A Comparative Analysis of Student Growth in the Australian and UK University Sectors

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Introduction

The total number of students across all Australian universities combined has increased 17.1% in the last five years according to the most current data available, which is for the period 2006 to 2010. In comparison, the total number of students across all universities in the UK has increased 4.2% over the same period. This information shows a remarkable growth in the Australian university sector and a remarkable difference between Australia and the UK, which has prompted us to investigate further. So, key questions must be asked about this phenomenon, beginning with the most fundamental ones: If the student growth and its variations throughout time are not common to both sectors, then when and where do they differ, and why?

We will endeavour to answer these questions, or at least answer them partly, by taking the small yet important first step of comparing the student growth of the Australian university sector and the UK university sector. We will begin by establishing some of the fundamental differences between these sectors, and later, with these differences in mind, we will compare growth trends, magnitudes and statistics across key classification factors of interest for the purpose of obtaining a broader understanding of student growth.

The Universities

In this analysis we consider 39 Australian universities and 119 UK universities (see the Appendix for a full list). In order to assess their suitability for the study, we used the following criteria:

- whether the institution has university status (as defined in each country),
- the size of the institution in terms of the number of students it holds, and
- the number and variety of courses that the institution offers and the number of areas of education that the courses cover.

The 39 Australian universities comprise 37 public and two private institutions. The UK universities are composed almost entirely of public institutions with the exception of one private university.

Preliminary analysis showed that most universities in both countries offer courses representing many areas of education. The UK, however, has a small number of universities in the sample that specialise in specific areas of education. These institutions have a significant number of students enrolled and correspond to only 4% of the total number of UK universities in this study. The Australian equivalents of such institutions are very small in terms of the number of students they hold and/or do not have university status. Therefore, these Australian institutions have not been considered in this study.

The number of students from all 39 Australian universities combined corresponds to approximately 94.5% of all recorded higher education students in Australia. Similarly, the number of students from all 119 UK universities combined corresponds to approximately 87.6% of all recorded higher education students in the UK. Hence, we have a very large representation of the population of students and universities of both sectors.

The Countries

The UK, while a single nation state, actually consists of four countries, namely, England, Northern Ireland, Wales and Scotland, all of which combined cover an area of 243,610 km² with a population of approximately 62,262,000 people. Australia, on the other hand, covers an area of 7,692,024 km² with a population of approximately 22,696,000 people. Table 1 shows these statistics together with the number of universities we have considered for this study.

Given the population of each country, the number of universities in the UK is 10% higher than the relative number of universities in Australia. The remarkable difference, however, is that in the UK, on average, a university would exist in every 2047 km², while in Australia, on average, a university would exist in every 195,332 km². Of course, these measurements of institutional density are only indicative. One would need to consider other factors for more accurate measurements. For example, approximately 78% of UK universities are located in England alone, meaning that 78% of the universities are located in approximately 50% of the surface area of the UK — obviously then the institutional density in the UK is not evenly distributed. The same can be said about Australia, as some areas and states are more populated than others. Although these measurements are only approximate, they nonetheless indicate that the degree of remoteness of institutions and the distances between major institutions are remarkably different between the sectors in the two countries. These are important factors that may affect the results of this investigation and therefore their interpretations.

Table 1: General country information

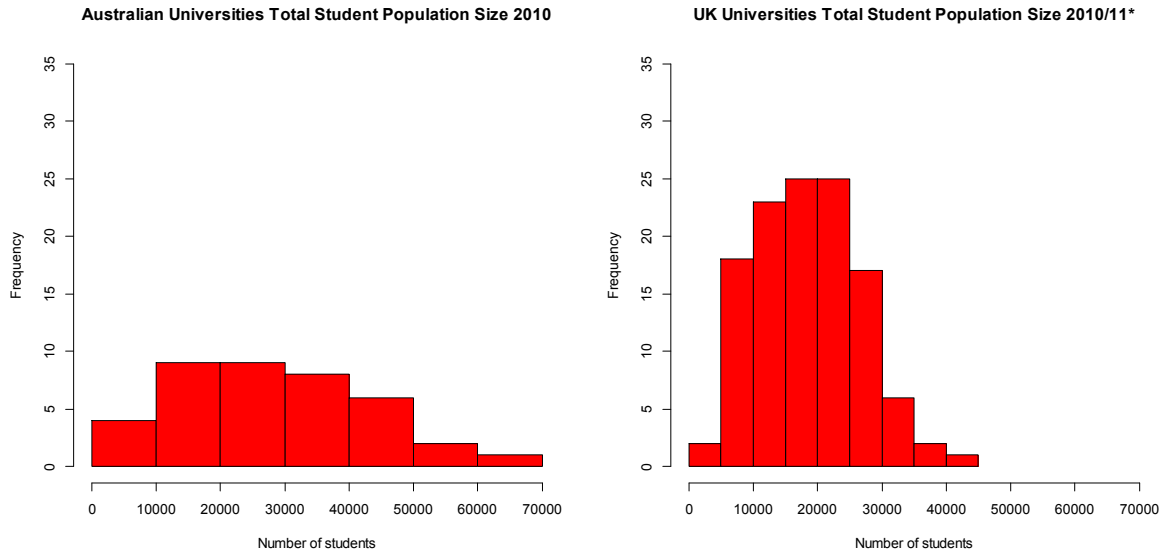
	Area	Population	Universities
Australia	7,692,024 km²	22,696,000	39
UK	243,610 km²	62,262,000	119

