBRF funding allocations by component in 2011
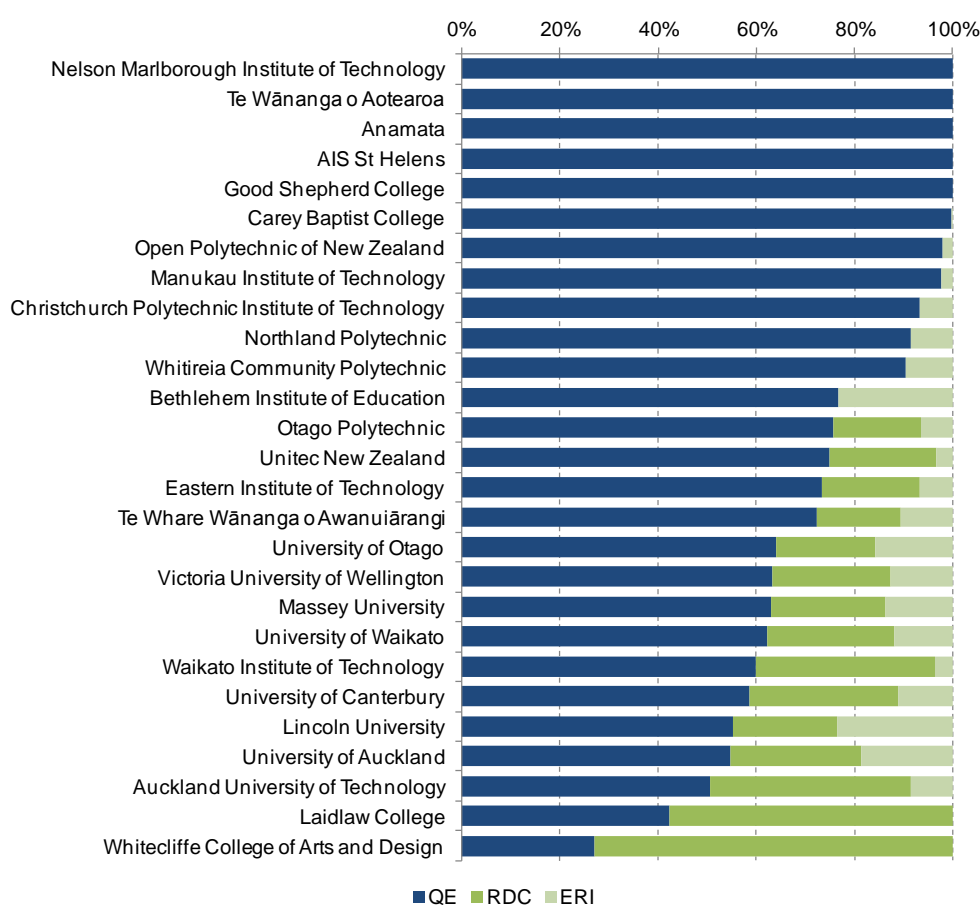
Source: Tertiary Education Commission

In Figure 11, we present the PBRF allocations in 2011 on a per PBRF-eligible FTE basis to control for the size of the participating TEOs. A number of factors will influence the funding per FTE. These include the performance of the TEOs in the three component measures as well as the mix of subject areas of eligible staff and the RDCs. TEOs with delivery in more expensive subject areas will receive higher levels of funding per FTE.

Even after adjusting for size, the University of Auckland received the most PBRF funding per FTE in 2011 (over $45,000), followed by the University of Otago ($43,000). There was a noticeable step down from the last university (Auckland University of Technology) to the

remaining TEOs. This reflects the lesser performance in the three PBRF components for the non-universities.

In the individual PBRF components, the University of Otago received the most in Quality Evaluation funding per FTE, the University of Auckland received the most in RDC funding per FTE and Lincoln University the most in ERI funding per FTE.

Figure 11
PBRF funding allocations per PBRF-eligible FTE by TEO in 2011
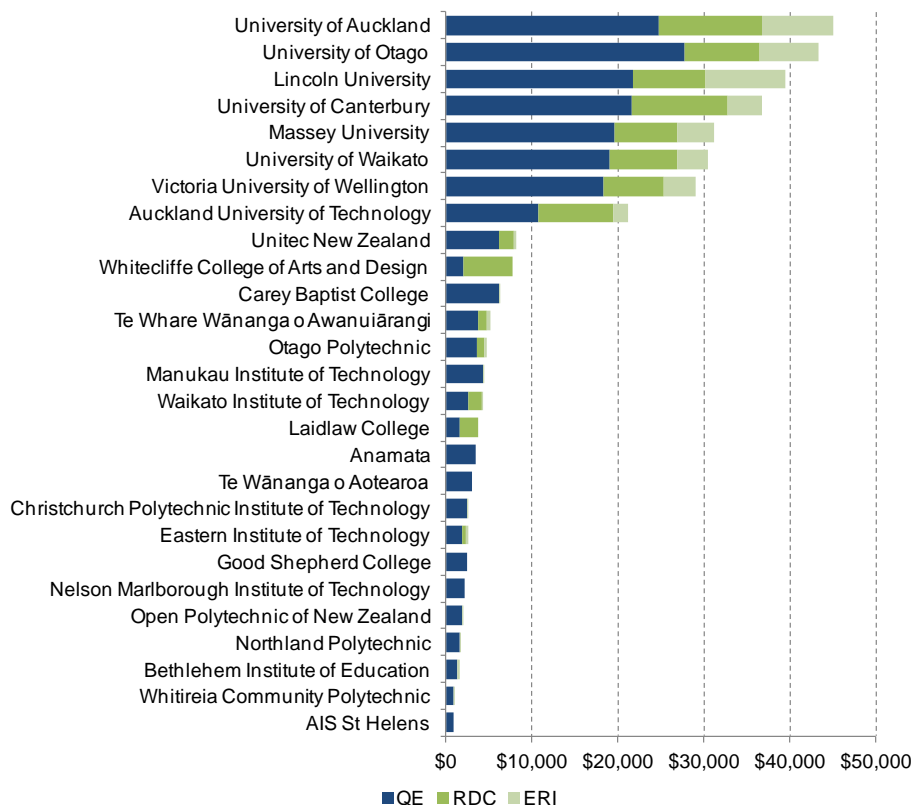
Source: Ministry of Education and Tertiary Education Commission

PBRF funding allocation per unit

In each year, a certain number of 'points' are used to distribute the funding in the three PBRF components. In this section, we use these 'points' to analyse how the PBRF allocations per funding unit have tracked over time. We focus on the years between 2007 and 2011, the years where the PBRF was fully phased in and for which the data used to distribute the allocations has been finalised.

Quality Evaluation

The results of the 2006 QE were the basis for funding allocations in the QE component for the years we are analysing, 2007 to 2011. PBRF allocations to TEOs via the Quality Evaluation were based on the number of points they received after subject weightings, FTE weightings and quality category weightings were applied. There are three levels of subject weightings, which are based on the funding rate differentials in the Student Achievement Component and reflect cost relativities. Subjects such as History and Business receive a weighting of 1 and subjects such as Chemistry and Physics a weighting of 2, while subjects like Engineering and Technology, and Clinical Medicine receive a weighting of 2.5. The technical notes section at the end of this chapter contains a full list of subjects and weightings.

In total, 20,288 points were used in the 2006 QE to allocate funding to TEOs. If we divide the QE funding allocation in each year by the number of points (which did not change over the period of this analysis), we can calculate a measure of per unit funding.

Figure 12 below shows the QE per unit funding over time in nominal and inflation-adjusted terms. Between 2007 and 2011, per unit funding increased by 21 percent in nominal terms and 9 percent in real terms. The increases in the PBRF pool size in 2008, 2009 and 2010 outstripped inflation, which is why the funding per point increased in real terms. However, when the PBRF pool size remained constant in 2011, the QE funding per point decreased by 2.4 percent in real terms.

Figure 12
PBRF Quality Evaluation component funding per unit
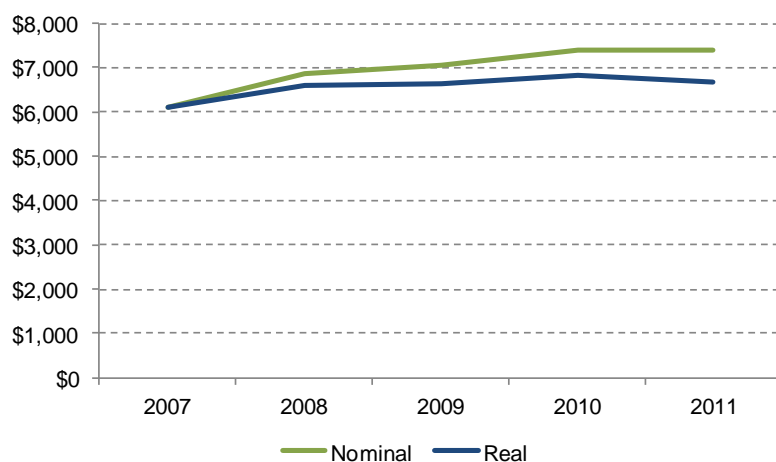
We can use the QE per unit funding data to estimate how much funding PBRF-eligible staff members in the 2006 Quality Evaluation attracted for their TEO in 2011. Table 2 shows that the highest funding would have been attracted by a researcher who received an A in a high cost subject (with a weighting of 2.5) – who would have attracted $92,419. This compares with the funding attracted by a researcher who received a C in the 2006 Quality Evaluation in a low cost subject area (with a weighting of 1) – who would have attracted $7,394. The differences in funding between high and low performers in the same subject area provide a significant incentive for TEOs to maximise the quality category received by their PBRF-eligible staff.

Table 2

Quality Evaluation funding for 1 FTE staff member by quality category and subject in 2011

Quality Evaluation category	QE weighting	Subject weighting	Total points	Funding
A	5	1	5	$36,968
	5	2	10	$73,935
	5	2.5	12.5	$92,419
B	3	1	3	$22,181
	3	2	6	$44,361
	3	2.5	7.5	$55,451
C or C(NE)	1	1	1	$7,394
	1	2	2	$14,787
	1	2.5	2.5	$18,484

Note: The subjects that are allocated to the three subject weightings are listed in the technical notes section at the end of this chapter.

Research degree completions

The RDC funding per unit varies between years, depending on the size of the PBRF funding pool and the type, subject area and number of RDCs reported by TEOs in the relevant three-year data collection period. There are three levels of subject weightings, which are based on the funding rate differentials in the Student Achievement Component and reflect cost relativities. Subjects such as History and Business receive a weighting of 1 and subjects such as Chemistry and Physics a weighting of 2, while subjects like Engineering and Technology, and Clinical Medicine receive a weighting of 2.5. The technical notes section at the end of this chapter contains a full list of subjects and weightings.

Figure 13 shows the RDC funding per unit. Between 2008 and 2011, RDC funding per unit decreased by 11 percent in nominal terms and 16 percent in real terms. The fall in per unit funding in 2009 and 2010 reflects an increase in RDCs outstripping the increases in the PBRF pool size. In 2011, in addition to another increase in RDCs, the RDC funding pool remained unchanged, so the rate of decrease in funding per unit was greater.

The 2002 PBRF Working Group had recommended that the PBRF pool should increase enough over time to take into account increased RDCs and so preserve the per unit funding received by TEOs. Over the period 2008-2011, this did not occur.

Figure 13
PBRF research degree completions component funding per unit
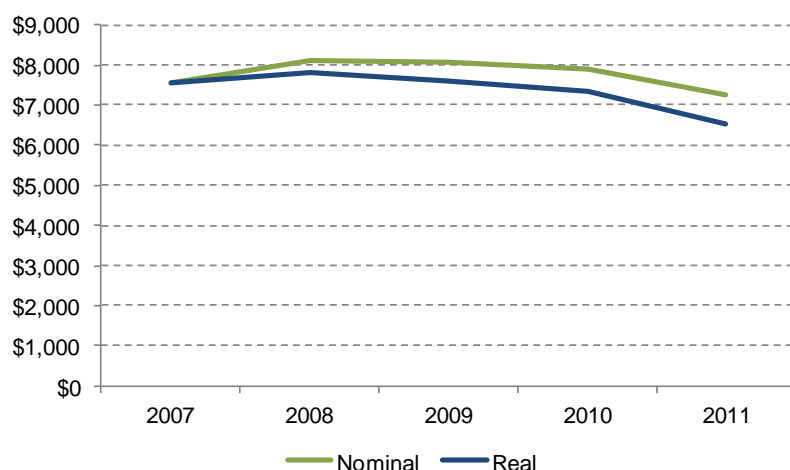
Source: Ministry of Education and Tertiary Education Commission

The RDC component was introduced not only as a proxy measure of quality, but also to provide an incentive to maximise the completion rates of higher research degrees, which the 2002 Working Group had perceived were low in New Zealand. To get a sense of how much money is attracted by different types of RDC, we present a number of scenarios. These show the funding that a TEO would have received for an RDC in the 2007 year. The RDC funding received by a TEO varies by subject, by volume of research factor (VRF), and by ethnic group (Māori or Pasifika graduates attract additional weighting).

The funding to a TEO for an RDC is spread over three years. For a completion in 2007, the funding would be allocated to a TEO in 2009, 2010 and 2011. The funding attracted for various scenarios is presented in Table 3 in nominal and real terms. Once we adjust for inflation, the greatest total funding attracted by a non-Māori or non-Pasifika doctoral student over those three years was almost $61,000 dollars. The lowest amount was just over $24,000 dollars. For a non-Māori or non-Pasifika student who completed a 1 EFTS masters thesis in 2007, the maximum amount this would have earned for a TEO in real terms was $20,326 and the lowest $8,131. This is for the case where there was a VRF of 1.

For Māori and Pasifika graduates, the maximum earned by a TEO for a doctorate completed in 2007 would have been almost $122,000 dollars in real terms, compared with a minimum of around $47,000 (see Table 4). The maximum funding received for a 1 EFTS masters thesis completed in 2007 would have been $40,653 dollars in real terms, compared with a minimum of around $16,000.

Table 3

Funding attracted by research degree completions in 2007 by non-Māori or non-Pasifika students

Type of degree		Volume of research factor	Subject weighting	2009	2010	2011	Total
Doctorate	Nominal	3	1	$12,091	$8,313	$3,262	**$23,666**
		3	2	$24,181	$16,625	$6,525	**$47,332**
		3	2.5	$30,227	$20,781	$8,156	**$59,164**
	Real	3	1	$12,611	$8,518	$3,262	**$24,392**
	(2011$s)	3	2	$25,221	$17,037	$6,525	**$48,783**
		3	2.5	$31,527	$21,296	$8,156	**$60,979**
Masters	Nominal	1	1	$4,030	$2,771	$1,087	**$7,889**
		1	2	$8,060	$5,542	$2,175	**$15,777**
		1	2.5	$10,076	$6,927	$2,719	**$19,721**
	Real	1	1	$4,204	$2,839	$1,087	**$8,131**
	(2011$s)	1	2	$8,407	$5,679	$2,175	**$16,261**
		1	2.5	$10,509	$7,099	$2,719	**$20,326**

Note: The subjects that are allocated to the three subject weightings are listed in the technical notes section at the end of this chapter.

Table 4

Funding attracted by research degree completions in 2007 by Māori or Pasifika students

Type of degree		Volume of research factor	Subject weighting	2009	2010	2011	Total
Doctorate	Nominal	3	1	$24,181	$16,625	$6,525	**$47,332**
		3	2	$48,363	$33,250	$13,050	**$94,663**
		3	2.5	$60,454	$41,563	$16,312	**$118,329**
	Real	3	1	$25,221	$17,037	$6,525	**$48,783**
	(2011$s)	3	2	$50,443	$34,074	$13,050	**$97,567**
		3	2.5	$63,054	$42,592	$16,312	**$121,958**
Masters	Nominal	1	1	$8,060	$5,542	$2,175	**$15,777**
		1	2	$16,121	$11,083	$4,350	**$31,554**
		1	2.5	$20,151	$13,854	$5,437	**$39,443**
	Real	1	1	$8,407	$5,679	$2,175	**$16,261**
	(2011$s)	1	2	$16,814	$11,358	$4,350	**$32,522**
		1	2.5	$21,018	$14,197	$5,437	**$40,653**

Note: The subjects that are allocated to the three subject weightings are listed in the technical notes section at the end of this chapter.

To get a better sense of the incentive for completion, we compare the funding that would have been attracted by a student who completed a doctoral or masters thesis via the Student Achievement Component (SAC) with the funding attracted via the RDC component (see Tables 5 and 6). For the doctorate example, we assume they studied for three years between 2005 and 2007 and consumed 3 EFTS of SAC funding. For the masters thesis, we assume they studied for one year in 2007 and consumed 1 EFTS of SAC funding. Note that we use the non-degree SAC funding rates for tertiary education institutions in these scenarios. By doing so we are assuming the PBRF had been fully implemented in the years the student was enrolled.

For a non-Māori or non-Pasifika student who completed their doctorate in 2007 and was in a low cost category, the proportion earned for a TEO via the completion was 57 percent. This increases to 64 percent for a completion in a higher cost subject.

For Māori and Pasifika, because of the additional PBRF weighting, the proportion of funding attracted from the RDC component is higher. For a doctorate in a low cost category, the completion component is worth 73 percent, compared with 57 percent for a non-Māori or Pasifika student.

It is important to remember that the size of the RDC funding pool in each year is fixed. This means that if all TEOs doubled their RDCs overnight they would receive half the funding per RDC, as the RDC pool size wouldn't change. Nevertheless, there is still an incentive for TEOs to increase their research degree enrolments if other providers are doing so to maintain their relative portion.

Table 5
Student Achievement Component and PBRF funding for a student completing a doctoral thesis in 2007 (in 2011 dollars)

Ethnic group	SAC funding category	SAC funding	PBRF subject weighting	PBRF funding	Total funding	% SAC	% PBRF
Māori or	A1	$18,320	1	$48,783	$67,103	27%	73%
Pasifika	B1	$28,036	2	$97,567	$125,603	22%	78%
	C1	$33,704	2.5	$121,958	$155,662	22%	78%
Other	A1	$18,320	1	$24,392	$42,712	43%	57%
	B1	$28,036	2	$48,783	$76,819	36%	64%
	C1	$33,704	2.5	$60,979	$94,683	36%	64%

Notes: 1. This analysis assumes the doctorate has a volume of research factor of 3. 2. The SAC funding assumes that the student studied for three years from 2005 to 2007 and consumed 3 EFTS. 3. The SAC funding rate used is for tertiary education institutions and excludes the tri-partite component of the funding rates introduced in 2006. 4. The subjects that are allocated to the three subject weightings are listed in the technical notes section at the end of this chapter.

Table 6
Student Achievement Component and PBRF funding for a student completing a 1 EFTS masters thesis in 2007 (in 2011 dollars)

Ethnic group	SAC funding category	SAC funding	PBRF subject weighting	PBRF funding	Total funding	% SAC	% PBRF
Māori or	A1	$6,096	1	$16,261	$22,357	27%	73%
Pasifika	B1	$9,330	2	$32,522	$41,852	22%	78%
	C1	$11,215	2.5	$40,653	$51,868	22%	78%
Other	A1	$6,096	1	$8,131	$14,227	43%	57%
	B1	$9,330	2	$16,261	$25,591	36%	64%
	C1	$11,215	2.5	$20,326	$31,541	36%	64%

Notes: 1. This analysis assumes the masters thesis has a volume of research factor of 1. 2. The SAC funding assumes that the student studied for one year in 2007 and consumed 1 EFTS. 3. The SAC funding rate used is for tertiary education institutions and excludes the tri-partite component of the funding rates introduced in 2006. The subjects that are allocated to the three subject weightings are listed in the technical notes section at the end of this chapter.

External research income

The ERI funding distributed to TEOs is determined by a weighted average of ERI earned by TEOs over a three-year period. The ERI that attracts PBRF funding can be sourced from Government, business or overseas. There is no weighting applied to ERI from different sources. More detail on the ERI measure can be found in the Appendix. Figure 14 shows the PBRF allocation per weighted dollar of ERI earned in nominal and real terms between 2007 and 2011. Due to a significant increase in ERI earned by TEOs, the funding per dollar of ERI they receive has decreased. The lack of increase in the PBRF pool size in 2011 was also a factor in the decline. Between 2007 and 2011, the ERI funding per dollar earned has decreased by 16 percent in nominal terms and 24 percent in real terms.

Figure 14
PBRF external research income component funding per point
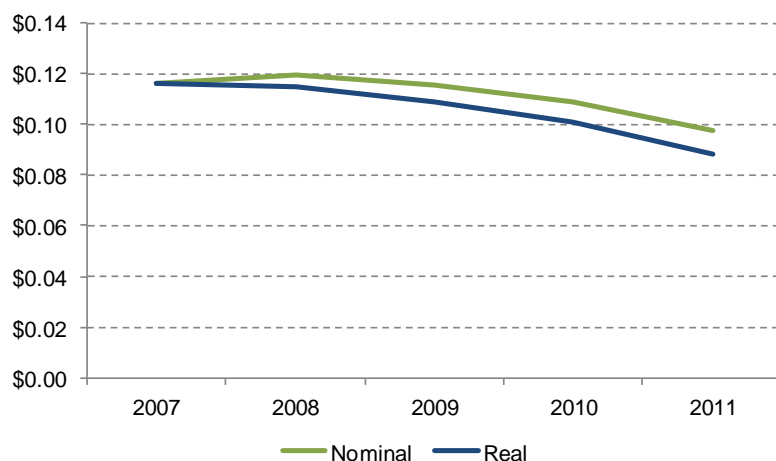
Source: Ministry of Education and Tertiary Education Commission

The correlation between PBRF funding components

In this section, we examine the correlation between the various components of the PBRF allocations. This will give an indication of how closely related the component measures are and to what degree they are capturing the same effect, given that the RDC and ERI measures were included in the PBRF as proxy measures for research quality.

The share of each PBRF component earned by each TEO is presented in Table 7, ranked by the size of the share of the Quality Evaluation allocation. For example, in 2011 the University of Auckland received 27.02 percent of funding via the Quality Evaluation component, 31.5 percent of the RDC component and 36.65 percent of the ERI component. Table 7 also presents the percentage point difference between the various components.

A negative sign in the QE – RDC column means that the TEO achieved a higher share of RDC funding in 2011 compared with QE funding. Similarly, a negative sign in the QE – ERI column indicates that the TEO achieved a higher share of ERI funding compared with QE funding. Finally, a negative sign in the RDC – ERI column indicates that the TEO earned a higher share of ERI funding than RDC component funding. For example, the share of Quality Evaluation component funding for the University of Auckland was 4.48 percentage points lower than the RDC component and 9.63 percentage points lower than the ERI component.

For other TEOs, the opposite was the case. For example, the share of Quality Evaluation component funding earned by the University of Otago was 5.46 percentage points higher than

the share it received from the RDC component and 0.35 percentage points higher than the ERI component.