Distribution of University Student Population Size

Figure 1 shows the distribution of university student population size according to the most recent data available for the two sectors. Table 2 describes the statistics of the histograms.

The distribution of the Australian sector is centred at 28,888.9, with a standard deviation of 14,061.1. The distribution of the UK sector is centred at 18,406.8, with a standard deviation of 7,990.9. On average, Australian universities have larger student populations and with larger variability. The large variance of the mean of the Australian sector implies that the frequency of universities with similar student population sizes is rather low. In the UK sector, however, where the variance is narrower and closer to the mean, we find a larger proportion of universities that are of a similar size.

Figure 1: Distributions of total university student population size



*The academic year in the UK begins in autumn and ends the following summer.

Table 2: Descriptive statisics of the distributions of student population size

Australia				UK			
N	**Total**	**Mean**	**St.dev**	**N**	**Total**	**Mean**	**St.dev**
39	1,126,666	28,888.9	14,061.1	119	2,190,410	18,406.8	7,990.9

The Trend of the Average Student Population Size

Figure 2 shows the average size of the total student population of a university in the two sectors over a period of five years. The figure shows two lines for each of the sectors, which were produced using linear mixed-effect modelling as described in Pinheiro and Bates (2000). Note that the time series for the UK is in fact from 2006/07 to 2010/11 because the academic year in the UK begins in autumn and ends the following summer. However, due to statistical modelling, we must conform to a time series of whole years.

The solid lines represent the non-linear growth in the average student population size, while the dashed lines represent the linear growth. Both these lines are close to each other in curvature, which allows for an efficient linear interpretation.

Clearly, the rate of growth of the average total student population size in Australia is greater than that in the UK. In the Australian sector, the size of the total student population increases at a rate of 1064 students per year for the average-sized university. In comparison, the size of the total student population in the UK sector increases at a rate of 276 students per year for the average-sized university. Both trend lines have been increasing significantly throughout time (see Table 3 for model diagnostics). However, the models for the Australian sector describe a steady increase, while the UK sector is flatter with some noise in the non-linear trend, which shows no increase in the average size of total student populations from 2009/10 to 2010/11.

Noticeably, the large difference between the standard errors of the rates of growth (see errors of the coefficients in Table 3) reflects the difference in sample variability of university sizes between the two sectors, with 63.02 and 37.48 for Australia and the UK, respectively.

Figure 2: Mixed-effect models of average total student population size

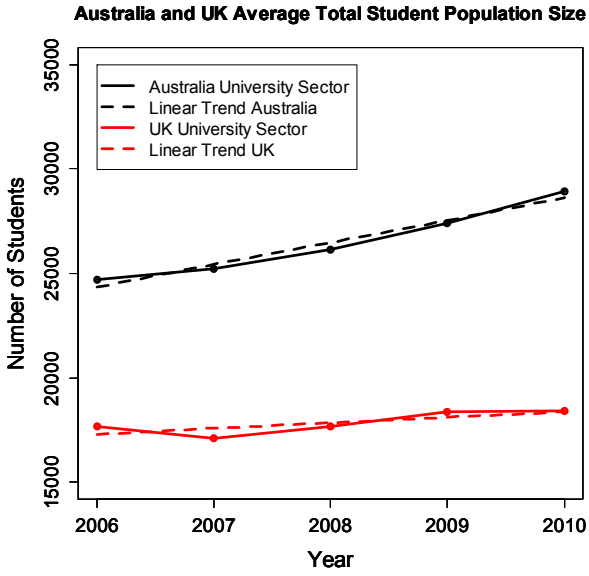


Table 3: Diagnostics of linear mixed-effect models of average total student population size

Australia				UK			
N	**Coefficient**	**St.error**	**p-value**	**N**	**Coefficient**	**St.error**	**p-value**
39	1063.8	63.02	0.000	119	275.9	37.48	0.000

Percentage Change in the Size of Total Student Populations

Figure 3 shows boxplots of the distribution of percentage changes in both sectors, that is, the change in the total number of students enrolled in a university from one year to the next, expressed as a percentage increase or decrease. Throughout the time periods, we can see a similar trend in the median percentage change of both sectors, with the median increasing in the first three time periods followed by a decrease in the last time period.

This is interesting because it is the first sign of common variation between the sectors in the two countries. Having said this, the UK shows a larger drop in the median in the last time period (see Table 4 for the boxplot statistics), which could be explained by the slight drop in average student population size from 2009/10 to 2010/11, as shown in Figure 2. Now, while the Australian sector has been increasing rapidly, the median also dropped in the last time period from 2009 to 2010. This is counterintuitive because the Australian sector was experiencing one of its biggest increases in the size of student populations since 2006, yet we can observe an overall decrease in catchment in this time period.

This phenomenon could be explained in several ways: decreasing student retention rates, a large number of completions in the previous year, uneven growth benefiting only large universities, or a combination of these. Of course, these hypotheses would be subject to further investigation.

We can also see that the UK boxplots show larger variability. The interquartile range (IQR) of the boxplots (a measure of statistical spread, shown in Table 4) shows that throughout the time periods percentage changes for the UK are more variable and contain outliers that are more extreme than those observed in the boxplots of the Australian sector.

Figure 3: Distribution of percentage changes in the size of the total student populations

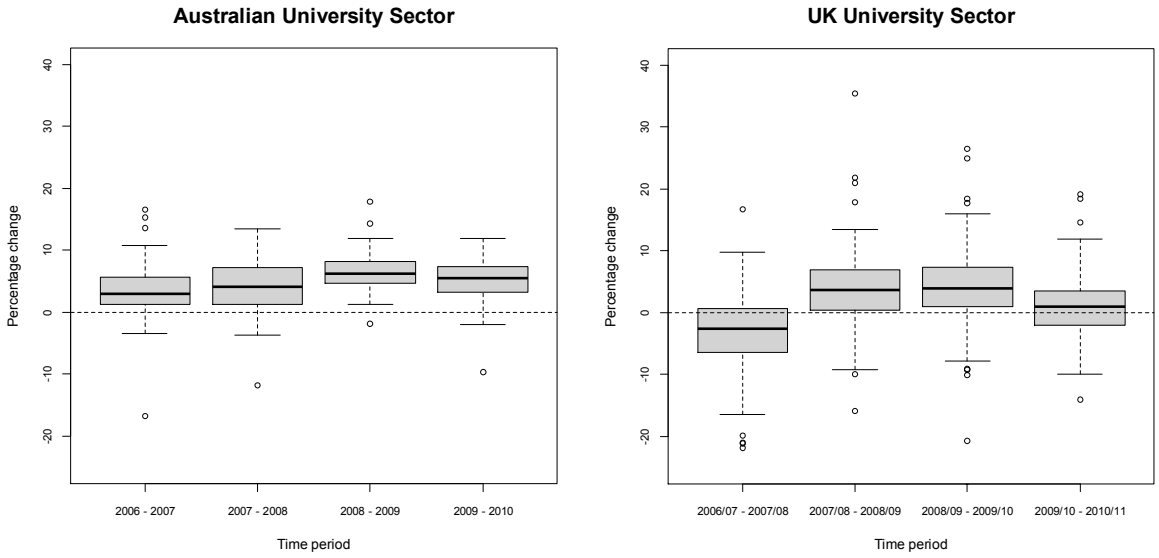


Table 4: Boxplot statistics of the percentage changes in the size of total student populations

Time Period	Australia		UK	
	Median	IQR*	Median	IQR*
2006/07_2007/08	2.94	4.39	-2.58	7.03
2007/08_2008/09	4.11	5.99	3.63	6.55
2008/09_2009/10	6.21	3.51	3.91	6.44
2009/10_2010/11	5.53	4.08	0.94	5.33

*IQR — interquartile range

The Domestic and Overseas Populations

A key area of investigation that follows from the analysis so far, particularly in understanding the rapid growth of the Australian sector, is to explore the trends of the domestic and overseas student populations. For this, we produced models of the average student population size of both domestic and overseas students for the Australian and the UK sectors. Figure 4 and Figure 5 show the models.