Table 7

Share of 2011 PBRF funding allocations by TEO and by component

TEO	QE	RDC	ERI	QE - RDC	QE - ERI	RDC - ERI
University of Auckland	27.02%	31.50%	36.65%	-4.48%	-9.63%	-5.15%
University of Otago	22.42%	16.96%	22.08%	5.46%	0.35%	-5.11%
Massey University	14.56%	12.96%	12.62%	1.60%	1.94%	0.34%
University of Canterbury	10.60%	13.17%	8.03%	-2.57%	2.57%	5.14%
Victoria University of Wellington	9.73%	8.87%	7.85%	0.86%	1.88%	1.02%
University of Waikato	6.38%	6.37%	4.86%	0.01%	1.52%	1.51%
Lincoln University	3.12%	2.89%	5.33%	0.23%	-2.21%	-2.44%
Auckland University of Technology	2.74%	5.28%	1.87%	-2.54%	0.87%	3.41%
Unitec New Zealand	1.55%	1.09%	0.27%	0.46%	1.28%	0.82%
Otago Polytechnic	0.33%	0.19%	0.11%	0.14%	0.22%	0.08%
Manukau Institute of Technology	0.33%	0.00%	0.03%	0.33%	0.30%	-0.03%
Christchurch Polytechnic Institute of Technology	0.25%	0.00%	0.07%	0.25%	0.18%	-0.07%
Waikato Institute of Technology	0.23%	0.34%	0.05%	-0.11%	0.18%	0.28%
Te Whare Wānanga o Awanuiārangi	0.13%	0.08%	0.08%	0.06%	0.06%	0.00%
Open Polytechnic of New Zealand	0.12%	0.00%	0.01%	0.12%	0.11%	-0.01%
Te Wānanga o Aotearoa	0.11%	0.00%	0.00%	0.11%	0.11%	0.00%
Eastern Institute of Technology	0.11%	0.07%	0.04%	0.04%	0.07%	0.03%
Nelson Marlborough Institute of Technology	0.06%	0.00%	0.00%	0.06%	0.06%	0.00%
Whitireia Community Polytechnic	0.04%	0.00%	0.02%	0.04%	0.02%	-0.02%
Northland Polytechnic	0.04%	0.00%	0.01%	0.04%	0.02%	-0.01%
Carey Baptist College	0.03%	0.00%	0.00%	0.03%	0.03%	0.00%
Whitecliffe College of Arts and Design	0.03%	0.18%	0.00%	-0.16%	0.03%	0.18%
Laidlaw College (originally Bible College of NZ)	0.02%	0.06%	0.00%	-0.04%	0.02%	0.06%
Bethlehem Institute of Education	0.01%	0.00%	0.02%	0.01%	0.00%	-0.02%
AIS St Helens	0.01%	0.00%	0.00%	0.01%	0.01%	0.00%
Good Shepherd College	0.01%	0.00%	0.00%	0.01%	0.01%	0.00%
Anamata	0.01%	0.00%	0.00%	0.01%	0.01%	0.00%
Total	**100.00%**	**100.00%**	**100.00%**			

Source: Tertiary Education Commission

It is easier to get a sense of the correlation between the three component measures using scatterplots. Figure 15 presents scatterplots of combinations of the shares of the three PBRF component measures, where each green dot represents the data for a particular TEO. Note there are two graphs for each combination – the left-hand graph represents all TEOs, while the right-hand graph represents those TEOs that have small shares of component funding and can't be clearly identified in the left-hand graph. Each graph also includes a line of best fit.

Figure 15 shows there was broad correlation between performance on the ERI, RDC and QE measures (suggesting that they are all robust measures), but sufficient variation to confirm that none of the measures is redundant.

Focusing on the QE versus RDC scatterplots, the dots above the line of best fit in the left-hand scatterplot show that three TEOs achieved a higher share of RDC funding than one would expect, given their level of QE funding. These are the University of Auckland, University of Canterbury and Auckland University of Technology. Among the smaller TEOs in the right-hand scatterplot, the TEOs with dots above the line of best fit (i.e. those that achieved a higher share of RDC funding than one would expect, given their QE funding) are the Waikato Institute of Technology, Whitecliffe College of Arts and Design and Laidlaw College.

In terms of the QE versus ERI scatterplots, there are two TEOs with dots above the line of best fit in the left-hand scatterplot. This indicates that they received a higher share of ERI funding than would be expected, given their share of QE funding. These two TEOs were the University of Auckland and Lincoln University. There are no smaller TEOs in the right-hand scatterplot with a share of ERI above what we would expect. In fact the opposite is the case – they all received a lower share of ERI than would be expected given their QE results. This result is unsurprising, given the advantages that the larger universities have in attracting ERI.

In terms of the RDC versus ERI scatterplots, the left-hand scatterplot shows that there are three TEOs that received a greater share of ERI funding than would be expected, given their RDC share. These three TEOs are the University of Auckland, the University of Otago and Lincoln University. Of the smaller TEOs in the right-hand scatterplot, there are several that received ERI funding but no RDC funding, which is why they were above the line of best fit. These included TEOs like Northland Polytechnic and Nelson Marlborough Institute of Technology.

Figure 15

Correlations between the share of PBRF funding allocations to TEOs by component in 2011
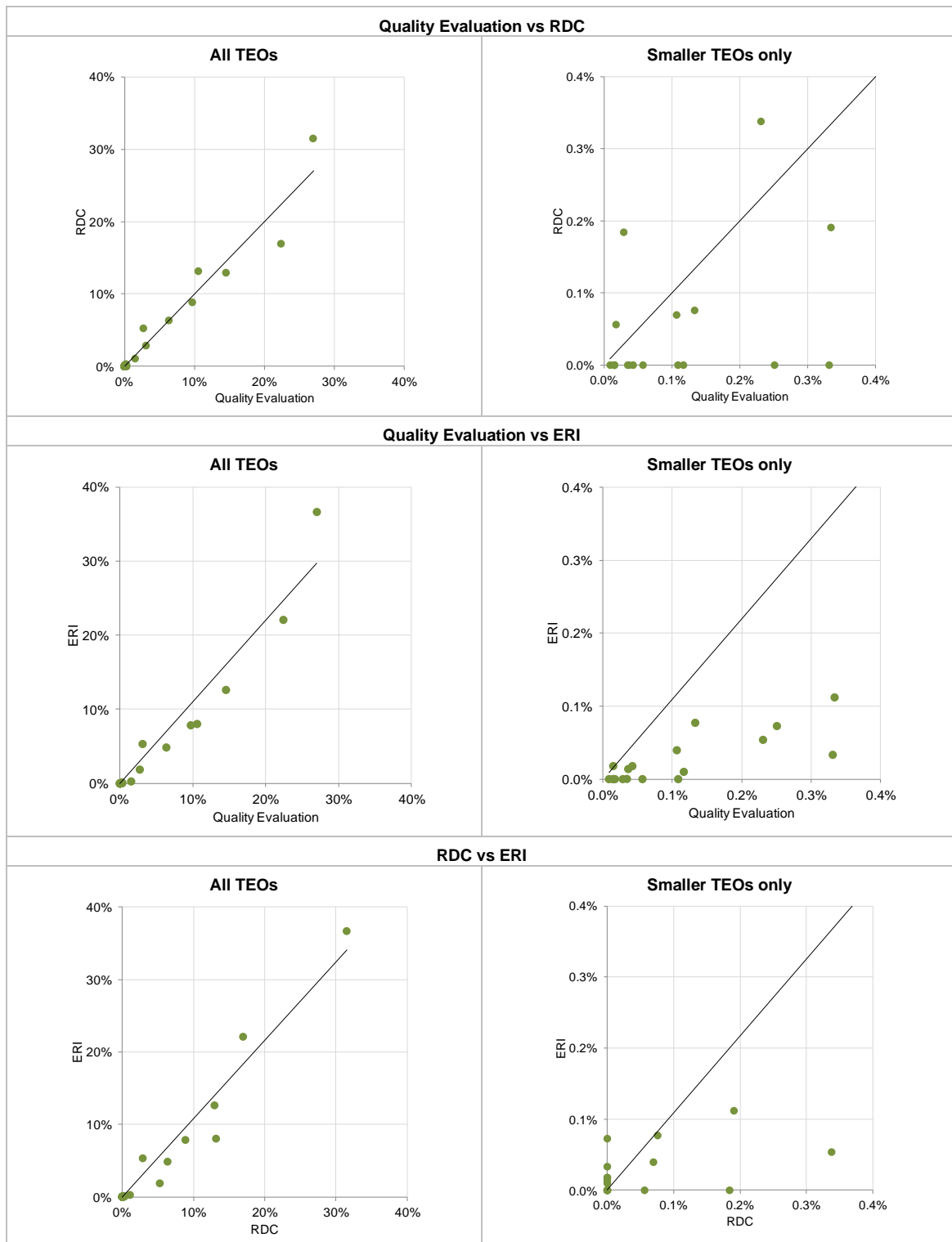
Notes: 1. Each dot represents the share of PBRF funding allocation of a participating TEO. 2. The left-hand scatterplot represents the data for all TEOs, while the right-hand scatterplot concentrates on smaller TEOs which can't be identified in the left-hand scatterplot.

Source: Ministry of Education and Tertiary Education Commission

The importance of PBRF funding to tertiary education institutions

The variation in research profile of the tertiary subsectors is reflected in the importance of PBRF allocations to their total income. Figure 16 shows PBRF funding in 2011 for each of the participating tertiary education institutions (TEIs)[2] as a percentage of total operating revenue and also reported research income. For some TEIs, the funding allocated via the PBRF is a key source of income. Generally, the PBRF is a significant percentage of the total operating revenue for the universities, while it is a low proportion of total research income. This is due to the additional external research income that universities attract that boosts their total research income.

For non-universities, the PBRF allocation is generally a major component of their research income, but a very low proportion of their total operating revenue. Two of the exceptions are the two wānanga that participate in the PBRF, although part of the reason for this is additional research funding that is provided by the Government.

Figure 16

PBRF funding allocations as a percentage of all research revenue and total operating revenue for participating tertiary education institutions in 2011
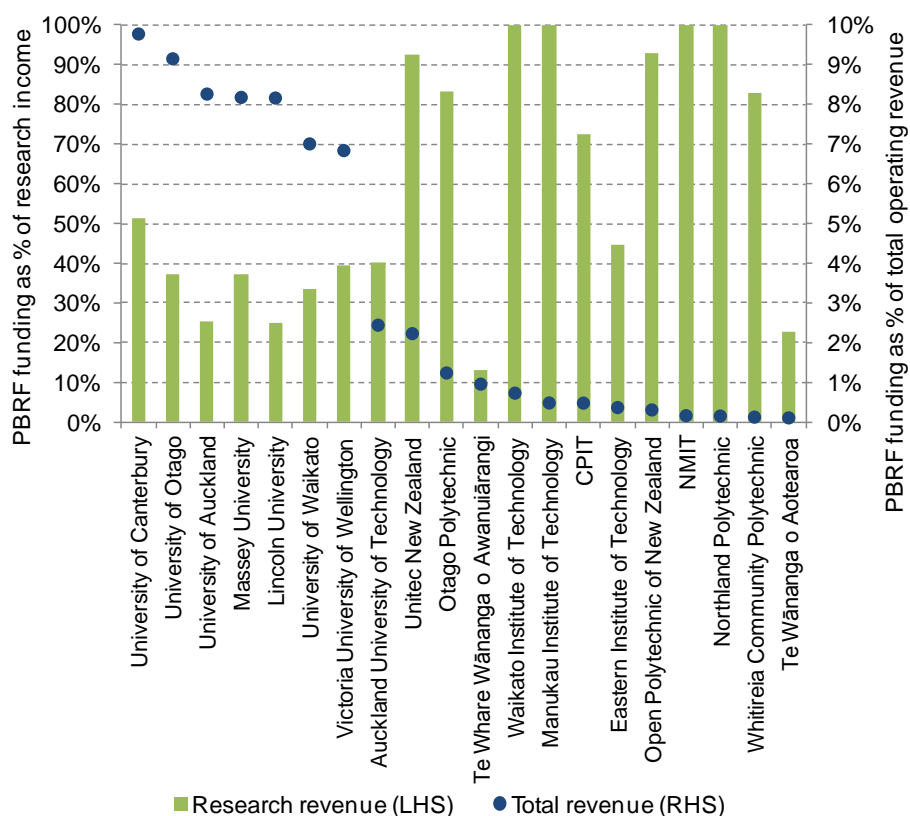
Source: Tertiary Education Commission

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[2] Tertiary Education Institutions include: universities, polytechnics and wānanga.

Technical notes

1. The colleges of education are treated as being part of their respective universities for the entire period.

2. All expenditure in this section is exclusive of GST.

3. The Consumers Price Index has been used to adjust for the impact of inflation on funding over time.

4. In calculating the research top-ups between 2001 and 2003, it is assumed that all TEOs accepted fee stabilisation and so received the effective rates of funding.

5. Subject category weightings for the Quality Evaluation and RDC components are as follows:

Subject areas	Funding category	Weighting
Māori knowledge and development; law; history, history of art, classics and curatorial studies; English language and literature; foreign languages and linguistics; philosophy; religious studies and theology; political science, international relations and public policy; human geography; sociology, social policy, social work, criminology and gender studies; anthropology and archaeology; communications, journalism and media studies; education; pure and applied mathematics; statistics; management, human resources, industrial relations, international business and other business; accounting and finance; marketing and tourism; and economics.	A, I, J	1
Psychology; chemistry; physics; earth sciences; molecular, cellular and whole organism biology; computer science, information technology, information sciences; nursing; sport and exercise science; other health studies (including rehabilitation therapies); music, literary arts and other arts; visual arts and crafts; theatre and dance, film and television and multimedia; and design.	B, L	2
Engineering and technology; agriculture and other applied biological sciences; ecology, evolution and behaviour; architecture, planning, surveying; biomedical; clinical medicine; pharmacy; public health; veterinary studies and large animal science; and dentistry.	C, G, H, M, Q	2.5

Source: Tertiary Education Commission

4　ACADEMIC IMPACT OF RESEARCH

KEY POINTS

- The bibliometric data in this chapter shows that the research performance of New Zealand tertiary education institutions has improved since the introduction of the PBRF. Specifically, the data shows that:
  - the share of world indexed publications and citations of research from New Zealand tertiary education institutions has increased since the PBRF was introduced. This improvement was evident to some degree among all universities

  - the proportion of research publications produced at New Zealand tertiary education institutions that were cited increased relative to the world average

  - the proportion of subject areas where research by New Zealand tertiary education institutions had a relative academic impact above the world average has increased since the PBRF was introduced

  - the proportion of subject areas where research by New Zealand tertiary education institutions had a relative academic impact above that of the Australian Group of Eight universities has increased since the PBRF was introduced.

- The improvement in bibliometric performance also coincides with the introduction of Centres of Research Excellence funding. It is likely that this is also a factor in the improved performance, as is the improvement of the performance of Auckland University of Technology as it has matured since becoming a university in 2000. However, the system-wide improvement in research performance is broad enough to suggest that the PBRF is also a likely factor.

- In summary, although we cannot imply causation, the improvement in bibliometric performance by New Zealand tertiary education institutions has coincided with the introduction of the PBRF. It is likely that this improved performance is at least partly due to the sharpened focus placed on research by the PBRF.

Introduction

One of the key aims of the PBRF was to increase the average quality of research in New Zealand tertiary education organisations (TEOs), with the PBRF Quality Evaluation the main tool used to achieve this. The results of the Quality Evaluation are published and so create an additional incentive for TEOs to maximise the quality of research produced by staff.

Using the results of the Quality Evaluation to measure improvements in the average quality of research over time has two significant drawbacks. First, the Quality Evaluation results are published only every six years, so there is a significant lag in assessing whether research quality has changed. Second, there have been methodological changes made to the way each QE has been undertaken, making it difficult to draw conclusions about improvements in research quality. This means that using a measure of research quality that sits outside of the PBRF process is essential in monitoring the impact of the PBRF.

The initial PBRF evaluation plan listed bibliometrics as a potential way of monitoring the impact of the PBRF (Tertiary Education Commission, 2003). In his strategic review of the PBRF, Adams (2008) also identified bibliometric measures as a key way of monitoring the

impact of the PBRF. The rationale for using bibliometrics measures, such as the rate of citation (the number of times a journal article is referenced in another journal article), is that many studies have found a correlation between rates of citation and quality of research as determined through a peer-review process. The assumption is that the higher the quality of the article, the greater the number of citations it should attract.

In the United Kingdom, bibliometric data has been used to evaluate the impact of the Research Assessment Exercise (RAE) on the research performance of tertiary institutions. The RAE, like the PBRF, is a peer-review-based system for funding tertiary education research. In evaluating the impact of the RAE on research performance, Adams and Smith (2006) found that the share of world citations from research carried out by United Kingdom researchers increased following the introduction of the RAE. Although the authors were at pains to note the difference between correlation and causation, they nevertheless were of the opinion that the RAE was likely to have been a key factor in these observed trends.

The Australian Federal Government uses bibliometric measures more explicitly in measuring the quality of research produced by the higher education sector in Australia. The Excellence in Research Australia (ERA) exercise uses a number of metrics, including citation rates, in their suite of measures to determine research quality.

In New Zealand, bibliometrics has played no formal role in the PBRF Quality Evaluations. However, the Ministry of Education has produced a number of reports using bibliometric measures to monitor the academic impact of research by New Zealand TEIs over time (see Smart and Weusten 2007; Smart, 2009). In this chapter, we use updated data from Thomson Reuters to examine the performance of New Zealand tertiary education institutions using a variety of metrics.

The bibliometric data

The bibliometric dataset used in this chapter was sourced from Thomson Reuters and contains data on the number of academic journal publications and their associated citations between 1981 and 2011. In total, the Thomson Reuters dataset currently draws on information from over 11,000 journals selected because of their high quality.

The publications included in the database are articles, notes, reviews, and proceedings papers. Other types of items such as editorials, letters, corrections and abstracts have been omitted. A publication was assigned to an institution if at least one author was from that institution. Note that this dataset treats the universities as having been merged with colleges of education for the entire time period.

The measures presented in this chapter include the share of world indexed publications and citations and the relative academic impact of research. The relative academic impact is measured by dividing the average number of citations per New Zealand TEI publication by the average number of citations for every publication worldwide. Normalisation of the academic impact is important as the rates of citation vary between subject areas and because the rates of citation are rising over time as the rates of research activity expand internationally.

A relative academic impact value of 1 indicates the citations per publication in a New Zealand institution are the same as the world average. A relative academic impact value greater than 1 indicates that the citations per publication of New Zealand research is higher than the world average and a relative academic impact value less than 1 indicates the citations per publication of New Zealand research is below the world average.

Limitations of bibliometric data[3]

While citations have become an increasingly common measure of research performance, there are reservations about their use and the results presented in this analysis need to be considered in the light of these caveats. Some of the most important (but by no means all) caveats are:[4]

- The coverage of the social sciences and humanities in the Thomson Reuters database – the most commonly used source of citations data – is not as extensive as coverage of the natural and medical sciences. In addition, publishing conventions in disciplines such as the humanities and social sciences may favour research outputs such as books and book chapters, which are not captured in the Thomson database.
- Because citations are a better measure of science and medicine research impact, we need to take care when comparing performance. For instance, it isn't appropriate to compare raw citations scores across disciplines; nor is it appropriate to draw conclusions from a comparison of citation rates among research organisations without allowing for the balance of the disciplines in which the organisations conduct research.
- The Thomson Reuters database is mostly made up of English language journals based in North America and Europe. As such, research in New Zealand journals that may be of a high impact may be excluded from the Thomson Reuters database. In New Zealand, this may be a greater problem for applied fields of research and for research in the social sciences, where the research may be more focused on local problems and hence more likely to appear in local journals.
- Some of the citations may in fact refer to the source article in a negative way, meaning that some citations reflect a low opinion of the quality of the research. However, it is estimated that only around 7 percent of citations are negative (Bayers, 2007).
- There have been claims that some academic journals have attempted to manipulate citation rates by insisting that authors ensure that they include superfluous reference to other articles in the same journal. Thomson Reuters monitors this issue and bans journals from its *Journal Citation Reports* publication for two years (Jump, 2012). In terms of the PBRF, as citations are not an explicit part of the Quality Evaluation process, the incentive to manipulate citations is arguably low.
- One of the key measures in this study, relative academic impact, is an average figure. Therefore, one or two highly cited papers can skew the relative academic impact figure upwards. This is especially a problem in cases where number of papers is small. Therefore, the analysis of academic impact is restricted to subject areas that have a minimum of 50 publications within each five-year period.
- The small size of the New Zealand university sector, relative to other countries, can pose a problem in terms of the smaller number of publications the citation data is based on. The smaller the number of publications, the less stable the data can be. Therefore, some of the smaller narrow subject areas can be subject to considerable shifts in relative academic impact between periods.

Nevertheless, despite these caveats, bibliometrics data still provides one of the few independent ways that the impact of the PBRF on the research performance of New Zealand TEIs can be monitored. The Thomson Reuters data used in this analysis also has the advantage of containing data that predates the introduction of the PBRF, so that the impact of it can be more clearly assessed.

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[3] This section is derived from Smart (2009).

[4] A fuller discussion on the issues surrounding the use of citations to measure research performance can be found in Coryn (2006) and the Research Evaluation and Policy Project (2005).

Results

In this section, we examine bibliometric data to analyse the research performance of New Zealand tertiary education institutions. We use overlapping five-year time periods throughout this section. For example, the five-year period 2007-2011 contains the number of publications indexed during that five-year period and the citations linked to those publications. This approach is useful for time series analysis and also results in higher aggregations of publications and citations, making the bibliometric data more stable and less prone to being affected by outliers.

There is no precise time period where the impact of the PBRF should start to show in the bibliometric data, but given that the decision to implement the PBRF was made in May 2002, and taking into account the lag associated with the publication process, any changes in performance should begin around the 2001-2005 five-year window.

Figure 17 presents the share of world indexed publications and citations authored by researchers at New Zealand TEIs between 1981 and 2011.[5] The share of world indexed publications and citations has generally been increasing over time, but in the period immediately preceding the introduction of the PBRF the share of world indexed publications and citations had remained relatively static. The share of world indexed publications was 0.38 percent in 1996-2000 and was only 0.39 percent in 2000-2004. The share of world indexed citations remained static for slightly longer, being 0.33 percent in 1996-2000 and only 0.34 percent in 2001-2005.

Since the introduction of the PBRF, the share of world publications and especially the share of world citations by New Zealand TEIs has increased significantly. The share of world indexed publications has increased from 0.40 percent in 2000-2004 to 0.46 percent in 2007-2011. The increase in the share of world indexed citations was even more impressive, rising from 0.34 percent in 2001-2005 to 0.49 percent in 2007-2011.

Although the PBRF does not aim explicitly to increase the quantity of research, an increase in the share of indexed publications is not unexpected. This is because researchers are more likely to publish in the highly esteemed journals captured by Thomson Reuters, reflecting the higher quality of the research. But the shift in share of citations is even stronger, which suggests that research at New Zealand TEIs is having greater academic impact and hence has been of higher quality.

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[5] We express publications and citations as a percentage of the world, due to increases in the journal set used by Thomson Reuters over time.

Figure 17

Share of world indexed publications and citations – New Zealand tertiary education institutions
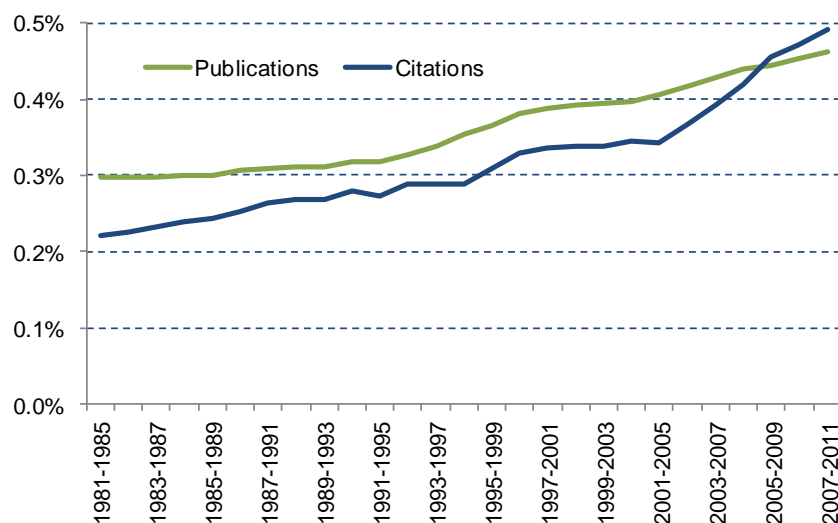
Source: Thomson Reuters

There are some caveats about the improved bibliometric performance evident in Figure 17. First, the timing of the improvement in bibliometric performance also roughly coincides with the introduction of the Centres of Research Excellence (CoRE) fund in 2002. Although much smaller in terms of fund size than the PBRF (it is only around $33 million a year compared with the $250 million for the PBRF), the CoRE fund also supports research excellence and is likely to have contributed to better performance. Second, the improvement in the performance of Auckland University of Technology as its research culture and performance matures since becoming a university in 2000 may have also played a role. Finally, funding for research via the contestable funds in Vote Science and Innovation may also have impacted on university performance.

We cannot isolate out the impact of the CoREs funding on overall bibliometric performance, but we can examine the performance of individual universities to see if the pattern of improvement evident in Figure 17 is across the board and widespread, and not just due to improvement by the Auckland University of Technology.

Figure 18 presents the share of world publications and citations for each of the New Zealand universities. Auckland University of Technology has clearly been improving in performance in the share of world publications and citations since becoming a university in 2000, although this improvement is off a low base and unlikely to be a key factor in the system-wide improvement in bibliometric performance.

The other universities all show some signs of improvement in performance following the introduction of the PBRF. Although the share of world indexed publications by Lincoln University has declined slightly since the PBRF was introduced (from 0.015 percent in 1998-2002 to 0.014 percent in 2007-2011), its share of world citations has increased significantly (from 0.009 percent in 1999-2003 to 0.013 percent in 2007-2011). This indicates a lower rate of publication but a higher level of academic impact.

Massey University exhibited an increase in share of world publications and world citations following the introduction of the PBRF. Its share of world publications increased from 0.056

percent in 2000-2004 to 0.070 percent in 2007-2011, while the share of world citations increased to an even greater extent, from 0.037 percent to 0.067 percent over the same period.

The University of Auckland has experienced an increase in share of world publications since the PBRF was introduced, but the increase (from 0.127 percent in 2000-2004 to 0.144 percent in 2007-2011) was modest compared with the increase in share of world citations (from 0.128 percent in 1999-2003 to 0.176 percent in 2007-2011). This is once again evidence of an improvement in the academic impact of research coinciding with the introduction of the PBRF.

At the University of Canterbury, an increase in its share of world publications predates the introduction of the PBRF. It began increasing from the 1997-2001 five-year window, a period predating the introduction of the PBRF. However, an increase in its share of world citations is significant after the introduction of the PBRF (it increased from 0.033 percent in 2000-2004 to 0.055 percent in 2007-2011), and means that the improvement in academic impact of research at the University of Canterbury coincides with the introduction of the PBRF.

The University of Otago exhibits a relatively small increase in its share of world indexed publications following the introduction of the PBRF (it increased from 0.108 percent in 2000-2004 to 0.121 percent in 2007-2011). However, after remaining static for a period prior to the introduction of the PBRF, the share of world citations by the University of Otago has increased (from 0.119 percent in 2001-2005 to 0.153 percent in 2007-2011).

The University of Waikato is one of two universities to show a decrease in share of world publications since the PBRF was introduced (Lincoln University being the other). Its share of world publications decreased from 0.026 percent 2001-2005 to 0.025 percent in 2007-2011. Although subject to more variation than the other universities, the University of Waikato's share of world citations has also increased, from 0.014 percent in 2000-2004 to 0.022 percent in 2011.

At Victoria University of Wellington, the share of both world publications and world citations has increased. In terms of publications, its world share increased from 0.029 percent in 1999-2003 to 0.046 percent in 2007-2011, while its increase in world share of citations over the same period was slightly larger, from 0.018 percent to 0.042 percent.

Overall, there has been improvement in bibliometric performance at all of the universities since the PBRF was introduced. In particular, the incidence of citation of research by New Zealand universities has increased significantly.

Figure 18

Share of world indexed publications and citations by individual New Zealand universities
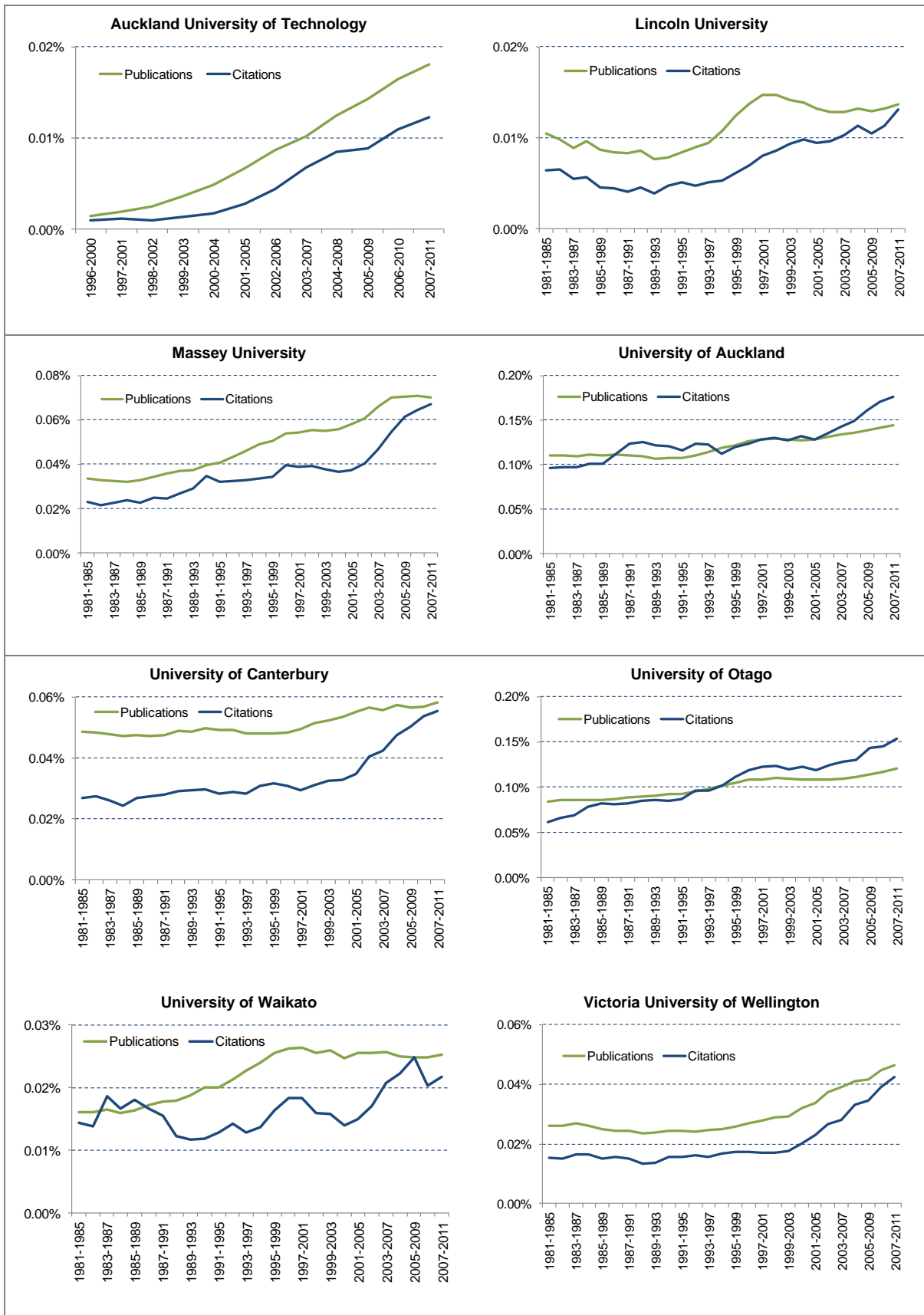
Source: Thomson Reuters

In Figure 19, we present the share of world publications and citations by non-university TEIs. The data shows an increase in the share of both publications and citations over time, although the performance has plateaued somewhat since the 2004-2008 five-year window. However, this data is based on relatively small numbers of publications and is dominated by larger polytechnics, such as Unitec New Zealand.

Figure 19

Share of world indexed publications and citations by non-university New Zealand tertiary education institutions
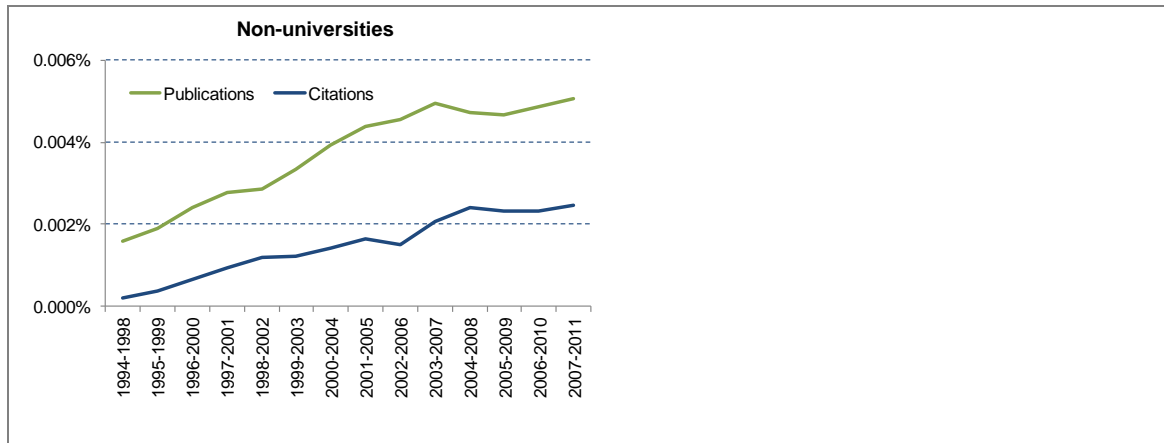
Source: Thomson Reuters

Although the improvement in overall share of world publications and citations suggests that the academic impact of research at New Zealand TEIs has increased since the PBRF was introduced, it may be that the improvement is due to a number of highly cited papers, rather than an increase in the number of journal papers being cited.

To investigate if that is the case, Figure 20 compares the percentage of indexed publications from New Zealand TEIs that were cited at least once and compares this with the percentage of journal papers that were cited worldwide. We express this in the form of a ratio, with a value of 1 indicating that the percentage of publications by New Zealand TEIs that were cited was the same as was exhibited worldwide. We need to do this because the percentage of publications that are being cited is rising over time, so we need to normalise for this effect.

What Figure 20 shows is that the ratio was static or falling between 1991-1995 and 2001-2005. Since the introduction of the PBRF, the ratio has increased slightly from 1.01 in 2001-2005 to 1.06 in 2007-2011, suggesting an increase in the percentage of publications that have been cited at least once.

Figure 20

Ratio of the proportion of publications that were cited compared with the world average – New Zealand tertiary education institutions
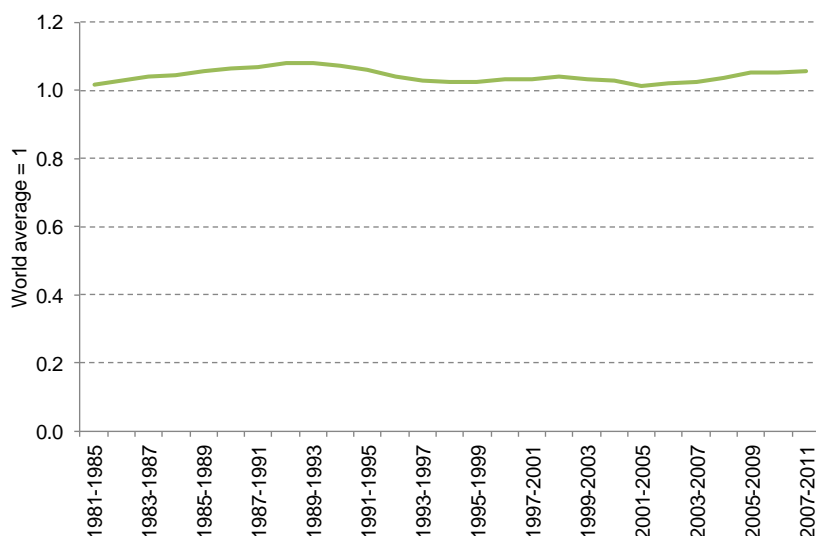
Source: Thomson Reuters

Another way to assess if the improvement in academic impact has been across the board is to analyse the proportion of subject areas reported by Thomson Reuters by their relative academic impact. Thomson Reuters reports data for 252 subject areas, although New Zealand TEIs do not publish enough research in all of these areas to permit us to analyse performance. For stability in the data, we examine only those subject areas that had at least 50 papers indexed in each of the five-year windows.

Figure 21 shows the distribution of subject areas by their relative academic impact. A value of 1 indicates the academic impact is equal to the world average, while a value greater than 1 indicates the research has an academic impact greater than the world average. The figures in brackets after the years in Figure 21 indicate the number of subject areas that reached the threshold of 50 publications or more in the five-year window and have been assessed. With increased publication, the number of subject areas with 50 or more publications has risen from 67 in 1981-1985 to 188 in 2007-2011.

The data shows that since the introduction of the PBRF the proportion of subject areas that have an academic impact above the world average has increased from 36 percent in 1999-2003 to 60 percent in 2007-2011. This indicates that the improvement in academic impact evident in the scale of the increase in the share of world citations is not due to improvement in a few subject areas and is more of an across-the-board improvement.

Figure 21

Distribution of subject areas by relative academic impact – New Zealand tertiary education institutions
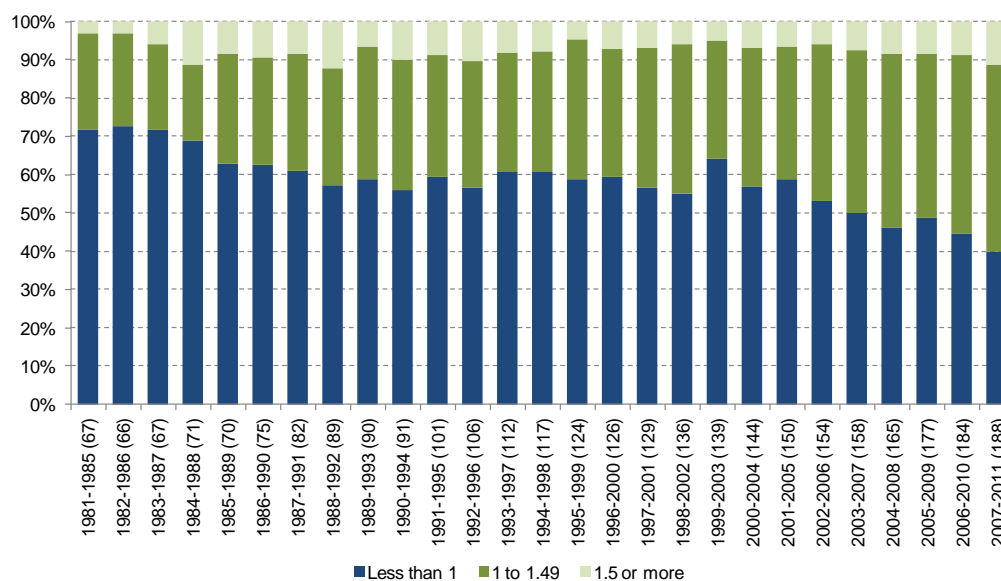
Notes: 1. A value of 1 for relative academic impact shows that the number of citations per publication for the New Zealand TEI-authored research was equal to the world average rate of citation. 2. Only subject areas with 50 or more publications were selected for this analysis. 3. The number in brackets refers to the number of subject areas with at least 50 indexed publications.

Source: Thomson Reuters

We can also compare the academic impact in the subject areas with that of the Australian Group of Eight (G8) universities (see Figure 22). The G8 universities are large, research-intensive universities that are often used as a benchmark by New Zealand universities. Also, in Australia, universities have been funded by volume of research output since 1993. Recently, the Australian Government has begun publishing research performance information for the universities, mostly based on bibliometric measures, such as relative academic impact. So the Australian universities have an incentive to maximise publication and the rate of citation.

The relative impact of research by New Zealand TEIs exceeded that of the G8 in 41 percent of the subject areas in 1990-1994. Then it fell to a low of 24 percent in 1999-2003. Since then, the percentage of subject areas where New Zealand TEIs have an academic impact above the G8 has recovered slowly to reach 32 percent in 2007-2011. This improvement since 2000-2004 coincides with the period when the PBRF was introduced.

In summary, although we cannot imply causation, the system-wide improvement in bibliometric performance since 2001-2005 presented in this chapter has coincided with the introduction of the PBRF. It is likely that this improved performance is at least partly due to the sharpened focus placed on research by the PBRF.

Figure 22

Percentage of subject areas where the academic impact of research from New Zealand tertiary education institutions exceeds that of the Australian Group of Eight universities
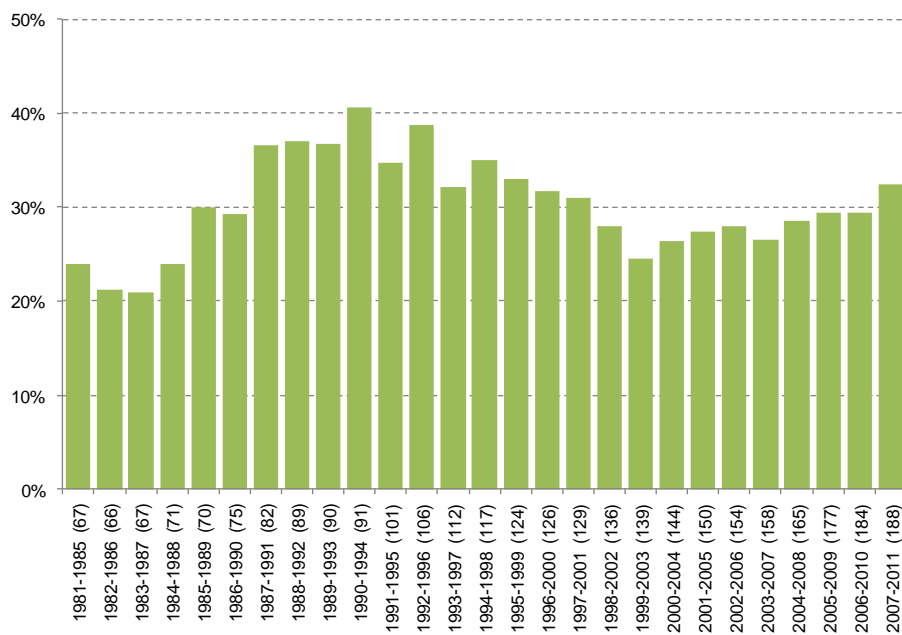
Source: Thomson Reuters

Technical notes

1. The colleges of education are treated as being part of their respective universities for the entire period.

5   RESEARCH DEGREE COMPLETIONS

KEY POINTS

- Participation rates in masters degrees are associated with the phases of the business cycle, whereas the doctoral level appears to show a long-term trend of increasing participation independent of the business cycle.

- The strong growth in enrolments in doctoral degrees over the last five years has been mainly due to an increase in international students.

- Since the PBRF was introduced, a greater proportion of Student Achievement Component-funded courses at masters level has been research based rather than taught.

- The number of PBRF RDCs has increased at participating TEOs between 2006 and 2011.

- The University of Auckland reports the largest volume of research factor (VRF), in total and on a per FTE basis.

- Although qualification completion rates have increased at all levels of study since the PBRF was introduced, the improvement at the masters and doctoral level has been greater than at the bachelors level.

- Data on the post-study outcomes of doctoral graduates shows around 60 percent of graduates were employed in New Zealand the year after they graduated. Around 20 percent of graduates were overseas the year after they finished studying.

Introduction

The RDC component was included in the PBRF as it provides a proxy for research quality.[6] The underlying assumption is that students who choose to undertake lengthy, expensive and advanced degrees (especially doctorates) tend to search out departments and supervisors who have reputations in the relevant fields for high-quality research and research training. In addition, it captures, at least to some degree, the connection between staff research and research training – thus providing some assurance of the future capability of tertiary education research.

As well as being another way of measuring the quality of research by a TEO, the PBRF RDC component was designed to incentivise TEOs to maximise the completion rates of postgraduate research degrees. The previous system of allocating funding for research was via tuition subsidies for enrolments at the degree or higher level, which incentivised enrolment rather than completion. In this chapter, we examine data on participation in, and achievement of, research-based degrees, to assess the impact of the PBRF.[7]

The structure of this chapter is as follows. First, we look at trends in enrolments and participation in doctoral and masters degrees. Then we present a statistical profile of the PBRF RDC completions, followed by an analysis of qualification completion rates at the masters and doctoral level. Finally, we look at post-study destinations for doctoral degree graduates.

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[6] More detail on the RDC measure can be found in the Appendix.
[7] The Education Performance Indicators published by the Tertiary Education Commission since 2010, and the switch to performance-linked funding based on these indicators in 2012, do not apply to postgraduate research courses that qualify as an RDC.