Clearly, the rapid growth in the total number of students in the Australian sector, shown in Figure 2, is primarily due to rapid growth in the number of domestic students, shown in Figure 4. We can also see that the drop in the number of students from 2009/10 to 2010/11 in the UK sector (Figure 2) is primarily due to a drop in the number of domestic students (Figure 4).

Figure 4: Mixed-effect models of average domestic student population size

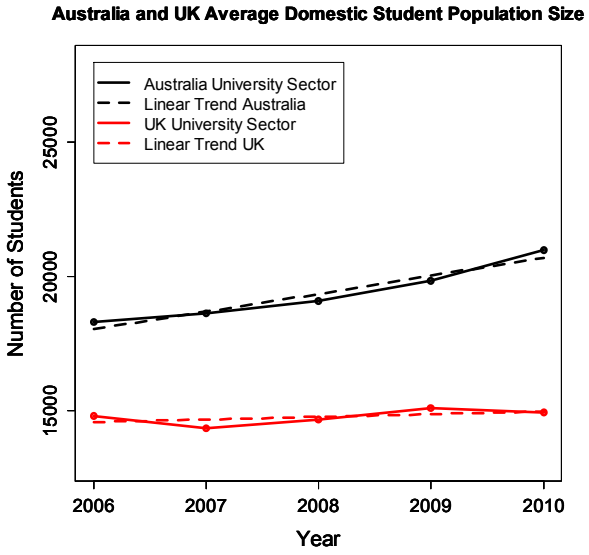


Figure 5: Mixed-effect models of average overseas student population size

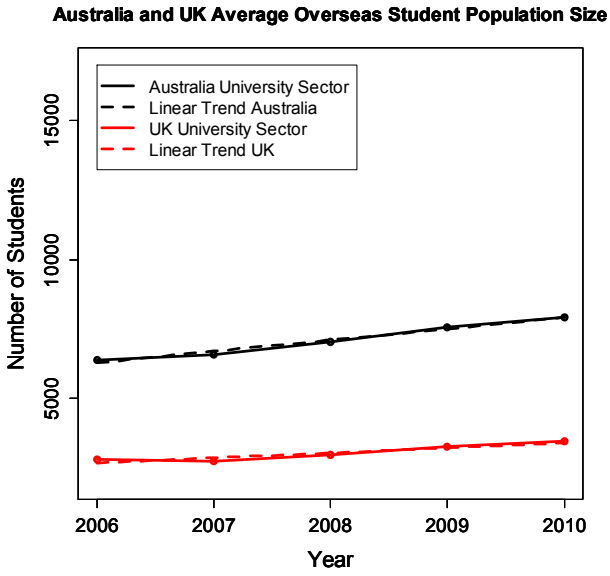


Table 5: Diagnostics of linear mixed-effect models of average domestic student population size

Australia				UK			
N	**Coefficient**	**St.error**	**p-value**	**N**	**Coefficient**	**St.error**	**p-value**
39	659.9	34.12	0.000	119	98.0	31.74	0.002