Participation in masters and doctoral degrees

Number of students enrolled in masters and doctoral degrees

In Figure 23 we present the number of students enrolled in masters degrees between 1994 and 2011 by residency status. Enrolments in masters degrees rose steadily from 1994 to 2004 for both domestic and international students (by 65 percent and 536 percent, respectively). Between 2004 and 2008, the number of domestic students enrolled in masters degrees fell. This coincided with a period of strong economic growth in New Zealand, which is likely to have encouraged bachelors graduates to pursue employment rather than higher study. Since 2008, the number of domestic students enrolled at the masters level has increased (by 14 percent), which coincided with a period of weaker economic growth.

Figure 23

Students enrolled in masters degrees by residency status
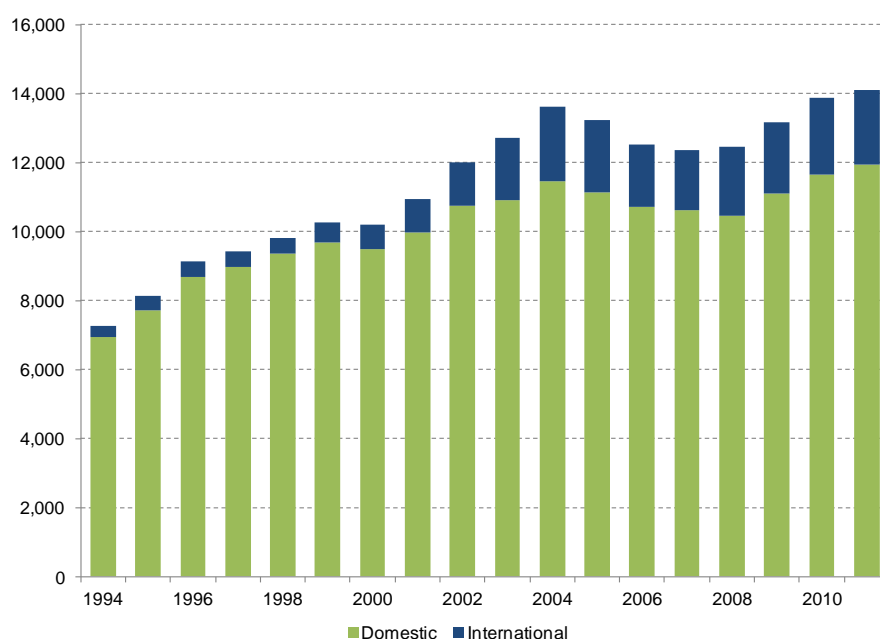
The number of students enrolled in doctoral degrees between 1994 and 2011 is presented in Figure 24. There was a steady increase in the number of domestic students enrolled in doctoral degrees over this period, with domestic enrolments increasing by 145 percent between 1994 and 2011. The strong growth in international student enrolments since 2006 reflects a policy change by the Government, whereby new international doctoral students were treated as domestic students for funding purposes and charged domestic fees. International enrolments increased by 346 percent between 2005 and 2011 and were 38 percent of total enrolments at this level in 2011, up from 14 percent in 2005.

Figure 24
Students enrolled in doctoral degrees by residency status
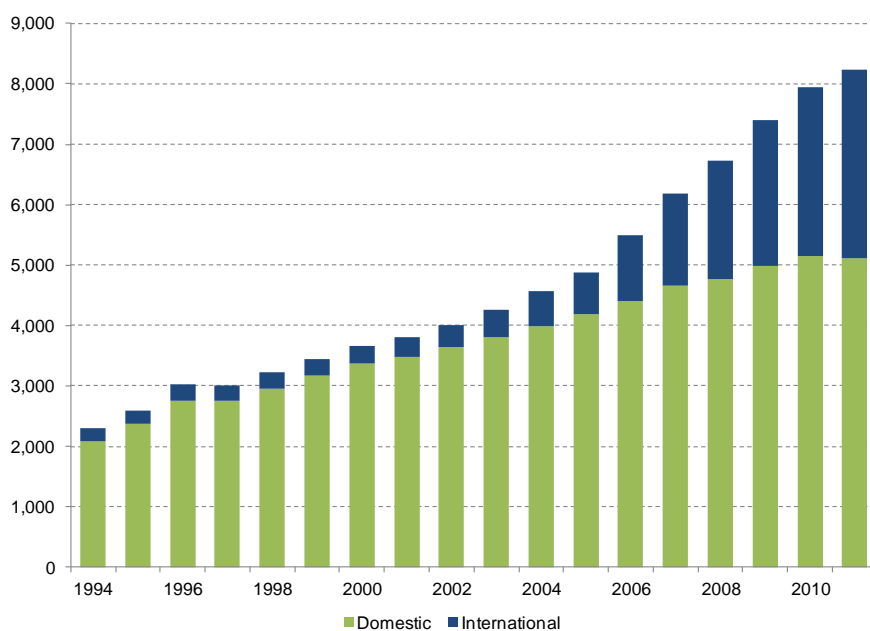
Participation rates in masters and doctoral degrees

One of the factors that influence the number of domestic enrolments at the masters and doctoral level is the size of the population. In this section, we control for the size of the population by analysing the rates of participation in masters and doctoral level study by domestic students.

Figure 25 presents the participation rates in masters degrees in total and by age group. In the years after the PBRF was introduced, the overall participation rate for masters degrees actually fell (from 0.36 percent in 2004 to 0.31 percent in 2008). As mentioned in the previous section, this coincided with a time when the New Zealand economy was performing relatively well, so instead of progressing into postgraduate study, bachelors graduates were more likely to have entered the labour market.

When looking at participation by age group, the participation rate of students aged 20-24, a key age group for masters study, exhibited an extended period of decline between 1996 and 2006 (from 0.92 percent to 0.64 percent). Since 2008, the participation rate has increased sharply in this age group, to reach 0.85 percent in 2011. This increase in participation coincided with the onset of higher unemployment as a result of the weaker New Zealand economy (see Figure 25).

In other age groups, the participation rate in the 25 to 39 age group rose from 1994 to 2006 (from 0.36 percent to 0.61 percent), but then fell for the next four years. The participation rate of this age group then increased between 2008 and 2011 (from 0.55 percent to 0.64 percent). Participation in the 40 and over age group has decreased from a peak of 0.24 percent in 2004 to 0.19 percent in 2011.

The trend in masters degree participation suggests that the economic cycle is a key factor in determining participation, especially in younger age groups, but there is little evidence that the move to RDC funding has led to an increase in participation at this level of study.

Participation rates in masters degrees by age group1994-2011 (domestic students only)
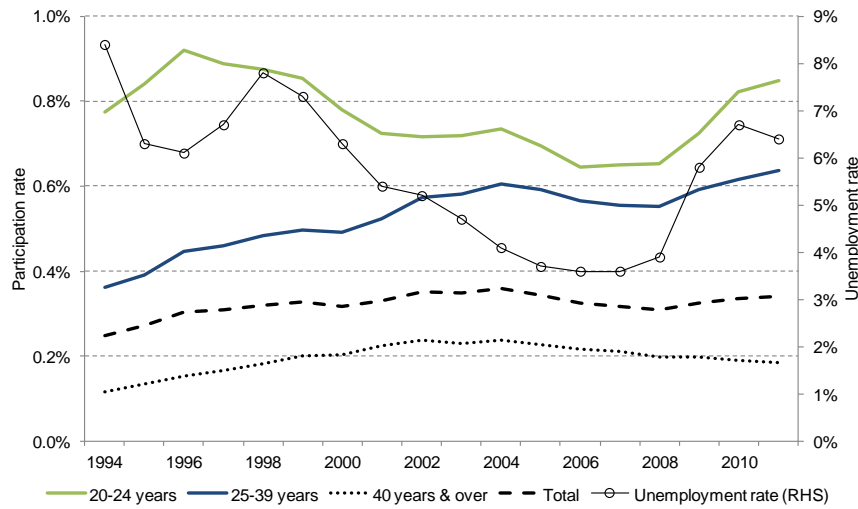
Source: Ministry of Education and Statistics New Zealand

The participation rates of domestic students in doctoral degrees are presented in Figure 26. The overall participation rate in doctoral degrees has exhibited a steady increase between 1994 and 2011 (from 0.07 percent to 0.15 percent). A key age group for doctoral study, the 25-39 age group, showed an increasing trend in participation over time with a slight increase in the growth of participation between 2005 and 2007. But the rate of growth in participation has since slowed and in fact fell slightly in 2011. The close association between the unemployment rate and participation rate seen at the masters level is not evident at the doctoral level.

Overall, there is little evidence that the PBRF RDC component has influenced participation at the doctoral level. Rather, a long-term trend towards greater participation in doctoral study is the key factor.

Figure 26

Participation rates in doctoral degrees by age group 1994-2011 (domestic students only)
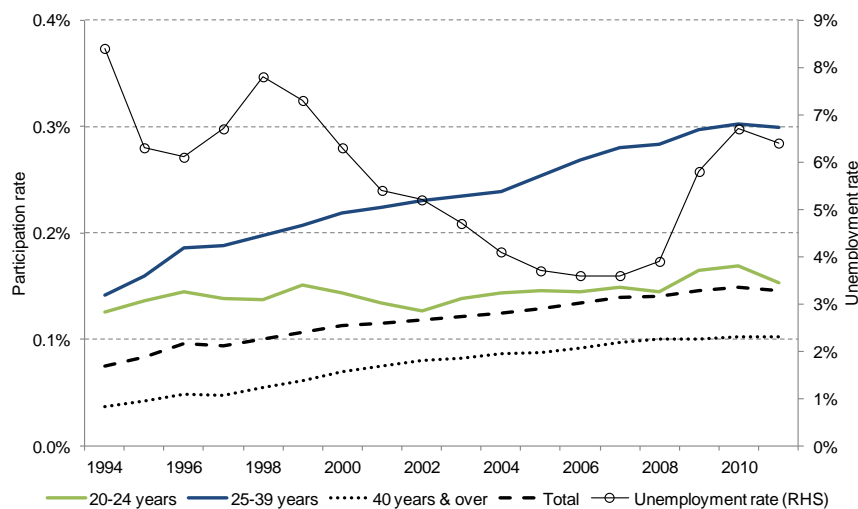
Source: Ministry of Education and Statistics New Zealand

Participation rates in masters and doctoral degrees by Māori and Pasifika

The PBRF RDC component has a specific weighting to encourage completion of research degrees by Māori or Pasifika.[8] In Figure 27, we present the participation rates in masters degrees by ethnic group. Note that the participation rates in Figure 27 have been standardised to adjust for the different age structures of the ethnic populations.

The participation rate by Māori at the masters degree level peaked at 0.31 percent in 2006 but has since fallen slightly to reach 0.28 percent in 2011. Participation for Pasifika reached 0.16 percent in 2011, a level not attained since 2004. There is still a substantial gap in participation rates of Māori and Pasifika compared with the European ethnic group at the masters level.

Figure 27

Standardised participation rates in masters degrees by ethnic group (domestic students only)
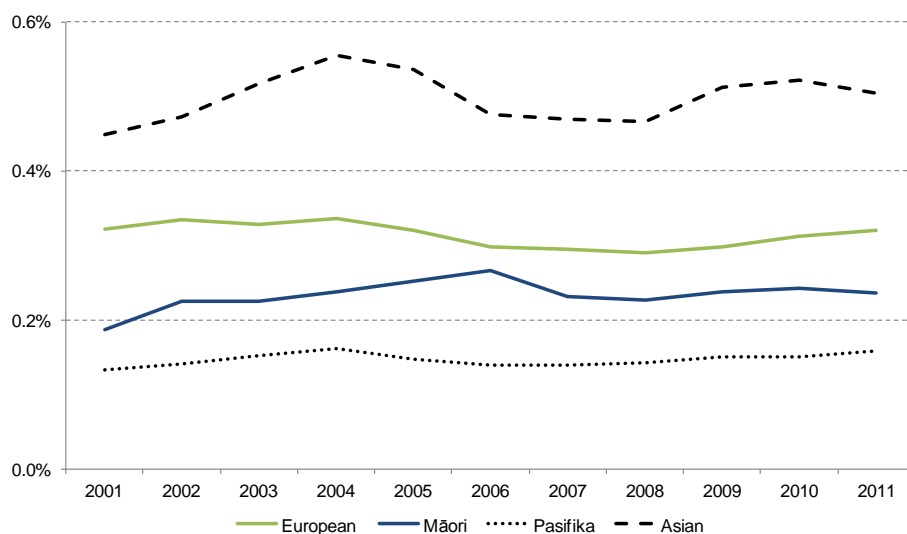
The standardised participation rates in doctoral degrees by ethnic group are presented in Figure 28. Generally, participation by all ethnic groups has been rising since 2001. However, participation by Māori increased noticeably compared with other ethnic groups from 2006 to 2011 (from 0.06 percent to 0.09 percent). A factor in this rise in participation may be the impact of Ngā Pae o te Māramatanga, a Centre of Research Excellence. Ngā Pae o te Māramatanga was established in 2002 and has a goal of encouraging participation in, and completion of, doctoral study by Māori. The participation by Pasifika has not accelerated to the same degree as Māori, but nevertheless has continued to rise from 0.05 percent in 2006 to 0.06 percent in 2011.

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[8] Māori and Pasifika RDCs have a weighting of 2 attached to them.

Figure 28

Standardised participation rates in doctoral degrees by ethnic group
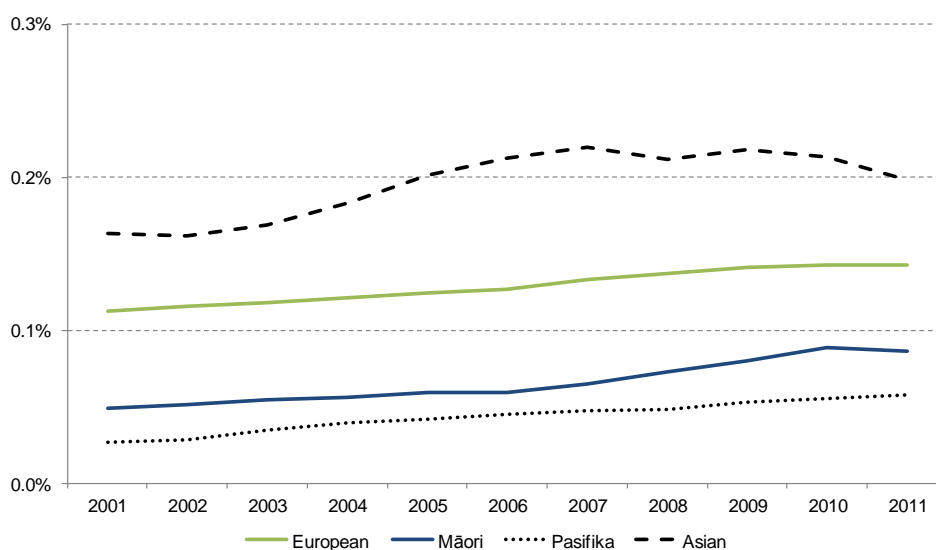
The proportion of research-based training in masters degrees

Figure 29 shows the proportion of masters degree EFTS that were research based (in Student Achievement Component funding categories at the 'postgraduate research' and 'foreign-based research' levels) and those that were not (in Student Achievement Component funding categories at the 'postgraduate taught' level). In 2000, 38 percent of masters EFTS were research based. By 2003, this had fallen to 32 percent. Since the introduction of the PBRF, the percentage of research-based EFTS has increased to reach 40 percent in 2011. This shift to more Student Achievement Component EFTS being research based is to be expected, given the incentive that the PBRF RDC component now gives to the completion of research-based courses.

Figure 29

Proportion of SAC-funded masters degree EFTS that were research based
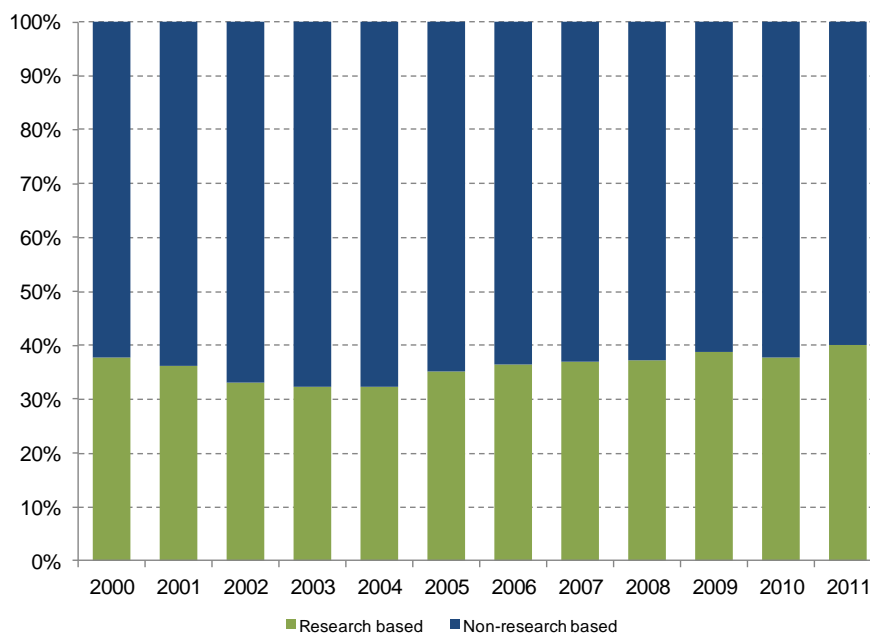
Note: Research based is defined as EFTS that were in Student Achievement Component funding categories for postgraduate research and foreign-based research.

A statistical profile of PBRF research degree completions

In this section, we present a statistical profile of PBRF RDC data between 2006 and 2011[9] and examine areas where the PBRF might be expected to influence patterns, but also provide a wider profile of RDCs. To do this we examine demographic and study-related factors and split the analysis into two levels – doctoral degree and masters degree. For the purposes of our analysis, the masters level RDC data we report in this section includes a small number of RDCs at the postgraduate diploma level. It is important to note that the RDC dataset used in this section has been provided for analytical purposes only and is subject to ongoing revision and change over time, so the numbers may differ from those published by the Tertiary Education Commission in the PBRF annual reports.

Figure 30 presents the number of RDCs by level and residency status. Between 2006 and 2011, the number of RDCs at the masters level has increased by 27 percent to reach 2,431. In 2011, there was a significant increase of 16 percent in domestic RDCs, which is a flow-on from the increased participation evident in Figure 25 due to the onset of the recession. The proportion of international RDCs at masters level has increased slightly over time, from 11 percent in 2006 to 14 percent in 2011.

Between 2006 and 2011, the number of RDCs at the doctoral level has increased by 90 percent to reach 1,124. The growth of domestic RDCs was 48 percent and international RDCs 427 percent. As a result of these disparate growth rates, the proportion of international RDCs at the doctoral degree level has increased from 11 percent to 31 percent during this period. This increase is a reflection of the policy change in 2006 that treats international students starting a doctoral degree as a domestic student for funding purposes.

Figure 30
The number and distribution of PBRF RDCs by level and residency status
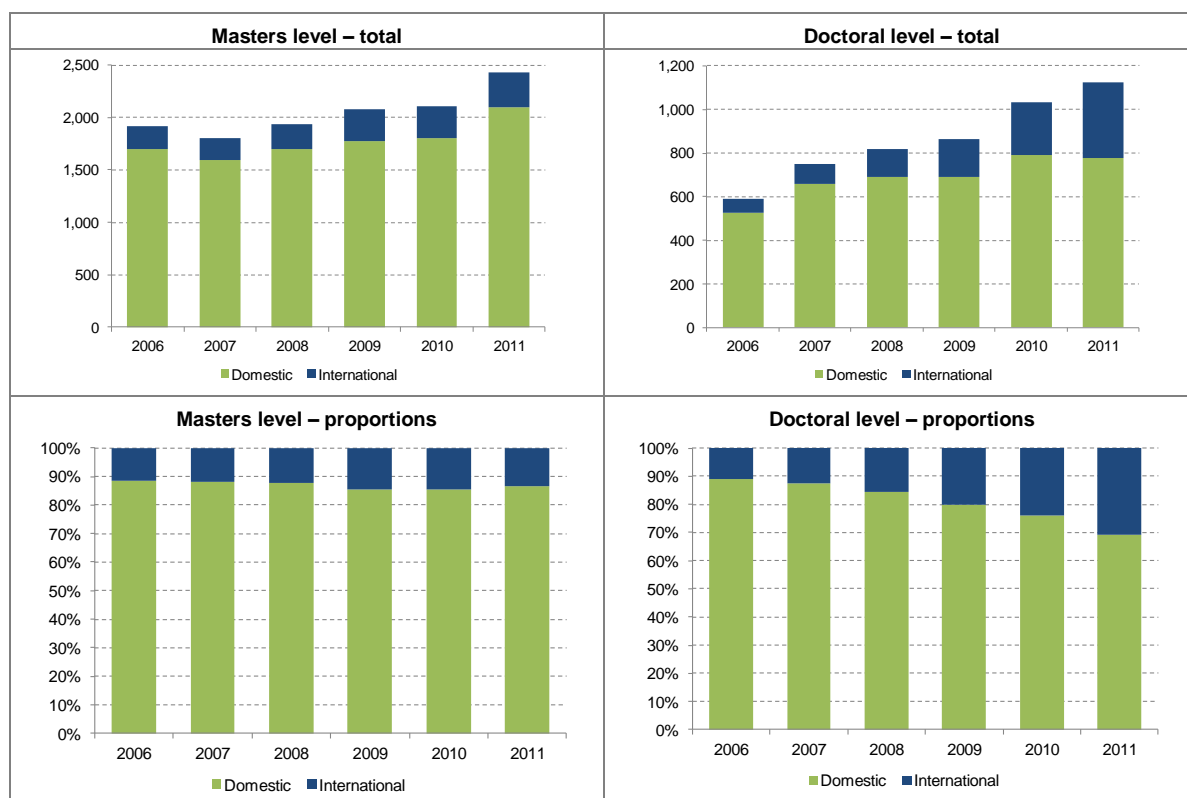
Source: Ministry of Education and Tertiary Education Commission

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[9] The analysis is restricted to 2006 onwards as the method of RDC collection was different before 2006.

We now present a statistical profile of RDCs by level and residency status for a number of demographic and study-related characteristics (including age group, gender, ethnic group and subject weighting). Figure 31 shows the distribution of RDCs by residency, level and age group. For domestic RDCs at the masters level, there is a trend towards a greater proportion of younger RDCs between 2009 and 2011. At the doctoral degree level, there is no discernible trend in the distribution of domestic RDCs over time. However, the initial trend of an increasing proportion of younger international RDCs between 2006 and 2008 has since been reversed.

The distribution of RDC by level, residency status and gender is presented in Figure 32. At the masters level, the proportion of women is relatively stable at around 60 percent for domestic RDCs and 50 percent for international RDCs. At the doctoral degree level, the proportion of domestic RDCs by women has increased between 2007 and 2011, reflecting long-term enrolment trends.