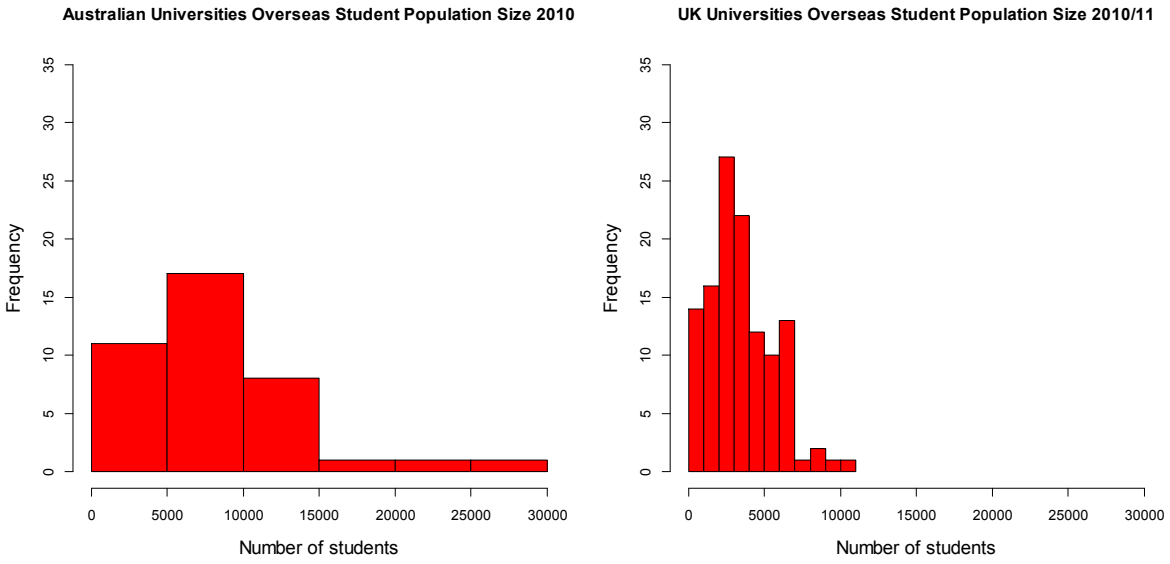
Table 6: Diagnostics of linear mixed-effect models of average overseas student population size

Australia				UK			
N	**Coefficient**	**St.error**	**p-value**	**N**	**Coefficient**	**St.error**	**p-value**
39	403.9	49.00	0.000	119	178.0	12.46	0.000

The domestic rate of growth in the Australian sector is 660 domestic students per year for the average-sized university. In comparison, the domestic rate of growth in the UK is 98 domestic students per year for the average-sized university.

The overseas rate of growth in the Australian sector is 404 overseas students per year for the average-sized university. In comparison, the overseas rate of growth in the UK sector is 178 overseas students per year for the average-sized university.

Figure 6: Distribution of overseas student population size



Clearly, the difference between the two overseas growth rates is not as large as the difference between the two domestic growth rates. However, the difference between the standard errors of the growth rates of the overseas populations in the two countries is considerably larger than the difference between the standard errors of the growth rates of the domestic populations (see Tables 5 and 6). The standard error difference for the domestic populations is 34.12 – 31.74 = 2.38 while the standard error difference for the overseas populations is 49.00 – 12.46 = 36.54. This finding constitutes strong evidence that the domestic populations in the universities of both sectors have similar sampling variability, but their overseas populations do not. The standard error of the Australian sector's overseas population rate of growth is four times larger than that of the UK sector. This may be related to outliers in the Australian sample.

Figure 6 shows the distributions of the overseas student population sizes of both sectors for the most recent year of available data. Clearly, the Australian sector is more skewed than the UK sector, containing overseas student population sizes that can be considered outliers.

Percentage Changes in the Size of the Domestic and Overseas Student Populations

Figure 7 shows boxplots of the distribution of percentage changes in the domestic student populations of both sectors. The Australian sector shows medians that are steadily increasing throughout the time periods. Therefore, it is evident that the drop of the median in the period 2009 to 2010, shown in Figure 3, is primarily due to the effect of the overseas population. This can be seen directly in Figure 8. In contrast, the UK sector shows consistency in the trends of the medians in both the domestic and overseas populations.

Both the UK and Australian sectors show decreases in the last time period of the overseas student populations, while also showing evidence of an overall increase in the average size of the overseas student population. Having said this, the growth rate of the Australian overseas student population is double that of the UK overseas student population. Further investigation showed that in the Australian sector, the average percentage change in the size of the overseas student population of universities above the median size was 6.17%. In comparison, the average percentage change in overseas student population size for universities below the median size was 3.63%. The last time period for the Australian sector (i.e. 2009–2010) is the only time period (and the Australian sector is the only university sector) where percentage changes are, on average, significantly higher for larger universities. Therefore, it follows that for the Australian sector the increase in the average size of the overseas student population from 2009 to 2010 is due to greater growth occurring in larger universities.