The distribution of RDCs by level, residency status and ethnic group is presented in Table 8. In Table 8, we assign an RDC to an ethnic group based on a multiple response basis, in which the RDC has been assigned to each ethnic group they identified with (up to a maximum of three). The data shows that at the domestic masters level the proportions have remained relatively stable – Māori and Pasifika RDCs declined slightly between 2006 and 2011 (from 8 percent to 7 percent for Māori and 3 percent to 2 percent for Pasifika). At the domestic doctoral level, the proportion of RDC reporting in the European ethnic group decreased from 72 percent in 2006 to 65 percent in 2011. The proportion of Māori RDCs increased slightly from 5 percent to 6 percent, while domestic Pasifika RDCs increased from 2 percent to 3 percent.

The distribution of RDCs by level, residency status and subject weighting is presented in Figure 33. Between 2006 and 2011, the proportion of domestic RDCs in higher weighted subject areas has increased from 65 percent to 71 percent. At the doctoral degree level, domestic and international RDCs exhibit a similar pattern – an increase in the proportion of higher-weighted subject categories between 2006 and 2008, followed by a reversal in this trend between 2008 and 2011.

Figure 31

Distribution of RDCs by level, residency status and age group
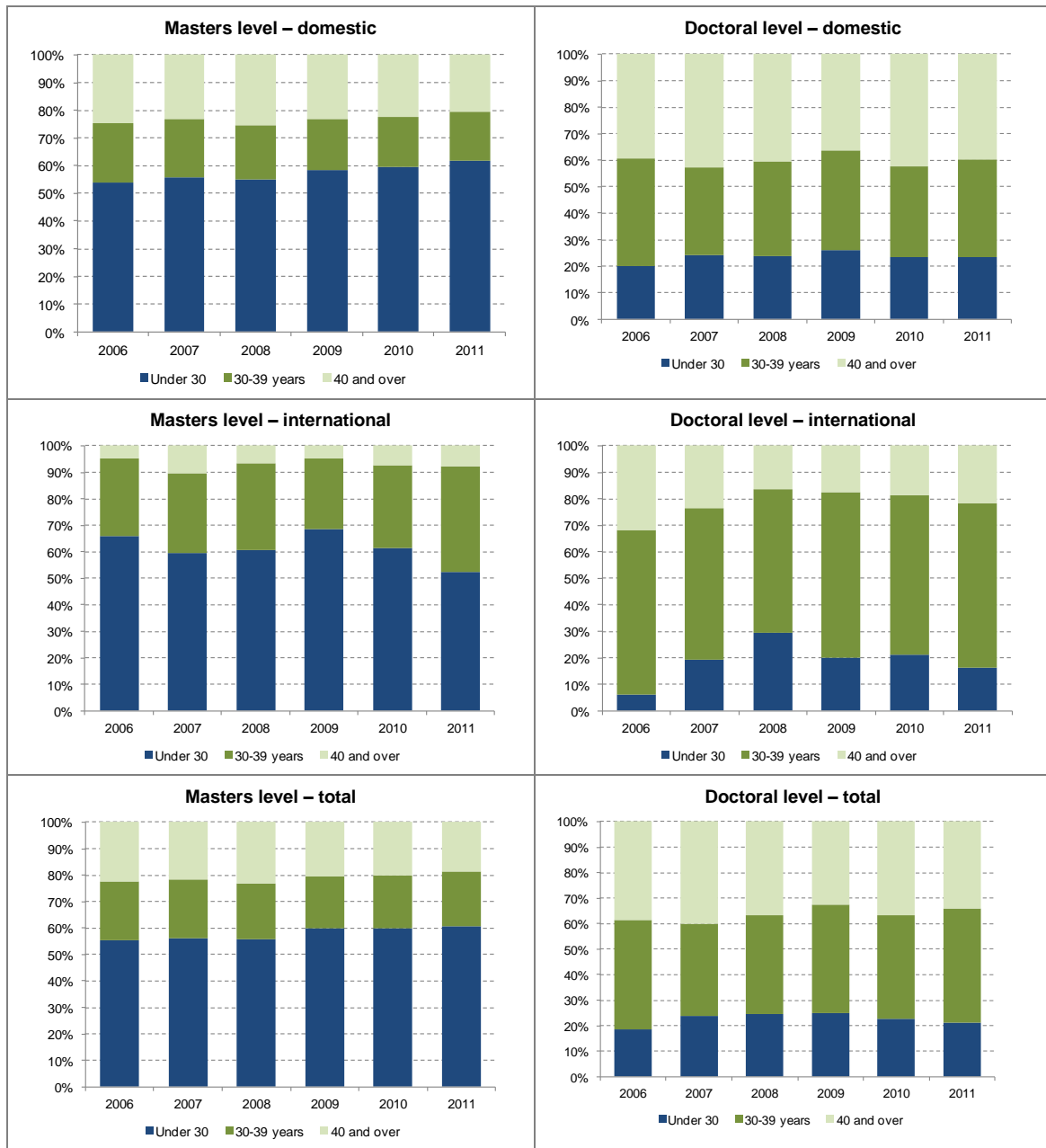
Note: Masters level includes a small number of some RDCs at the postgraduate diploma level.

Source: Ministry of Education and Tertiary Education Commission

Figure 32

Distribution of RDCs by level, residency status and gender

Note: Masters level includes a small number of some RDCs at the postgraduate diploma level.

Source: Ministry of Education and Tertiary Education Commission

Table 8

Distribution of RDCs by level, residency status and ethnic group

Level	Residency	Ethnic group	2006	2007	2008	2009	2010	2011
Masters	**Domestic**	**European**	71%	67%	70%	73%	69%	71%
		Māori	8%	7%	8%	7%	7%	7%
		Pasifika	3%	2%	3%	3%	3%	2%
		Asian	18%	22%	18%	19%	22%	21%
		Other	6%	8%	6%	7%	6%	6%
	International	**European**	25%	26%	26%	27%	27%	24%
		Māori	0%	0%	0%	0%	0%	0%
		Pasifika	4%	6%	11%	6%	11%	7%
		Asian	37%	37%	32%	34%	39%	42%
		Other	26%	21%	25%	24%	18%	23%
	Total	**European**	66%	62%	64%	66%	63%	65%
		Māori	7%	6%	7%	6%	6%	6%
		Pasifika	3%	3%	4%	3%	4%	3%
		Asian	20%	24%	20%	21%	24%	24%
		Other	8%	9%	8%	10%	8%	8%
Doctoral	**Domestic**	**European**	72%	71%	69%	68%	69%	65%
		Māori	5%	5%	5%	5%	6%	6%
		Pasifika	2%	1%	2%	2%	2%	3%
		Asian	17%	17%	20%	21%	20%	22%
		Other	10%	9%	9%	7%	8%	10%
	International	**European**	26%	36%	40%	41%	32%	31%
		Māori	0%	0%	0%	0%	0%	0%
		Pasifika	8%	3%	1%	1%	2%	2%
		Asian	24%	29%	29%	32%	37%	38%
		Other	33%	27%	29%	21%	28%	27%
	Total	**European**	67%	67%	65%	63%	60%	55%
		Māori	5%	5%	4%	4%	5%	4%
		Pasifika	3%	2%	2%	2%	2%	3%
		Asian	17%	19%	21%	23%	24%	27%
		Other	13%	11%	12%	10%	12%	15%

Notes: 1. Masters level includes a small number of some RDCs at the postgraduate diploma level. 2. Ethnic group has been calculated on a multiple response basis, so an RDC may fit into more than one ethnic group.

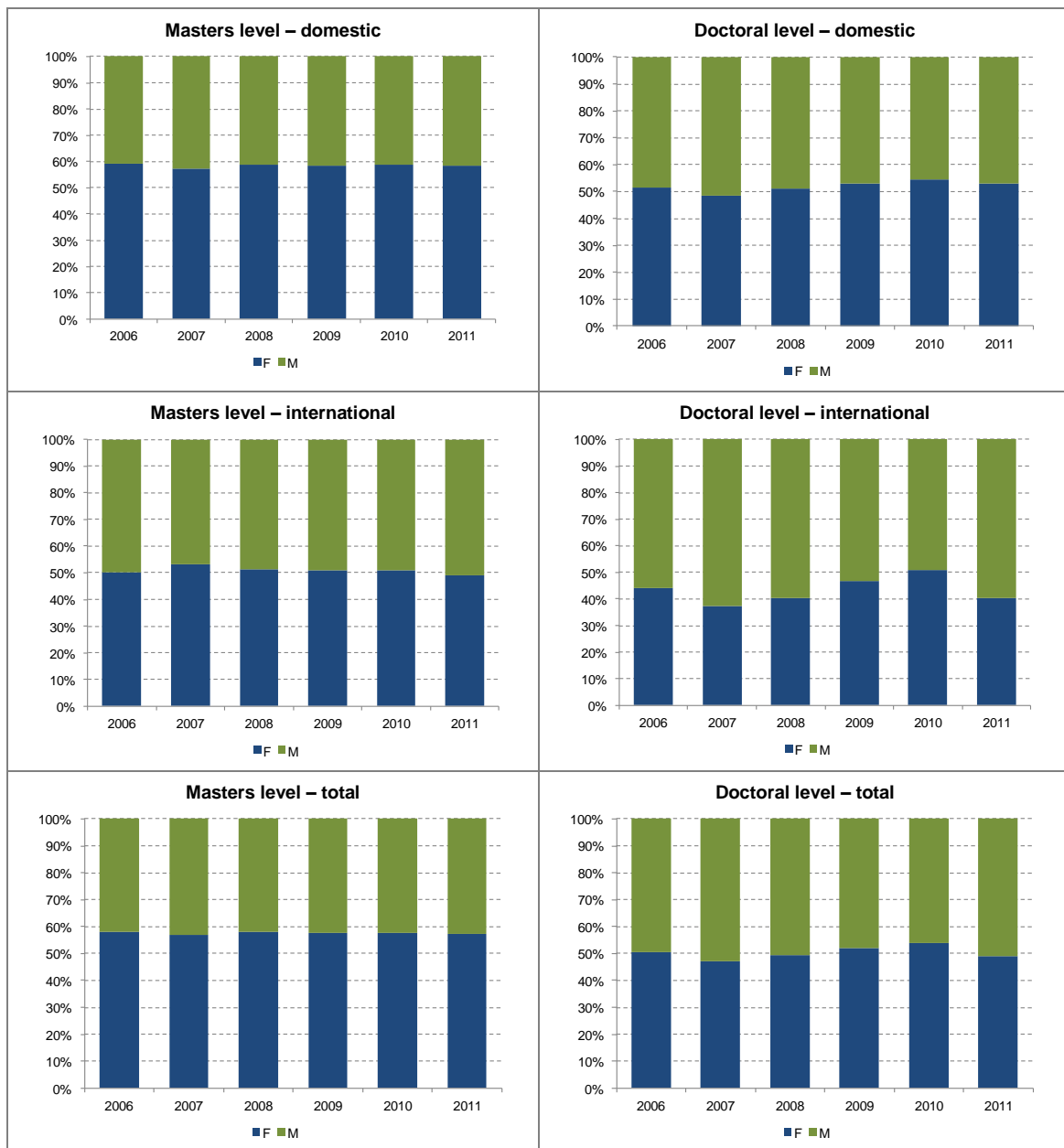Source: Ministry of Education and Tertiary Education Commission

Figure 33

Distribution of RDCs by level, residency status and subject weighting

Note: Masters level includes a small number of some RDCs at the postgraduate diploma level.

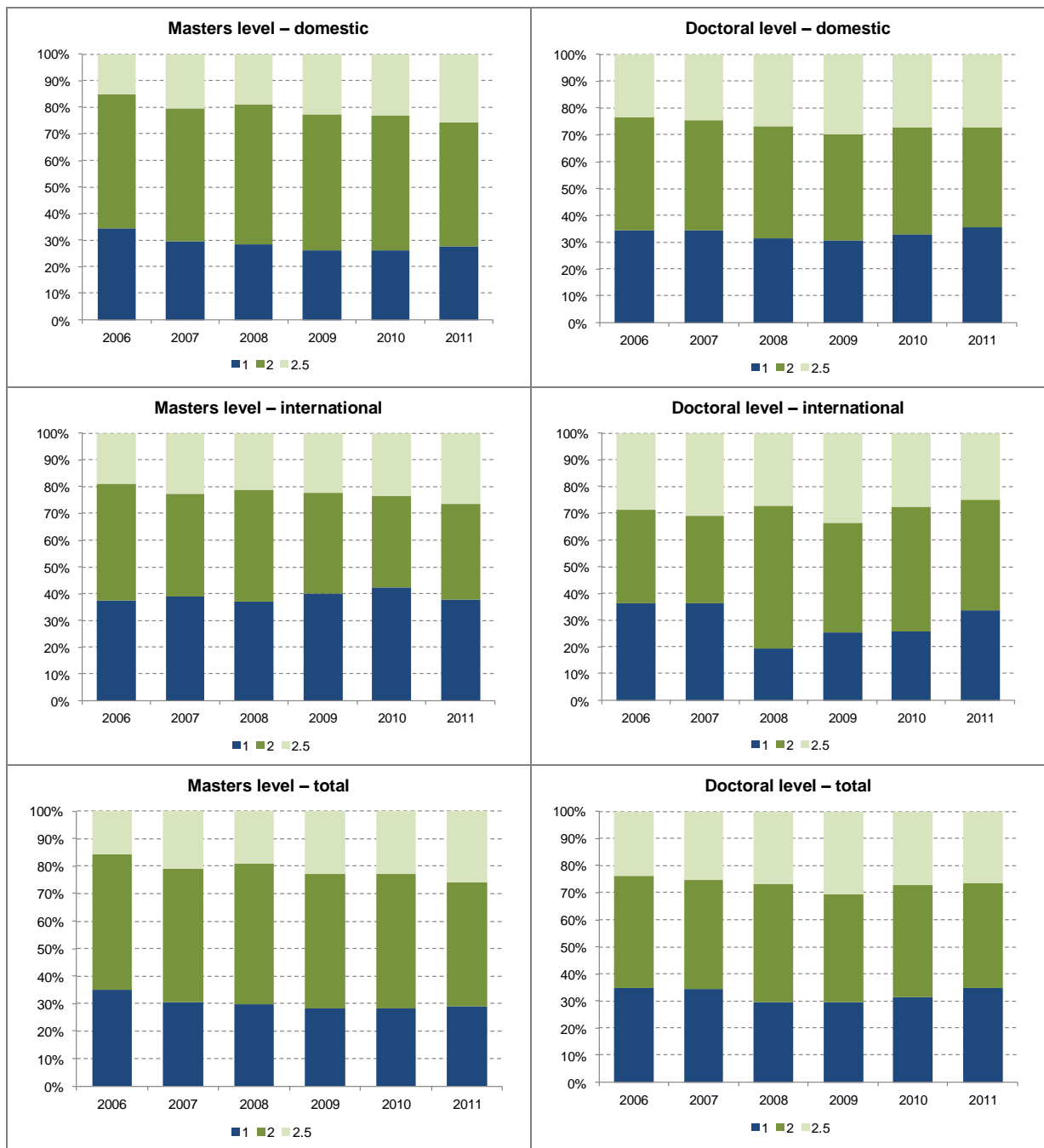Source: Ministry of Education and Tertiary Education Commission

The volume of research

In this section, we present data on the volume of research (as measured by the VRF factor) at TEOs in total and on a per PBRF-eligible FTE basis. The VRF is used in the PBRF funding formula to measure the EFTS-weighted volume of each RDC. For example, the VRF for a doctoral degree is usually 3, whereas a 1 EFTS masters thesis has a VRF of 1.

In total, the VRF increased at participating TEOs by 56 percent between 2006 and 2011. Figure 34 shows that the University of Auckland had the highest total VRF of participating TEOs. It was followed by the University of Otago and Victoria University of Wellington. The University of Auckland has exhibited significant growth between 2006 and 2011, as has Victoria University of Wellington, and Auckland University of Technology. The VRF at Massey University has remained relatively flat since 2006 and has been flat or falling at the University of Canterbury since 2007. The VRF of non-university RDCs generally increased between 2006 and 2010, but fell in 2011.

Figure 34

PBRF volume of research factor by individual universities and for non-university subsectors
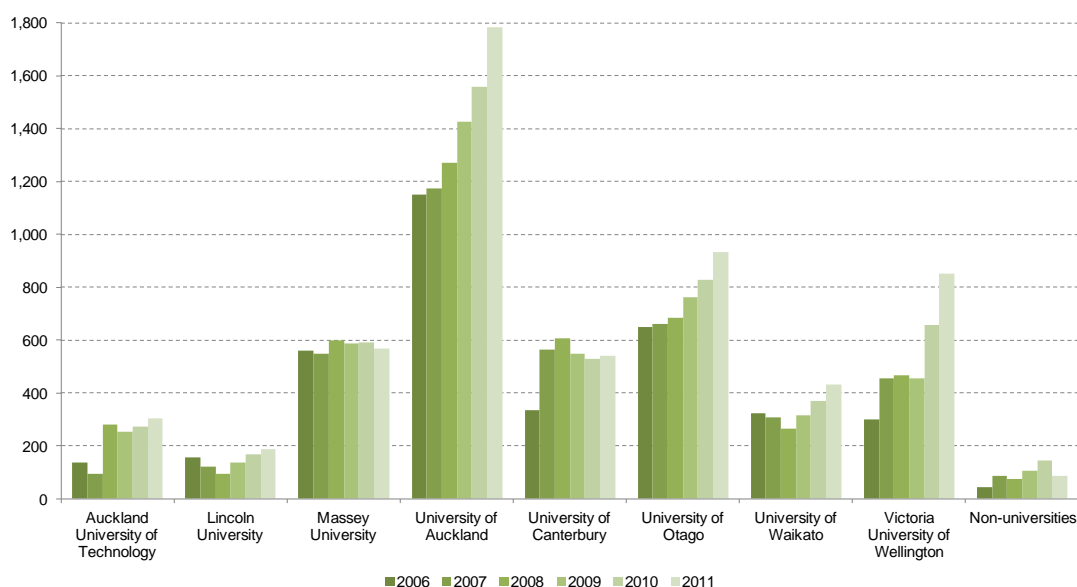
Source: Ministry of Education and Tertiary Education Commission

The size of a TEO is one of the factors behind the scale of total VRF reported by TEOs. To adjust for this, we present the total VRF for the period 2006-2011 on a per PBRF-eligible FTE staff basis. In doing so, we get a sense of the research training intensity of a TEO. Figure 35 shows that, on a per FTE basis, the University of Auckland has produced the largest VFR between 2006 and 2011 (5.1), even after adjusting for size. The remaining universities were relatively close in VRF per FTE, ranging from 4.2 for the University of Canterbury to 3.1 for Massey University. As is to be expected, the non-universities have a lower VRF per FTE, ranging from a value of 2.2 for Whitecliffe College of Art and Design to 0.1 for Eastern Institute of Technology.

Figure 35
PBRF volume of research factor 2006-2011 per PBRF-eligible FTE by TEO
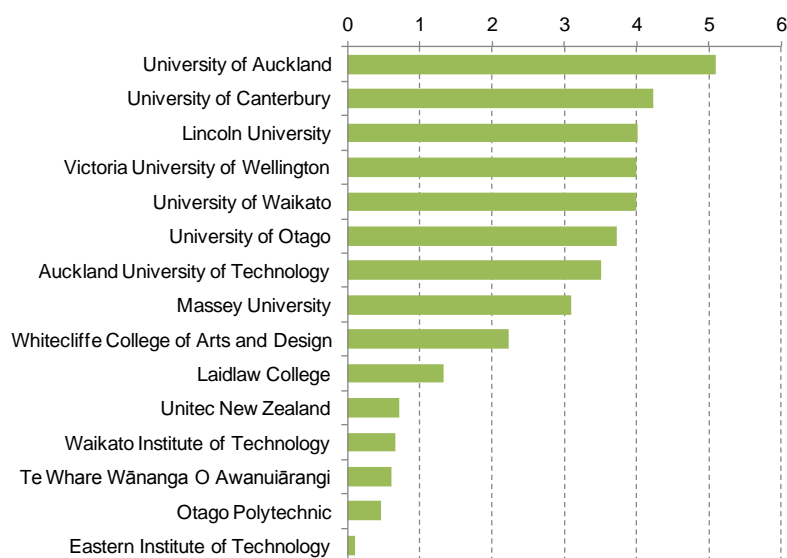
Source: Ministry of Education and Tertiary Education Commission

Qualification completion rates for doctoral and masters degrees

Figure 36 presents the cumulative completion rates for doctoral students who started a doctoral degree in 1998, 2001, 2004 and 2007.[10] The data is presented for all students and for domestic and international students. Cumulative completion rates show the percentage of a starting cohort who have completed their degree by the stated year after study. For example, 14 years after starting their doctoral degree, around 58 percent of the 1998 starting cohort had completed their qualification.

The higher tracks of the cumulative completions rates for later starting cohorts show a continuing improvement in student achievement rates since the PBRF RDC measure was introduced. For example, for all students, the eight-year cumulative completion rate had increased from 49 percent for the 1998 starting cohort to 62 percent for the 2001 starting cohort, to 67 percent for the 2004 starting cohort. A similar pattern of improvement is evident for later starting cohorts of domestic and international students.

Looking at the most recent starting cohort, the cumulative five-year completion rate also tracks above earlier starting cohorts for all doctoral students. The five-year cumulative completion rate for the 2007 starting cohort is 39 percent, compared with 29 percent for the 1998 starting cohort.

There is some difference between the domestic and international five-year cumulative completion rates for the 2007 cohort, with the domestic rate tracking above previous starting cohorts but the international rate tracking slightly below earlier starting cohorts.

The cumulative completion rates for masters degrees are presented in Figure 37. They also show that more recent starting cohorts have higher rates of completion. The four-year cumulative completion rate for all masters students was 69 percent for those starting in 2008, compared with 64 percent for those starting in 2005 and 51 percent for those starting in 2002. A similar pattern of improvement in cumulative completion rates for later starting cohorts is evident in the domestic and international data.

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[10] These are representative starting cohorts. The pattern is similar when including all starting cohorts.

Figure 36

Cumulative completion rates for doctoral degrees by starting year of qualification

All students

Domestic students

International students
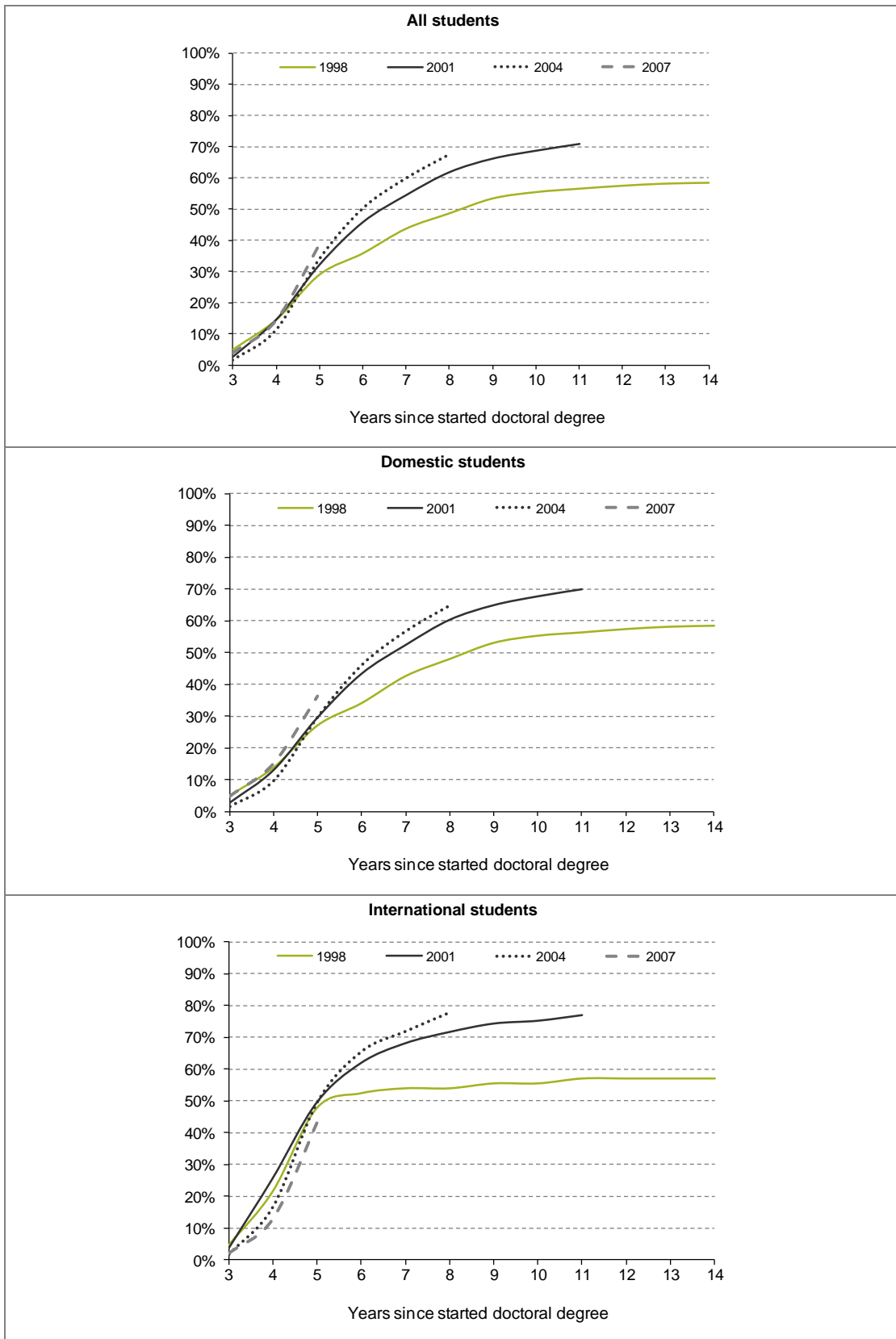
Figure 37

Cumulative completion rates for masters degrees by starting year of qualification
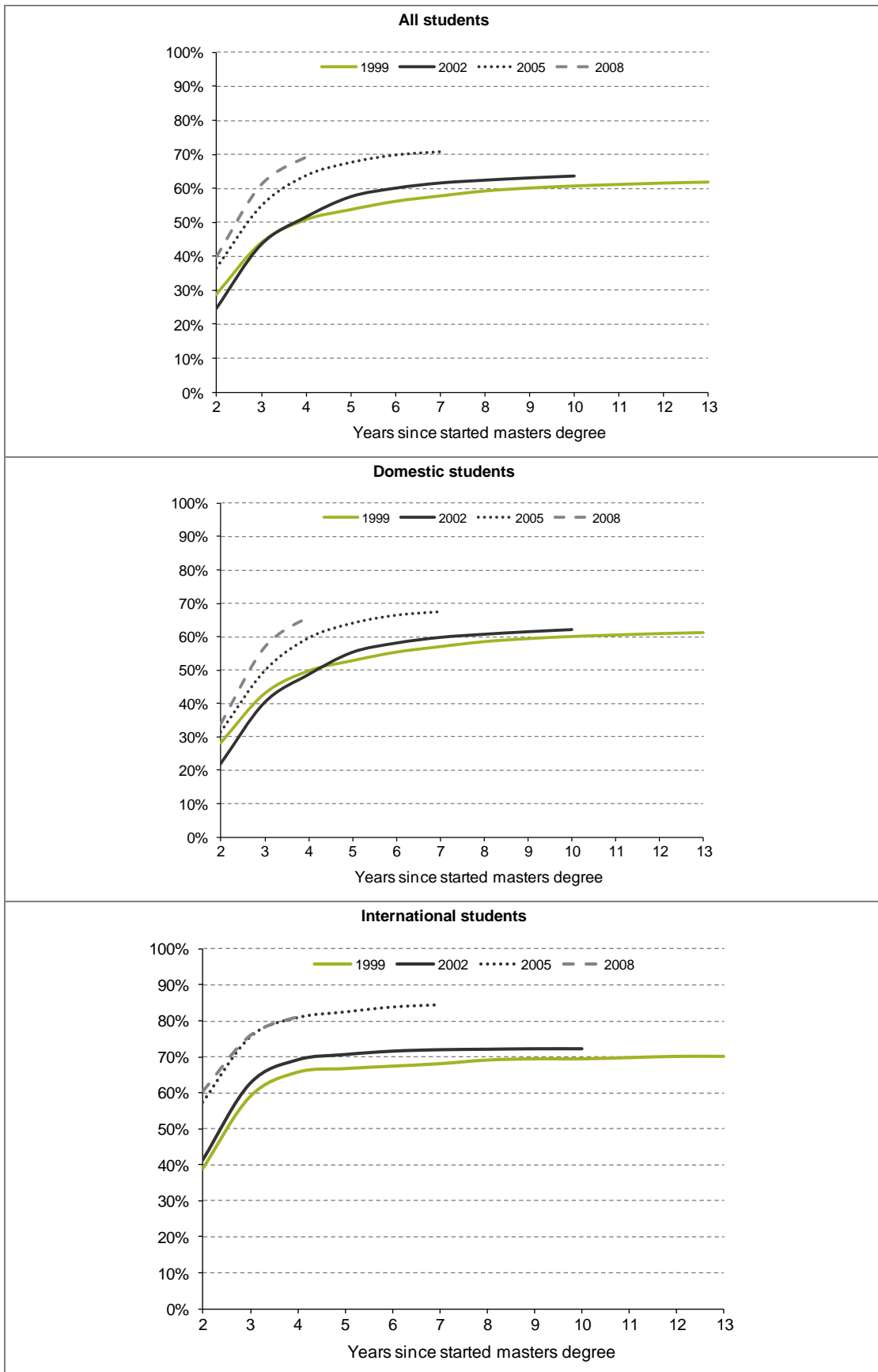
Although masters and doctoral qualification completion rates have been improving, qualification completion rates at other levels have also been rising. In Figure 38, we present the six-year completion rate for bachelors degrees, masters degrees and doctoral degrees by starting year. The data shows that, although all three levels have exhibited improvements, the rate of improvement in completion rates for masters and doctoral degrees has been much greater than that for bachelors degrees. This suggests that the improvement in research degree completion rates has been influenced by the introduction of the PBRF RDC component.

Figure 38
Six-year qualification completion rates by level
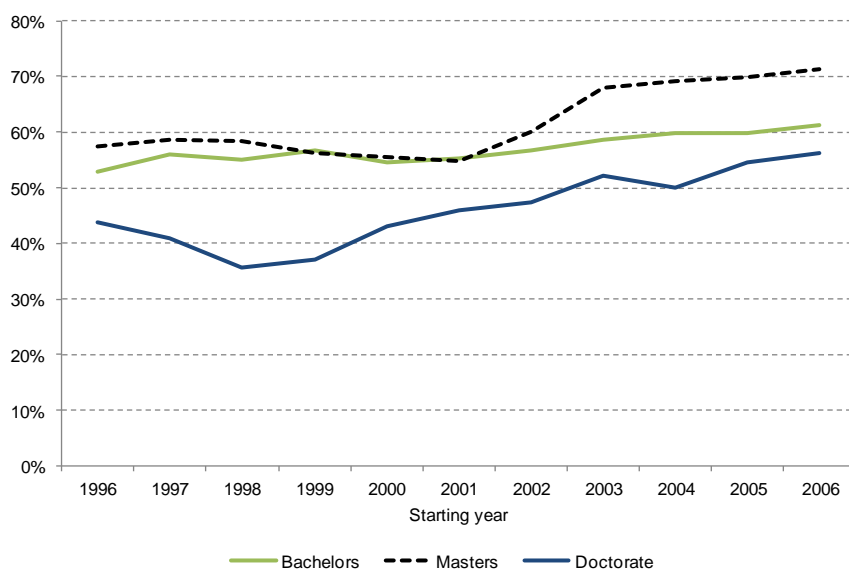
Qualification completion rates in masters degrees by ethnic group

In this section, we examine the qualification completion rates by ethnic group. The numbers of completions by Māori and Pasifika are too small at the doctoral level to undertake a robust completion rate analysis, but there are sufficient numbers to look at completion rates of masters degrees. The five-year completion rate for masters degrees for domestic students by ethnic group is presented in Figure 39. The variability in completion rates for Māori and Pasifika students is related to the smaller numbers in these ethnic groups that study at the masters level.

The completion rate for Pasifika has increased from a low of 38 percent for those starting in 2000 to a high of 59 percent for those starting in 2007. Māori exhibit a similar pattern, as their highest completion rate was exhibited by those starting in 2007 (49 percent). However, completion rates have been rising for other ethnic groups as well. So there is no real evidence that the extra incentive for completion for Maōri or Pasifika students has closed the gap in attainment at the masters level.

Figure 39
Five-year qualification completion rates for masters degrees by ethnic group by starting year
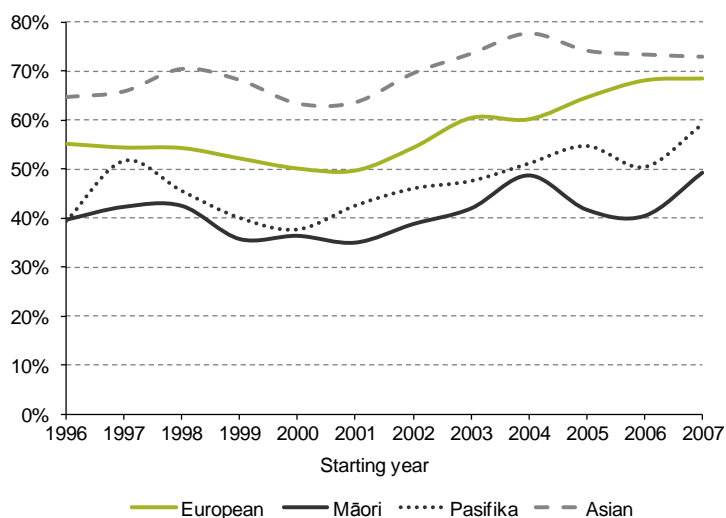
The post-study destinations of domestic doctoral degree graduates

In this section, we examine the post-study outcomes for New Zealand domestic doctoral degree graduates. The previous sections have examined inputs or outputs of research training, but now we switch to outcomes to see how graduates have fared after they have completed their doctoral degree. To do this, we use data from Statistics New Zealand's Integrated Data Infrastructure (IDI), which contains matched records on education, migration and earnings data. We use this data to analyse the destinations for doctoral degree graduates up to five years after they last studied at that level.

We have assigned three categories of destinations to the doctoral graduates. These are **Employed**, **Overseas** or **Other**. If someone was overseas for nine or more months of the year, they were defined as Overseas. If the graduate was not classified as Overseas and if they received earnings for six months or more of the year they were considered Employed. The remainder of graduates were placed in the Other category. There are two main limitations to the IDI data used in this analysis: we can't tell the occupation of the graduate or the number of hours they worked.

Figure 40 presents the post-study destinations for domestic doctoral degree graduates who last studied at the doctoral level in 2003. The data shows that around 60 percent of this cohort was employed in New Zealand in the years after completing study. The percentage of graduates overseas increased slightly in the first few years after study to eventually reach around 29 percent by five years post-study. It is perhaps not surprising that this many graduates were overseas, given the specialised nature of some of the research that is undertaken at the doctoral level. Many graduates will look to work overseas to further their experience.

Figure 40
Destinations of domestic doctoral degree graduates who last studied in 2003
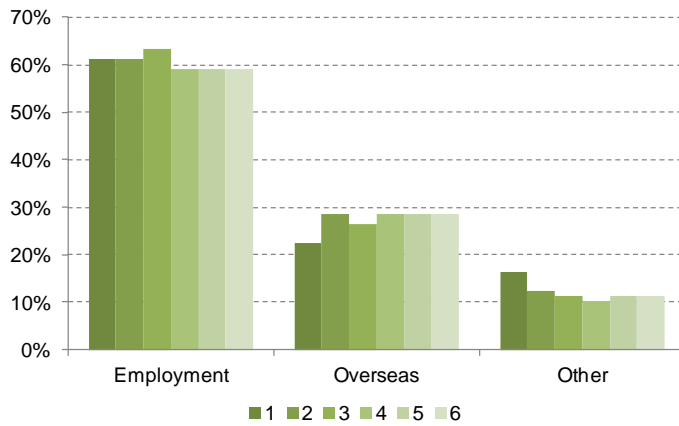
Note: All counts behind this table of a value up to 18 are randomly rounded to base 3, counts of 19 are randomly rounded to base 2, counts between 20 and 99 are randomly rounded to base 5, counts between 100 and 999 are randomly rounded to base 10, and counts of 1,000 or more are randomly rounded to base 100.

Source: Figures have been extracted from the IDI prototype managed by Statistics New Zealand

In Figure 41, we present the destinations of domestic doctoral graduates one year after leaving study for cohorts who last studied at the doctoral level between 2003 and 2008. The percentage of graduates who were employed one year after study generally increased over time (from 61 percent for the 2003 cohort to 68 percent for the 2008 cohort). This represents a period prior to the main effects of the latest period of weak economic growth so these employment rates may have decreased for later cohorts.

Figure 41
Destinations of domestic doctoral degree graduates one year after study by last year of study

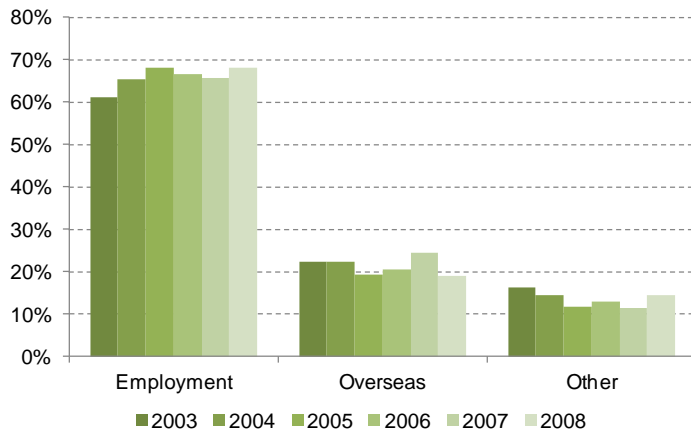Note: All counts behind this table of a value up to 18 are randomly rounded to base 3, counts of 19 are randomly rounded to base 2, counts between 20 and 99 are randomly rounded to base 5, counts between 100 and 999 are randomly rounded to base 10, and counts of 1,000 or more are randomly rounded to base 100.

Source: Figures have been extracted from the IDI prototype managed by Statistics New Zealand

Technical notes

1. Disclaimer: This data extraction was undertaken while the author was on secondment to Statistics New Zealand. The results are not official statistics; they have been created for research purposes from the Integrated Data Infrastructure (IDI) prototype managed by Statistics NZ. Ongoing work within Statistics NZ to develop the IDI means it will not be possible to exactly reproduce the data presented here. The results presented in this study are the work of the author. Statistics NZ or the Ministry of Education takes no responsibility for any omissions or errors in the information contained here. Access to the data used in this study was provided by Statistics NZ in accordance with security and confidentiality provisions of the Statistics Act 1975. Only people authorised by the Statistics Act 1975 are allowed to see data about a particular person, business or organisation. The results in this report have been confidentialised to protect individual people and businesses from identification. Careful consideration has been given to the privacy, security and confidentiality issues associated with using administrative data in the IDI prototype. Further detail can be found in the Privacy impact assessment for the Integrated Data Infrastructure available from www.stats.govt.nz. The results are based in part on tax data supplied by Inland Revenue to Statistics NZ under the Tax Administration Act 1994. This tax data must be used only for statistical purposes, and no individual information may be published or disclosed in any other form, or provided to Inland Revenue for administrative or regulatory purposes. Any person who has had access to the unit-record data has certified that they have been shown, have read and have understood section 81 of the Tax Administration Act 1994, which relates to secrecy. Any discussion of data limitations or weaknesses is in the context of using the IDI prototype for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

6 EXTERNAL RESEARCH INCOME

KEY POINTS

- The universities account for almost all reported PBRF ERI. In 2011, universities earned 99 percent of all reported PBRF ERI.

- In 2011, the largest share of PBRF ERI by an individual TEO was reported by the University of Auckland (35 percent) followed by the University of Otago (22 percent).

- The share of PBRF ERI earned by universities was generally stable over time, although the Auckland University of Technology and Victoria University of Wellington increased their share of PBRF ERI.

- On a per FTE basis, Lincoln University reported the highest amount of PBRF ERI, followed by the University of Auckland and the University of Otago. This partly reflects the skewed nature of ERI in New Zealand towards the biological and medical sciences. The best-performing non-university in this measure was Te Whare Wānanga o Awanuiārangi.

- PBRF external research income earned by universities has increased rapidly between 2002 and 2011, although the rate of increase has slowed in recent years. This slow-down has coincided with the start of slow growth in the economy.

- The vast majority of university ERI is sourced from Government (around 75 percent).

Introduction

In this chapter, we analyse the data collected via the PBRF external research income (ERI) component.[11] The ERI attracted by TEOs is an important indicator of the quality of the research they are undertaking, as the contracts are awarded on a contestable basis. Organisations that fund research only continue to do so if they consider they are getting good value from the funding they give. This was the reason for its inclusion in the mixed model approach used in the PBRF.

The structure of this chapter is as follows. First, we analyse the value of the ERI earned by participating TEOs in the PBRF. This includes an analysis of the ERI earned on a per FTE basis. Then, we use data from Statistics New Zealand's R&D survey to assess the key sources of ERI for universities and hence what may have driven some of the changes in ERI.[12]

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[11] More detail on the ERI component can be found in Appendix.

[12] We cannot use PBRF ERI returns to analyse the source of ERI as TEOs are only required to report a total sum of ERI in each year.

Trends in total PBRF external research income

For PBRF funding purposes, ERI is reported annually by participating TEOs, with the first year of reported ERI being 2002. All of the universities have reported ERI in each year since 2002, while in the other subsectors the values reported depended on how many TEOs were participating in the PBRF at that time.[13]

The amount of reported PBRF ERI for each university and the non-university subsectors is presented in Figure 42 in nominal terms and in Figure 43 in real terms. The universities account for almost all PBRF ERI. In 2011, 99 percent out of a total of $410 million of PBRF ERI was reported by the universities. Just 0.5 percent was reported by participating polytechnics, 0.2 percent by participating wānanga and 0.04 percent by participating PTEs.

Of the universities, the University of Auckland reported the largest amount of PBRF ERI in 2011 ($144 million), followed by the University of Otago ($92 million). Partly this was due to their larger size, but the discipline mix at these universities is also a factor, with ERI in New Zealand being skewed towards the biological and medical sciences. Both of these universities have medical schools and dominate funding from the Health Research Council.

In nominal and real terms, the PBRF ERI reported by universities has increased significantly between 2002 and 2011, although there are signs that the growth in PBRF ERI has slowed in the last three years of this period. Between 2002 and 2009, reported university PBRF ERI grew by 75 percent in real terms ($182 million in 2011 dollars), but between 2009 and 2011 it decreased by 4.4 percent (around $20 million in 2011 dollars). The slow-down in economic growth since 2008, along with constrained spending by the Government, is likely to be a contributing factor in this trend.

The first few years of PBRF ERI in the polytechnic and wānanga subsectors are affected by lower participation in the PBRF. However, from 2005 onwards (which reflects PBRF ERI of all currently participating polytechnics), an initial increase in the value of reported PBRF ERI has been followed by a decrease. Since 2005, the value of reported PBRF ERI has decreased by 29 percent in real terms (a reduction of $0.9 million in 2011 dollars). In wānanga, the value of reported ERI has increased from zero in 2007 to $1 million in 2011. Increases in reported PBRF ERI from Te Wānanga o Awanuiārangi were the reason for the rise.

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[13] Some TEOs reported ERI between 2004 and 2006 without participating in the 2003 Quality Evaluation.