Figure 7: Distribution of percentage changes in the size of the domestic student populations

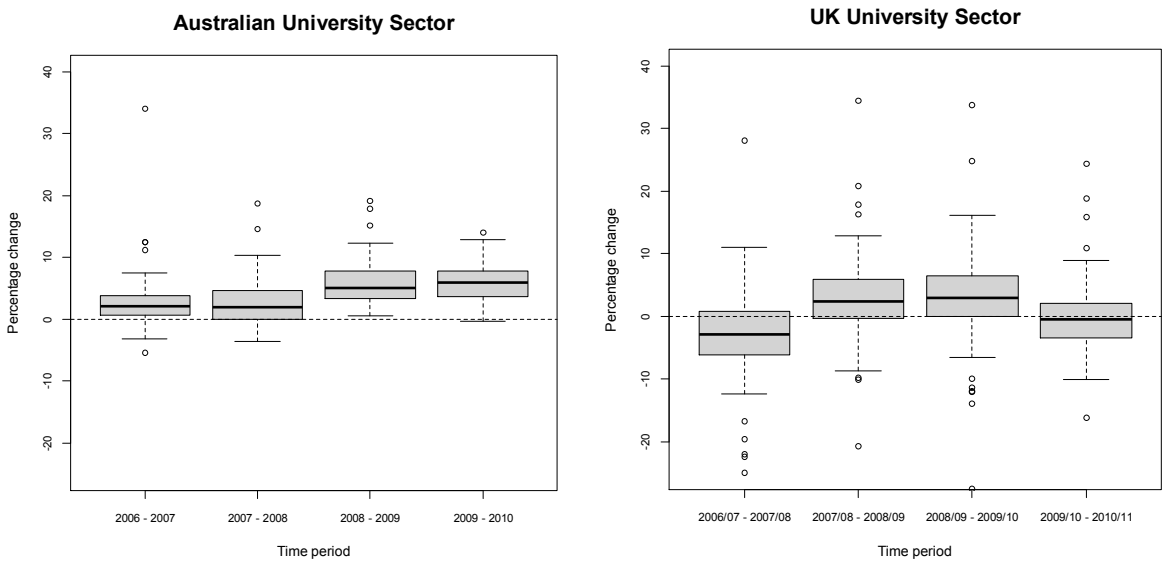


Table 7: Boxplot statistics of percentage changes in the size of domestic student populations

Time Period	Australia		UK	
	Median	IQR*	Median	IQR*
2006/07_2007/08	2.17	3.08	-2.86	6.95
2007/08_2008/09	1.89	4.69	2.44	6.22
2008/09_2009/10	5.04	4.48	2.93	6.50
2009/10_2010/11	5.91	4.03	-0.40	5.57

*IQR — interquartile range

Figure 8: Distribution of percentage changes in the size of overseas student populations

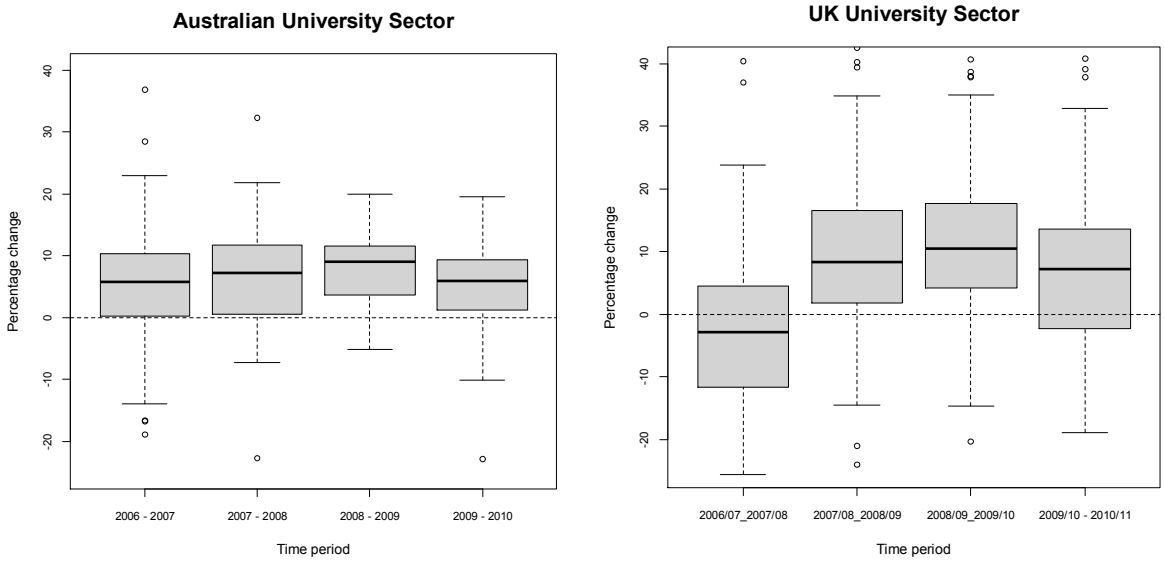


Table 8: Boxplot statistics of percentage changes in the size of overseas student populations