Figure 42

PBRF external research income by individual university and non-university subsectors in nominal terms
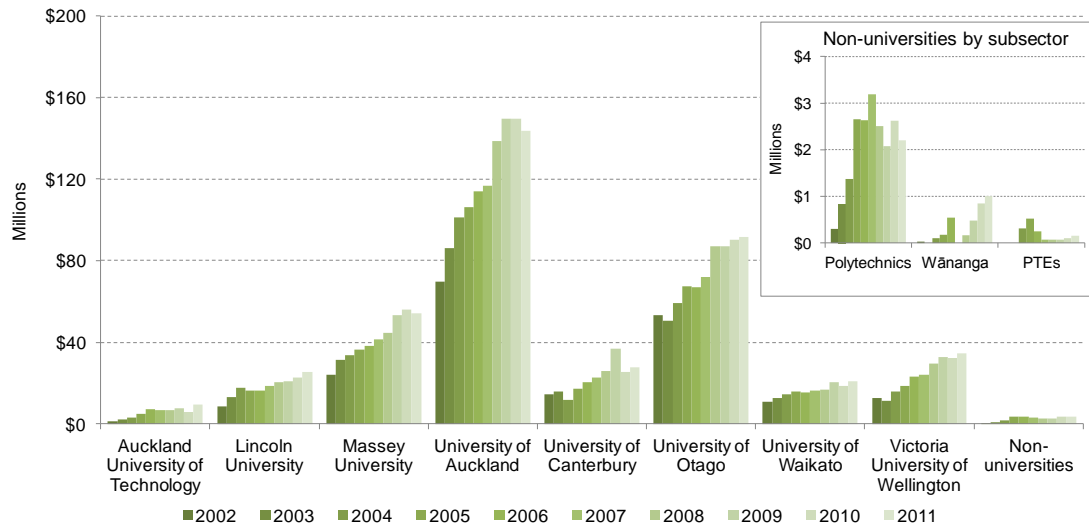
Source: Tertiary Education Commission

Figure 43

PBRF external research income by individual university and non-university subsectors in real terms (in 2011 dollars)
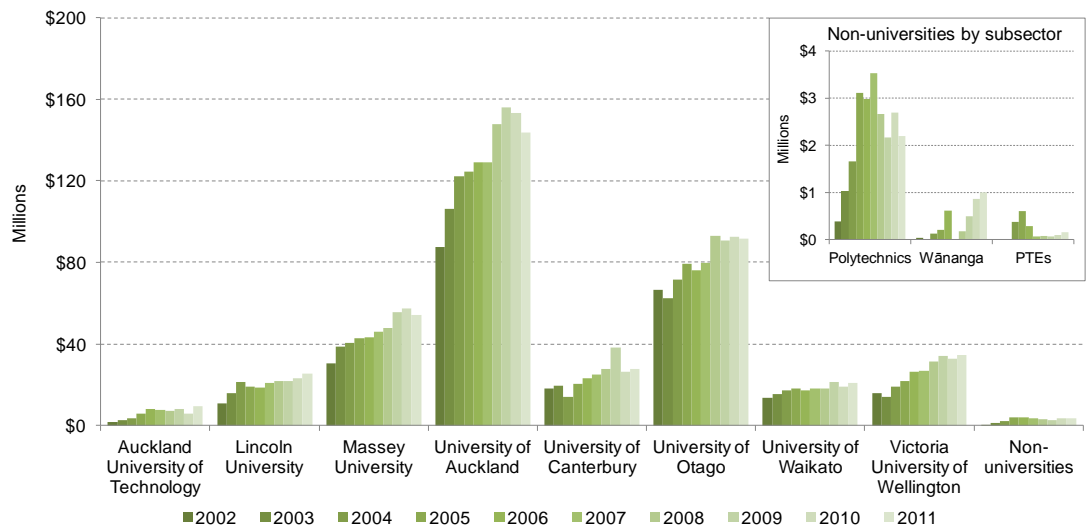
Source: Tertiary Education Commission

Figure 44 presents the share of reported PBRF ERI by individual university and by non-university subsectors. In 2011, the largest share of PBRF ERI was reported by the University of Auckland (35 percent), followed by the University of Otago (22 percent). Although there is an occasional year where a university exhibits variation in its share, generally the share of each of the universities has remained relatively stable over time. The exception is Victoria University of Wellington, which has been steadily increasing its share of PBRF ERI over time. In 2003, it attracted 5 percent of total PBRF ERI, compared with 8.4 percent in 2011.

Figure 44

Share of PBRF external research income by individual universities and non-university subsectors
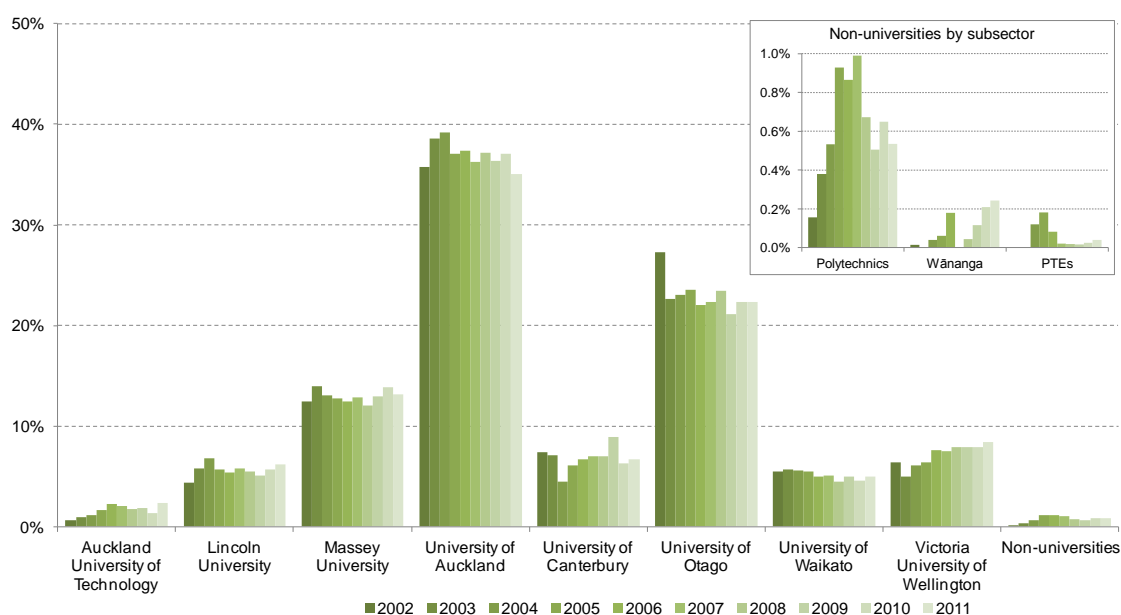
Source: Tertiary Education Commission

PBRF external research income per FTE

One of the factors influencing the share of total PBRF ERI is the size of a TEO. To adjust for this, we present reported PBRF ERI for 2011 on a per PBRF-eligible full-time equivalent (FTE) staff member basis in Figure 45. This shows that Lincoln University attracted the highest amount of PBRF ERI per FTE (just under $120,000). The University of Auckland and University of Otago were next in terms of ERI per FTE (with around $87,800 and $76,500, respectively).

The high placing of these three TEOs reflects the fact that ERI in New Zealand is skewed. Each of these universities undertakes research in the biological and medical sciences. Auckland and Otago dominate funding from the Health Research Council because they have medical schools, which helps to boost their per FTE funding. Of the $80 million distributed by the Health Research Council in 2010/11, 40 percent went to Auckland and 35 percent to Otago. The remaining universities received 10 percent.

After the eight universities, the next highest-placed TEO is Te Whare Wānanga o Awanuiārangi, with funding of close to $19,000 per FTE.

Figure 45
PBRF external research income per PBRF-eligible FTE in 2011
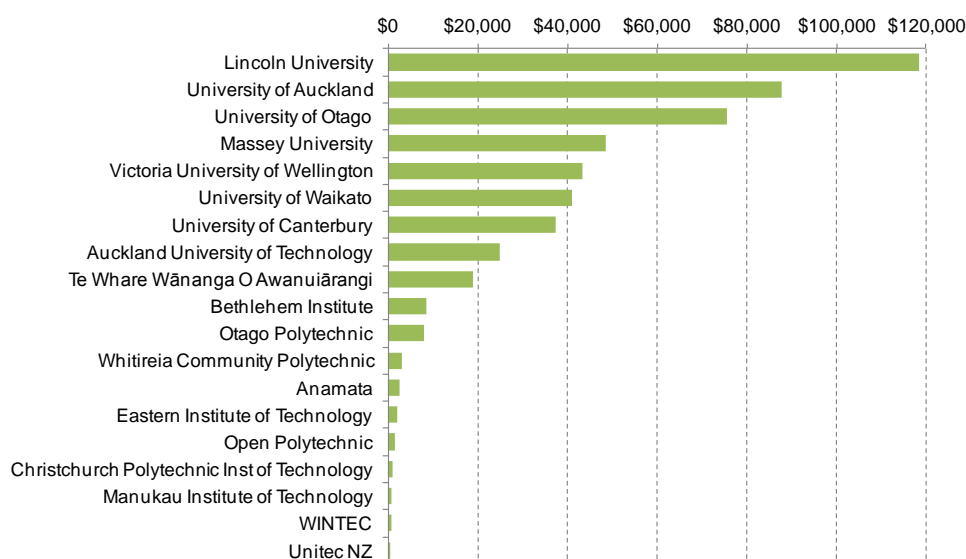
Source: Ministry of Education and Tertiary Education Commission

University external research income by source

As part of the reporting process, TEOs are only required to submit a total of the ERI that qualifies under the rules. This means that we cannot tell what the source of the PBRF ERI was. However, the biannual *Research and Development Survey* carried out by Statistics New Zealand does provide us with some information on the sources of university ERI. This ERI data is only available at the university subsector level, and also includes ERI that may be outside of the PBRF rules. Nevertheless, it provides us with some indication of what the main sources of university ERI were.

Figure 46 shows the sources of ERI for universities in 2004 and 2009. In 2009, the largest source of ERI for universities was government research purchase agencies (the Royal Society, Ministry of Business, Innovation and Employment, and the Health Research Council). In 2009, around 43 percent of university ERI was earned from this source. This was followed by ERI sourced from other government agencies (32 percent), New Zealand business (9 percent) and overseas sources (5 percent). Since 2004, there has not been a fundamental shift in sources of university ERI, although ERI from government sources increased from 70 percent in 2004 to 75 percent in 2009. Although all sources of ERI funding increased in real terms over this period, ERI sourced from Government increased at the fastest rate.

Figure 46

Sources of university external research income

2004 ($285 million)

- Other tertiary education providers 3%
- Other 7%
- Overseas 7%
- NZ business 13%
- Other government agencies 23%
- Government research purchase agencies 47%

2009 ($442 million)

- Other tertiary education providers 5%
- Other 6%
- Overseas 5%
- NZ business 9%
- Other government agencies 32%
- Government research purchase agencies 43%
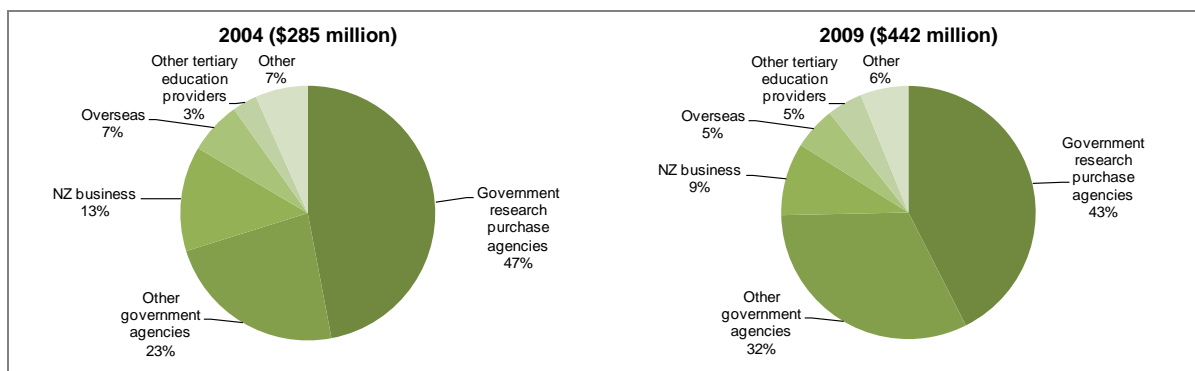
Note: Research income from state owned enterprises is treated as being from New Zealand business in this survey.

Source: Statistics New Zealand

The proportion of funding attracted by universities from contestable funds

The percentage of funding won by universities from contestable funds can also be an indication of the quality of the research they produce. In this section, we examine the share of contestable funding allocated to universities from two sources – the Health Research Council and the Royal Society (Marsden Fund).[14] The Health Research Council invests in a broad range of health research on issues of importance to New Zealand and supports the development of research careers. The Marsden Fund was established by the Government in 1994 to fund excellent fundamental research and is administered by the Royal Society of New Zealand.

The results in Figure 47 present a mixed picture. In the case of Marsden Fund payments, the universities have received a greater proportion of this funding over time. In 2000/01, around 76 percent of Marsden funding was paid to universities. By 2011/12, this had increased to 88 percent. However, the proportion of funding allocated via the Health Research Council and paid to universities has decreased over the period. In 2000/1, around 96 percent was paid to universities, compared with 84 percent in 2011/12. However, although universities have earned a lower share of Health Research Council funding, they received more actual funding due to increases in the total size of the funding pool.

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[14] The funding represents the money paid to universities in that year, not the multi-year contract sums that are publicised at the time the grants are announced.

Figure 47

Share of contestable funding paid to universities by fund type
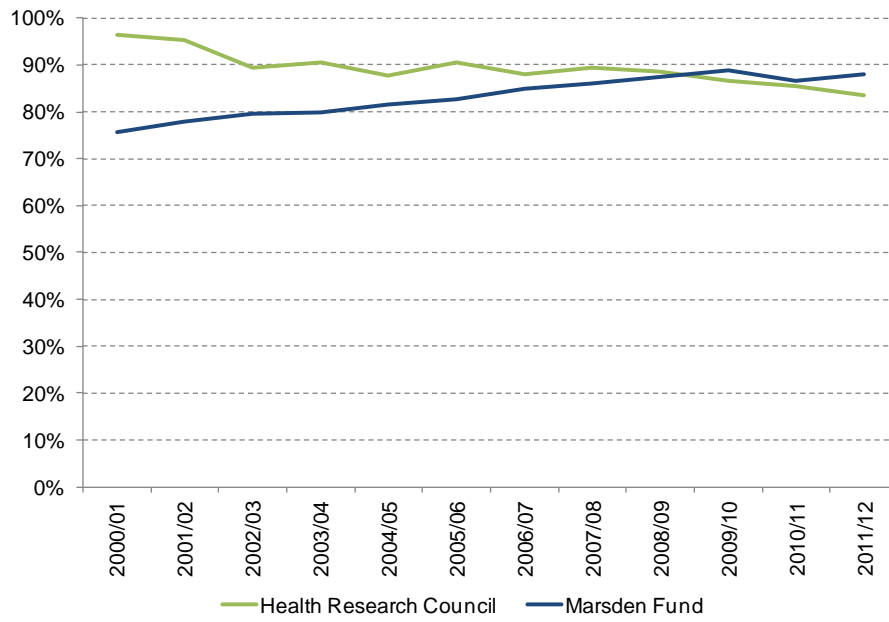
Note: This funding represents the money paid to recipients in that financial year.

Source: Royal Society of New Zealand, Health Research Council

Technical notes

1. All expenditure in this section is exclusive of GST.

2. The Consumers Price Index has been used to adjust for the impact of inflation on funding over time.

7   INDICATORS OF TEACHING PERFORMANCE

KEY POINTS

- EPI data shows increasing level of course completion over time.

- Qualification completion rates at the bachelors level have been increasing over time.

- Student and graduate surveys carried out by universities show that student satisfaction with teaching/supervision or experience has not deteriorated since the PBRF was introduced.

Introduction

The introduction of performance-based funding and publication of individual TEO performance via the PBRF in 2004 placed an extra focus on the research activities of participating TEOs. A similar focus on the teaching performance of TEOs, via the publication of Education Performance Indicators (EPIs) and the linking of the EPIs to government funding has only been in place since 2010 and 2012, respectively. So, at least initially, there was an imbalance in the application of performance-based funding.

In this chapter, we examine data on the teaching performance of TEOs to assess whether the extra focus placed on research has involved a trade-off with teaching activities. To do this, we look at the results of the Tertiary Education Commission's Education Performance Indicators (EPIs), cohort-based qualification completion rates and the results of surveys of university students and graduates.

Educational Performance Indicators

The Tertiary Education Commission has now published three years of EPI information. Figure 48 presents data for one of the EPIs, the EFTS-weighted course completion rate. This EPI measures the completion rate in courses funded via the Student Achievement Component that are not PBRF eligible (and so not research based).

The data shows that, at almost all levels and in almost all subsectors, course completion rates rose between 2009 and 2011. A number of factors are likely to have contributed to this improvement, including the publication of this information since 2010 and the introduction of performance-linked funding in 2012, where part of the funding of a TEO is determined by its performance in the EPIs. The shifting of funding away from areas of low course completion by the Tertiary Education Commission would also have contributed to this improvement in performance. So the incentive would have been to improve this result.
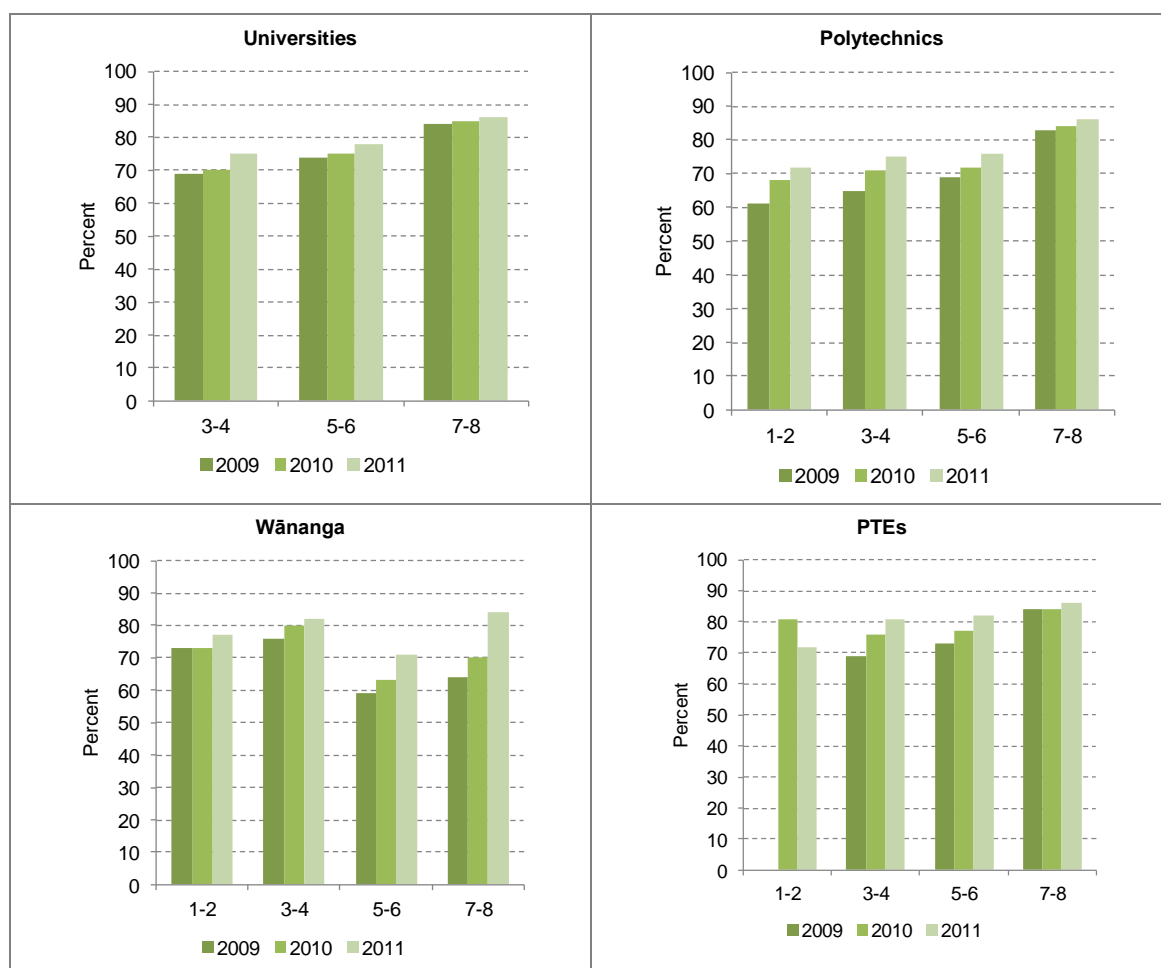
Source: Tertiary Education Commission

Qualification completion rates at the bachelors degree level

A longer-term view of student achievement can be assessed using cohort-based completion rates. Here we focus our analysis on the undergraduate level and look at the five-year completion rate at the bachelors degree level. Figure 49 shows that the five-year completion rate for domestic bachelors students has shown steady improvement from 49 percent for those who started in 2001 to 56 percent for those who started in 2007. The improvement in completion rate took place during the period where the PBRF was introduced. So this data suggests that the introduction of the PBRF did not have a negative impact on achievement by bachelors students.

Figure 49

Five-year qualification completion rates at the bachelors degree level by starting year

Domestic — — — **All**
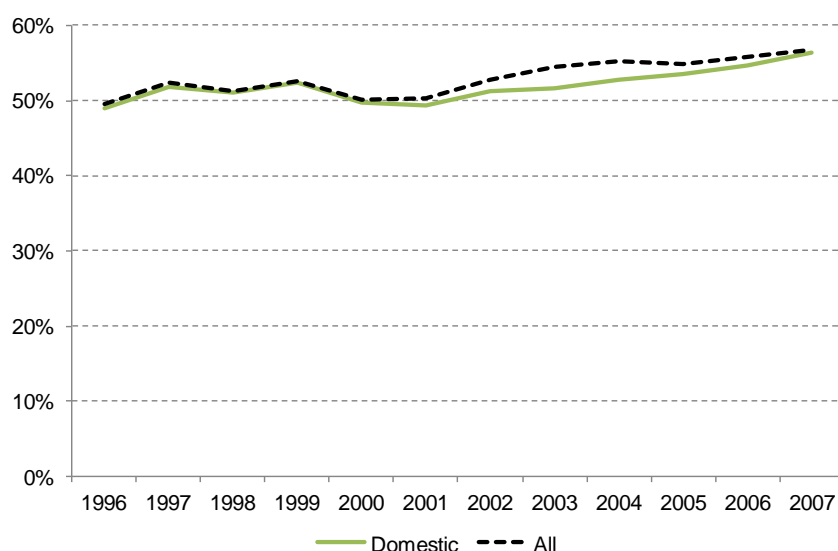
Surveys of university students/graduates

Some universities show in their annual reports the results of student and graduate surveys. The results of these surveys, where they are available on a consistent basis for an extended time frame, are presented in Table 9. Although there is variation in some of the survey findings, the results generally show a fairly consistent pattern of student satisfaction with teaching and/or supervision.

Table 9

Student and graduate survey results from various universities

University	Survey question	2003	2004	2005	2006	2007	2008	2009	2010	2011
Lincoln	Lecturer evaluations – % of students evaluating lecturers as good or better	83	81	81	81	82	82	85	85	85
	Undergraduate satisfaction survey – % expressing broad satisfaction with teaching and learning	n/a	89	n/a	n/a	87	n/a	n/a	n/a	90
	CEQ graduate feedback survey – % of students expressing broad agreement with the good teaching scale	83	91	91	95	93	89	91	93	89
	Postgraduate student satisfaction survey – % of students expressing broad satisfaction with supervision	92	n/a	93	n/a	96	n/a	93	n/a	95
Auckland	% of undergraduate students expressing satisfaction with university experience	n/a	n/a	n/a	91	94	82*	95	n/a	93
	% of postgraduate students expressing satisfaction with university experience	n/a	n/a	n/a	91	93	n/a	95	n/a	92
Otago	% of respondents to the annual student and graduate survey providing a positive assessment of teaching quality	n/a	n/a	n/a	n/a	n/a	89.0	87.4	90.2	87.0
	% of respondents to the graduate opinion survey reporting overall satisfaction with quality of doctoral or masters thesis supervision	n/a	n/a	81.6	89.6	85.8	92.3	88.5	88.6	77.8#

Notes: * The University of Auckland participated in the Australasian Survey of Student Engagement in 2008. This internationally benchmarked survey was undertaken on a different basis. # The 2011 result for satisfaction with supervision is due to specific issues in respect of a specific subject.