Time Period	Australia		UK	
	Median	IQR*	Median	IQR*
2006/07_2007/08	5.75	10.11	-2.92	16.20
2007/08_2008/09	7.20	11.15	8.29	14.62
2008/09_2009/10	8.99	7.93	10.43	13.46
2009/10_2010/11	5.86	8.10	7.24	15.85

*IQR — interquartile range

Another interesting finding is that the medians of the percentage changes in the size of the UK overseas student populations are mostly higher than those of the overseas student populations of the Australian sector (see Figure 8 and Table 8). Thus, the UK sector experiences higher percentage changes in overseas student population sizes, but with variability considerably larger than the variability shown by the Australian sector.

Conclusion

It is reasonable to say that the differences in student growth between the Australian and the UK sectors are primarily affected by two factors: the number of universities that each sector has proportional to their populations, and the institutional densities of both countries. Thus, the UK has 10% more universities than Australia and they are located closer to each other than the universities in Australia. This is an important consideration because the pool of local universities that is available to prospective students is greater for students in the UK than for students in Australia. This fact makes the UK university sector more competitive in the acquisition and retention of students. The effect of this competitiveness has manifested itself in the statistics and trends presented here.

The variability in percentage changes in the UK sector is higher than that in the Australian sector in every population and in every time period of the time series considered. Consistently the UK sector shows that changes in the size of student populations can be more severe (that is, variable) and more extreme (that is, showing values further away from the norm) than the changes observed in the Australian sector. This is true for both the domestic and overseas populations and reflects the nature of a dynamic sector. Furthermore, the median percentage changes of the domestic and overseas populations have similar trends. These findings suggest that factors affecting the student growth of the UK sector influence the sector more evenly than the factors affecting the growth of the Australian sector. The findings are indicative of a competitive market and a level playing field in the UK sector.

However, the signs of a level playing field cannot be observed as distinctly in the Australian sector precisely because of the effects of there being fewer universities and lower institutional density. The effects of these factors are more apparent in the growth of the overseas populations. The fewer number of universities in the Australian sector would allow for a greater influx of overseas students into the universities, yet this influx appears uneven across the sector. The statistical evidence suggests that some universities hold significantly larger numbers of overseas students, and hence they represent outliers in the sample of overseas populations. Furthermore, evidence showed that the increase in the average size of overseas populations from 2009 to 2010 is due to greater growth occurring in universities that are of above median size. A possible explanation for this may be the fact that a significant number of Australian universities are in regional areas. These universities may not be able to capitalize on the influx of overseas students as effectively as larger universities located in metropolitan areas.

The Australian sector has achieved remarkable growth in the domestic student population. Only very few universities have not been able achieve growth in every time period of the time series considered. We can see this in Figure 7. Understanding the factors associated with such rapid growth and its effect on the retention and progression of students is subject to further investigation, particularly in terms of the criteria for students' entry into universities. Such rapid growth in the Australian sector may also reflect successful domestic student acquisition strategies that may interest UK universities.

Further exploration related to comparative analysis of the retention rates of the two sectors would be an interesting path to take given the statistical evidence now at hand. The evidence suggests that the UK sector is much more competitive than the Australian sector in the acquisition and retention of students. Thus, it is reasonable to say that retention strategies may also differ significantly between the sectors, and these differences may be reflected in the retention rate of the sectors. Exploring these retention rates may produce evidence to support the notion of benchmarking activities between the Australian and UK university sectors.

Reference

Pinheiro, J C and Bates, D M (2000). *Mixed Effects Models in S and S-PLUS*, Springer, New York.

Sources

1) Data for the analysis has been obtained from the following sources and reproduced with their permission:

For Australia, copyright Commonwealth of Australia, data from the Department of Innovation, Industry, Science, Research and Tertiary Education (DIISRTE),

http://www.innovation.gov.au

For the UK, data from the Higher Education Statistics Agency Limited (HESA),

http://www.hesa.ac.uk

HESA cannot accept responsibility for any conclusions or inferences derived from the data by third parties.

2) Information related to population estimates was obtained from

The Australian Bureau of Statistics (http://www.abs.gov.au).

The Office of National Statistics (http://www.ons.gov.uk).

3) Information related to surface area was obtained from

Geoscience Australia (http://www.ga.gov.au).

For the UK we visited common channels of information that provide countries' facts and figures, none of which were directly related to a UK government entity. However, most of these sources agree on the results presented here. These include Wikipedia and the Central Intelligence Agency (CIA) World Factbook.

Computing

Models, model diagnostics and graphs have been produced using the open source statistical console R http://www.r-project.org.

Appendix: List of Universities

United Kingdom	Australia
Aberystwyth University	Australian Catholic University
Anglia Ruskin University	Bond University
Aston University	Central Queensland University
Bangor University	Charles Darwin University
Bath Spa University	Charles Sturt University
Birkbeck College	Curtin University of Technology
Birmingham City University	Deakin University
Bournemouth University	Edith Cowan University
Brunel University	Griffith University
Buckinghamshire New University	James Cook University
Canterbury Christ Church University	La Trobe University
Cardiff Metropolitan University	Macquarie University
Cardiff University	Monash University
Coventry University	Murdoch University
De Montfort University	Queensland University of Technology
Edge Hill University	RMIT University
Edinburgh Napier University	Southern Cross University
Glasgow Caledonian University	Swinburne University of Technology
Glyndŵr University	The Australian National University
Goldsmiths College	The Flinders University of South Australia
Heriot-Watt University	The University of Adelaide
Imperial College of Science, Technology and Medicine	The University of Melbourne
King's College London	The University of New England
Kingston University	The University of New South Wales
Leeds Metropolitan University	The University of Newcastle
Liverpool John Moores University	The University of Notre Dame Australia
London Metropolitan University	The University of Queensland
London School of Economics and Political Science	The University of Sydney
London South Bank University	The University of Western Australia
Loughborough University	University of Ballarat
Middlesex University	University of Canberra
Oxford Brookes University	University of South Australia
Queen Margaret University, Edinburgh	University of Southern Queensland
Queen Mary and Westfield College	University of Tasmania
Roehampton University	University of Technology, Sydney
Royal Holloway and Bedford New College	University of the Sunshine Coast
Sheffield Hallam University	University of Western Sydney
Southampton Solent University	University of Wollongong
Staffordshire University	Victoria University
Swansea Metropolitan University	
Swansea University	

Teesside University	
The City University	
The Manchester Metropolitan University	
The Nottingham Trent University	
The Queen's University of Belfast	
The Robert Gordon University	
The School of Oriental and African Studies	
The University of Aberdeen	
The University of Bath	
The University of Birmingham	
The University of Bolton	
The University of Bradford	
The University of Brighton	
The University of Bristol	
The University of Buckingham	
The University of Cambridge	
The University of Central Lancashire	
The University of Chichester	
The University of Dundee	
The University of East Anglia	
The University of East London	
The University of Edinburgh	
The University of Essex	
The University of Exeter	
The University of Glasgow	
The University of Greenwich	
The University of Huddersfield	
The University of Hull	
The University of Keele	
The University of Kent	
The University of Lancaster	
The University of Leeds	
The University of Leicester	
The University of Lincoln	
The University of Liverpool	
The University of Manchester	
The University of Newcastle-upon-Tyne	
The University of Northampton	
The University of Northumbria at Newcastle	
The University of Nottingham	
The University of Oxford	
The University of Plymouth	
The University of Portsmouth	
The University of Reading	

The University of Salford	
The University of Sheffield	
The University of Southampton	
The University of St Andrews	
The University of Stirling	
The University of Strathclyde	
The University of Sunderland	
The University of Surrey	
The University of Sussex	
The University of the West of Scotland	
The University of Wales, Newport	
The University of Warwick	
The University of West London	
The University of Westminster	
The University of Winchester	
The University of Wolverhampton	
The University of Worcester	
The University of York	
University College London	
University for the Creative Arts	
University of Abertay Dundee	
University of Bedfordshire	
University of Chester	
University of Cumbria	
University of Derby	
University of Durham	
University of Glamorgan	
University of Gloucestershire	
University of Hertfordshire	
University of the Arts, London	
University of the West of England, Bristol	
University of Ulster	
University of Wales Trinity Saint David	
York St John University	