Source: Annual reports of the University of Auckland, Lincoln University and the University of Otago

8 TRENDS IN UNIVERSITY STAFFING BY DESIGNATION

KEY POINTS

The distribution of university academic and research staff has changed significantly between 2001 and 2011. The main trends were:

- an increase in the proportion of higher-ranked academic staff (professors and associate professors) and research only staff

- a decrease in the proportion of lecturers and senior lecturers.

These trends are likely to be a result of several factors. Two of these are likely to be an aging academic workforce and the introduction of the PBRF influencing the academic and research staff mix at the universities.

Introduction

Generally, research excellence by academic staff is rewarded in the universities through promotion to higher academic ranks. In this chapter, we examine trends in the proportion of university academic and research staff by designation over the last 10 years to analyse what changes (if any) there have been to the distribution of university staff in the academic ranks and whether these have been associated with the introduction of the PBRF.[15] We focus on university staffing as the templates used to collect staffing data for polytechnics and wānanga are different from the university template and don't allow for this type of analysis of staffing trends.

Results

Figure 50 shows the proportions of university academic and research full-time equivalent staff between 2001 and 2012. The data shows that the proportion of:

- professors increased from 7 percent in 2001 to 12 percent in 2011

- associate professors increased from 9 percent in 2001 to 11 percent in 2011

- senior lecturers dropped from 34 percent in 2001 to 32 percent in 2011

- lecturers decreased significantly from 24 percent to 15 percent between 2001 and 2011

- 'other teaching and research' staff remained stable between 2001 and 2008, at around 16 percent, before increasing slightly to around 17 percent between 2009 and 2012. 'Other teaching and research' staff include visiting fellows, teaching fellows, assistant lecturers and tutors, but exclude graduate assistants.

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[15] We focus on university staffing as they capture the vast majority of PBRF funding and because the templates used to collect staffing data for polytechnics and wānanga are different from the university template and don't allow for this type of analysis of staffing trends.

- The proportion of research only staff began to increase in 2003 and reached a peak of 15 percent in 2010 (up from 10 percent in 2002). The proportion dropped slightly to 13 percent in 2012.

There are several possible reasons for this change. First, the academic workforce is aging and so staff will tend to progress through the academic ranks as they get older. Second, the introduction of the PBRF may have improved the research performance of some staff, which may have led to the proportion of higher ranks; or the universities may have been recruiting new staff at higher ranks to ensure they have a track record of quality research and so will score highly in the PBRF Quality Evaluations.

It is difficult to identify the main cause of the trends. The increasing trend in higher ranks and reduction in lecturers began before the introduction of the PBRF and suggests that the aging of the workforce is a major factor. However, the increase in research only staff from 2003 is likely to be associated with the introduction of the PBRF, rather than an aging academic workforce. The increase in 'Other teaching and research' staff may also indicate a degree of substitution with lecturer scale positions.

Figure 50

Distribution of university academic and research staff FTEs by designation
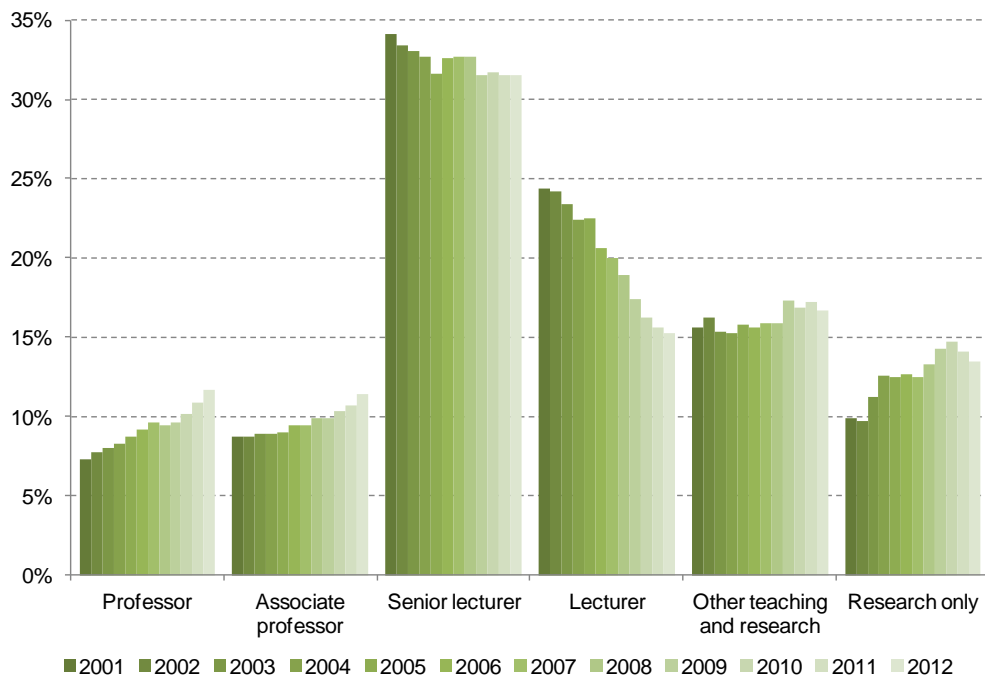
Note: This data is for universities only and does not include data from colleges of education.

Technical notes

1. The staffing data is only for the universities and does not include any data from colleges of education.

9 COMMERCIALISATION OF RESEARCH BY NEW ZEALAND UNIVERSITIES

KEY POINTS

- Data from the University Commercialisation Offices of New Zealand (UCONZ) generally showed increasing commercialisation activities between 2003 and 2008.

- Annual report data from some universities suggests commercialisation has generally continued to increase after 2008.

- University ERI sourced from New Zealand business increased in value, but not as a proportion of total business ERI, between 2002 and 2009.

- The Times Higher Education indicator that measures income from industry per academic staff member showed that New Zealand universities were ranked second (University of Auckland) and seventh (Massey University) of listed Australasian universities in the 2012/13 THE World University Rankings.

- Although the commercialisation data generally shows improvement, it is not possible to know what the level of commercialisation would have been like without the PBRF.

Introduction

This chapter examines commercialisation data to assess the impact of the PBRF on this activity.[16] Broadly speaking, there are two ways commercialisation of university research may be initiated:

- A firm may contract the university to conduct research to produce intellectual property which is then used by the firm in its business.

- University researchers may conduct an investigation that leads to a discovery that has the potential to yield commercial value.

Where the research is initiated by a firm, the revenue is paid to the university and is recognised for accounting purposes as the research is conducted and the intellectual property is delivered to the company. Where the research is initiated by the university researchers, the revenue is usually generated through:

- selling the intellectual property to a firm, or

- providing a license for a firm to use the intellectual property, or

- creating a 'spin-off' company that may have university share-holding, to undertake the commercialisation.

Concerns have been raised that the PBRF is impacting on commercialisation activities in TEOs, especially by younger researchers (Collier and Gray, 2010). One of the outcomes of these concerns has been the inclusion of the Professional and Applied Research Expert Advisory

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[16] This chapter contains extracts from Smyth and Smart (2012).

Group for the 2012 PBRF Quality Evaluation. The Professional and Applied Research EAG has four sub-groups: Commercial, Professional Practice, Social, and Environmental.

In this chapter, we look at summary findings from Ministry of Education reports on commercialisation of university research using data from the University Commercialisation Offices of New Zealand (UCONZ) and Statistics New Zealand's *Research and Development Survey*. We then look at annual report data for more recent commercialisation performance and also use data published as part of the Times Higher Education World University Rankings to assess the comparative performance.

UCONZ data

The Ministry of Education has published an analysis of performance by UCONZ (Smyth and Smart, 2012). This presented data between 2003 and 2008. The key findings of this report are presented below.

- Research commercialisation income in the eight New Zealand universities rose between 2003 and 2008.[17]
- Research commercialisation income increased as a proportion of total university income.
- The universities have improved measures of research commercialisation productivity – research commercialisation expenditure per staff member has risen, as has the ratio of commercialisation expenditure to total university equity, while the ratio of commercialisation revenue to equity has been stable.
- The number of invention disclosures increased, though patents per staff member were lower in 2008 than in 2005.
- The market capitalisation of and the number of staff employed by start-up companies set up to commercialise university research have both risen.

Smyth and Smart (2012) state in their report:

"One of the most important observations about these findings is that this growth has occurred over the period of the introduction of the two main current university research funding streams – the PBRF and the CoREs. Collier and Gray (2010) note that many people have argued that the PBRF has operated to stunt the growth of university research commercialisation. Their findings acknowledge that the PBRF may create disincentives for early career researchers to engage in commercialisation, but suggest that much commercialisation is undertaken by researchers who have high PBRF ratings. They also note that these claims are anecdotal and mostly made by those outside the universities.

The introduction of the PBRF has produced a much greater focus on research in the universities. This greater attention to research may have had benefits for research commercialisation in the universities; but we can't work out what would have happened to commercialisation in the absence of the PBRF or if the PBRF had been somehow different."

Annual report data on commercialisation from individual universities

One of the drawbacks of the UCONZ data used by Smyth and Smart (2012) is that it only relates to data between 2003 and 2008. To assess more recent data, we present information from the annual reports of universities on commercialisation performance in Table 10.

The data shows that external research income from industry rose at Auckland University of Technology between 2009 and 2011, while the value of research contracts from industry initially increased and then fell at the University of Canterbury in 2010. Massey University

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[17] Research income excludes contestable funding from the Health Research Council, the Marsden Fund or the Foundation for Research, Science and Technology.

publishes a number of commercialisation metrics, all of which indicate increasing levels of commercialisation between 2008 and 2011.

Table 10

Commercialisation data for universities

University	Measure	2007	2008	2009	2010	2011
Auckland University of Technology	ERI – total ($m)	n/a	n/a	$8.4	$9.2	$10.8
	ERI – from industry ($m)	n/a	n/a	$2.4	$3.2	$3.6
	%	n/a	n/a	29%	35%	33%
Massey	New disclosures	n/a	n/a	n/a	26	30
	Licences/commercialisation deals	n/a	2	2	3	3
	Licensing revenue ($000s)	n/a	$334	$272	$369	$415
	Non-govt research income ($m)	$14	$12	$14	$21	$23
	ERI total ($m)	$56	$63	$70	$79	$73
	%	25%	19%	20%	27%	32%
Canterbury	Number of research contracts with NZ industry	14	21	12	17	n/a
	Value of research contracts with NZ industry ($m)	$0.7	$2.5	$3.5	$1.7	n/a

Source: Annual reports of Auckland University of Technology, Massey University and the University of Canterbury

University research income sourced from industry

New Zealand research and development survey data

One of the ways to assess the interaction between TEOs and business is to examine the value of the external research income sourced from business. In the case of research funded by business, this means the funding organisation considers that the knowledge and ideas they have 'purchased' from a university can be translated into financial value for the firm. The Ministry of Education has published an analysis of external research income by source for New Zealand universities between 2000 and 2009 (Ministry of Education, 2011). In terms of ERI sourced from New Zealand business, the picture was mixed. The analysis showed that ERI sourced from business increased by 47 percent in inflation-adjusted terms between 2000 and 2009. On a per FTE academic staff basis, the inflation-adjusted increase was 33 percent.

As a proportion of all expenditure on research and development by business, the share earned by universities reached a high of 6 percent in 2004 and 2005, before dropping to a low of 3 percent in 2007. In 2009, the share increased slightly to 4 percent.

Times Higher Education World University Rankings data

The Times Higher Education (THE) World University Rankings include an indicator that measures the value of research income sourced from industry per FTE academic staff member. This is used to assess innovation, etc. The results of this indicator in the latest rankings are presented in Figure 51. This shows the score in this indicator (the top university = 100) for Australasian universities that were listed in the THE rankings.

The gold bars represent Australian non-Group of Eight universities, the green bars represent Australian Group of Eight universities and the black bars represent New Zealand universities. The results show that the University of Auckland is the second highest-placed Australasian university on this indicator, second only to the University of South Australia. Massey University

is placed seventh among Australasian universities. The performance of the remaining New Zealand universities listed in the rankings is lower, with the University of Waikato the lowest-placed Australasian university in terms of those listed in the rankings.

Figure 51

Times Higher Education World University Rankings 2012/13 indicator score measuring income from industry per academic – Australasian universities

THE score (top university = 100)
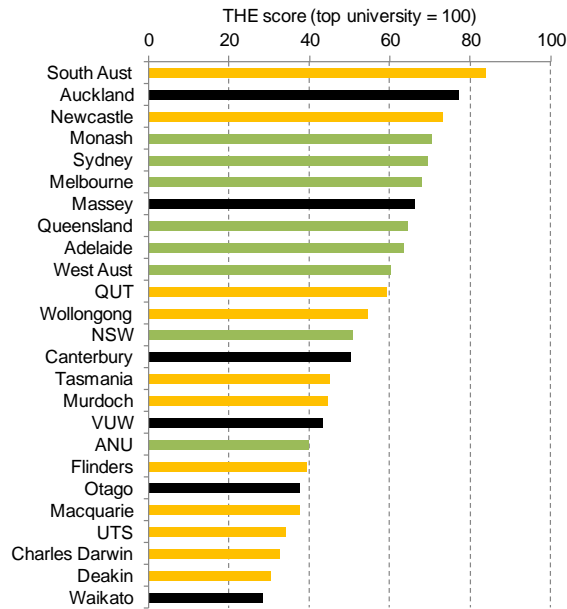
Source: Times Higher Education

APPENDIX: PBRF COMPONENTS

Quality Evaluation

The assessment of research quality – Quality Evaluation (QE) – is undertaken by interdisciplinary peer review panels consisting of disciplinary experts from both within New Zealand and overseas. These panels provide expert coverage of the subject areas within each panel's respective field of responsibility.

Each researcher presents their research in the form of an evidence portfolio (EP). The EP has three components:

- Research outputs: the outputs of a staff member's research (each staff member nominates up to four of their best research outputs for primary consideration by the panel, and up to 30 other research outputs (ORO))

- Peer esteem: an indication of the quality of the research of the staff member, as recognised by their peers in the form of fellowships, prizes, awards, memberships of learned societies, participation in editorial boards, invitations to present at conferences, favourable reviews, etc (each staff member determines their top 30 examples, providing a list and details to the peer review panel)

- Contribution to the research environment: the staff member's contribution to a vital, high-quality research environment, both within the TEO and beyond it, as evidenced by membership in research consortia, generation of external research income, supervision of student research, etc (each staff member determines their top 30 examples, providing a list and details to the peer review panel).

In assessing the EP, the scores assigned to each component are weighted to calculate a weighted total score, which corresponds to a quality category. There are six quality categories:

- Quality Category 'A': For an EP to be assigned an 'A', it would normally be expected that the staff member has, during the assessment period in question, produced research outputs of a world-class standard, established a high level of peer recognition and esteem within the relevant subject area of their research, and made a significant contribution to the New Zealand and/or international research environments

- Quality Category 'B': For an EP to be assigned a 'B', it would normally be expected that the staff member has, during the assessment period in question, produced research outputs of a high quality, acquired recognition by peers for their research at least at a national level, and made a contribution to the research environment beyond their institution and/or a significant contribution within their institution

- Quality Category 'C': For an EP to be assigned a 'C', it would normally be expected that the staff member has, during the assessment period in question, produced a reasonable quantity of quality-assured research outputs, acquired some peer recognition for their research, and made a contribution to the research environment within their institution. (This Quality Category is available for the EPs of all PBRF-eligible staff members except new and emerging researchers.)

- Quality Category 'C(NE)': For an EP to be assigned a 'C(NE)', a new or emerging researcher would normally be expected, during the assessment period in question, to have produced a reasonable platform of research, as evidenced by having: either (a) completed their doctorate or equivalent qualification and produced at least two quality-assured research outputs, or (b) produced research outputs equivalent to a doctorate and at least two quality-assured research outputs. (This Quality Category is available for the EPs of new and emerging researchers only.)

- Quality Category 'R': An EP will be assigned an 'R' when it does not demonstrate the quality standard required for a 'C' Quality Category or higher. (This Quality Category is available for the EPs of all PBRF-eligible staff members except new and emerging researchers.)

- Quality Category 'R(NE)': An EP will be assigned an 'R(NE)' when it does not demonstrate the quality standard required for a 'C(NE)' Quality Category or higher. (This Quality Category is available for the EPs of new and emerging researchers only.)

EPs are evaluated through a rigorous, collaborative process. EPs are assigned to a primary and secondary panellist who independently assess the EP and then agree an initial score together. This score is then discussed at the panel meeting and a final score is decided. All the scores are moderated by panel and between the panels.

Funding in relation to the QE is based on:

- the quality categories assigned to EPs

- the funding weighting for the subject area to which EPs have been assigned

- the full-time equivalent (FTE) status of the participating TEO's PBRF-eligible staff as at the date of the PBRF Census.

QEs are conducted every six years. However, given the need for a managed transition, the second QE round took place three years after the first, but was a partial round. Thus, QEs have taken place in 2003 and 2006 (partial). The third QE took place in 2012.

Table 11 shows the 12 peer review panels that assess EPs and the subject areas that each panel is responsible for assessing.

Table 11

PBRF EP assessment panels and subject areas

Panel	Subject area
Biological Sciences	Agriculture and other applied biological sciences
	Ecology, evolution and behaviour
	Molecular, cellular and whole organism biology
Business and Economics	Accounting and finance
	Economics
	Management, human resources, industrial relations, international business and other business
	Marketing and tourism
Creative and Performing Arts	Design
	Music, literary arts and other arts
	Theatre and dance, film and television and multimedia
	Visual arts and crafts
Education	Education
Engineering, Technology and Architecture	Architecture, design, planning, surveying
	Engineering and technology
Health	Dentistry
	Nursing
	Other health studies (including rehabilitation therapies)
	Pharmacy
	Sport and exercise science
	Veterinary studies and large animal science
Humanities and Law	English language and literature
	Foreign languages and linguistics
	History, history of art, classics and curatorial studies
	Law
	Philosophy
	Religious studies and theology
Māori Knowledge and Development	Māori knowledge and development
Mathematical and Information Sciences and Technology	Computer science, information technology, information sciences
	Pure and applied mathematics
	Statistics
Medicine and Public Health	Biomedical
	Clinical medicine
	Public health
Physical Sciences	Chemistry
	Earth sciences
	Physics
Social Sciences and Other Cultural/Social Studies	Anthropology and archaeology
	Communications, journalism and media studies
	Human geography
	Political science, international relations and public policy
	Psychology
	Sociology, social policy, social work, criminology and gender studies

There are two key principles underpinning the eligibility of a TEO's staff member to participate in a QE:

- The individual is expected to contribute to the learning environment at the degree level.

    and/or

- The individual is expected to make a sufficiently substantive contribution to research activity.

Other elements underpinning the staff participation criteria are:

- The staff member has an explicit requirement to teach and/or undertake research as one of their employment functions, as at the date of the PBRF Census.

- A sufficiently substantive contribution is determined by applying the substantiveness test.

- The full-time equivalent (FTE) counted in the QE for each PBRF-eligible staff member is generally that contained in their employment agreement.

- Employment history in the 12-month period prior to the PBRF Census date is to be apportioned on an FTE basis to ensure fair representation of staff time, and to minimise 'poaching'.

- Staff employed in wholly owned subsidiaries and fully controlled trusts of the TEO are PBRF eligible, since these bodies operate under the control of the participating TEO.

- Provision has been made to allow staff members based overseas, and staff members sub-contracted to TEOs by non-TEOs, to be PBRF eligible under certain conditions.

Research degree completions

Research degree completions (RDC) is a measure of the number of research-based postgraduate degrees (e.g. masters and doctorates) that are completed within a TEO and that meet the following criteria:

- The degree has an externally assessed research component of 0.75 EFTS value or more.

- The student who has completed the degree has met all compulsory academic requirements by the end of the relevant year (the year preceding the return).

- The student has successfully completed the course.

The use of RDC as a performance measure in the PBRF serves two key purposes:

- It captures, at least to some degree, the connection between staff research and research training – thus providing some assurance of the future capability of tertiary education research.

- It provides a proxy for research quality. The underlying assumption is that students who choose to undertake lengthy, expensive and advanced degrees (especially doctorates) tend to search out departments and supervisors who have reputations in the relevant fields for high-quality research and research training.

Within the RDC component of the PBRF, a funding allocation ratio calculated on a rolling average basis determines the amount allocated to each TEO annually. For example, in 2009, the funding allocation ratio for each TEO was 15 percent of its RDC figure for 2005, 35 percent of its RDC figure for 2006, and 50 percent of its RDC figure for 2007.

The funding formula for the RDC component includes weightings for the following factors:

- The funding category of the subject area (a cost weighting, the same as applies in the QE part of the PBRF; the funding categories are also the same as in the Student Achievement Component (SAC) funding), and Māori and Pasifika student completions (an equity weighting, aimed to encouraged TEOs to enrol and support Māori and Pasifika students who have little representation at higher levels of the qualifications framework)

- the volume of research in the degree programme (a research-component weighting using a volume of research factor (VRF) to represent the amount of research associated with the qualification completed).

External research income

External research income (ERI) is a measure of research income received by a TEO and/or any wholly owned subsidiary.

ERI is included as a performance measure in the PBRF on the basis that it provides a good proxy for research quality. The underlying assumption is that external research funders are discriminating in their choice of whether, and who, to fund and that they allocate their limited resources to those they see as undertaking research of a high quality.

Only research funding from outside the tertiary sector (and contestable funding from within the tertiary sector) can be included as ERI. All eligible forms of ERI are treated equally in the funding formula. Income cannot be included in the ERI calculation until the work has been 'undertaken'.

Government funding secured for research from sources other than the PBRF – such as the Foundation for Research, Science and Technology, New Zealand Trade and Enterprise, and Marsden funding – is declared by each TEO in their ERI returns.

This measure excludes income from TEO employees who receive external research income in their personal capacity (i.e. the external research income is received by them and not their employer). Also excluded is income from controlled trusts, partnerships, and joint ventures.

Within the ERI component of the PBRF, a funding allocation ratio calculated on a three-year rolling average basis determines the amount allocated to each TEO annually. This is the same as with the RDC component.

Each participating TEO submits an ERI return to the TEC. This return shows the TEO's total PBRF-eligible ERI for the 12 months ending 31 December of the previous year. In addition, in support of each ERI calculation, the TEO must provide an independent audit opinion and a declaration signed by the TEO's chief executive.

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