

AMSI
SURVEY
2014
Final results

Undergraduate

Postgraduate

Research

INTRODUCTION

In August 2014, departments of mathematics and statistics at Australian universities were sent a questionnaire about their staffing situation, teaching, research and student numbers in 2014. This was the third survey of its kind, with the aim to gather longitudinal data on research and higher education in the mathematical sciences. The annual survey complements other data gathering efforts and attempts to fill gaps in our knowledge of the state of mathematical sciences (which includes mathematics and statistics) in Australia.

In its initial year, the survey was sent to AMSI's member universities only, however in the past few years non-member universities have also been invited to participate. In the first survey, held in 2012, 27 departments from 25 AMSI member universities participated. In the 2013 survey, the number of participants increased to 33 departments from 32 universities. In 2014, the participation dropped to 25 departments from 24 universities. Despite the drop in participation, this still represents over 60% of Australian universities.

As the 2012 survey collected data from 2 years (2011 and 2012), a picture is now starting to emerge for the period 2011 to 2014. Even though the data are not complete for all mathematical sciences departments in the country, we are starting to gain a more comprehensive view of the state of mathematics and statistics in universities in Australia, even though it is still too early to draw firm conclusions on trends. AMSI aims to keep building on its data collection in order to gain a longitudinal view of trends and developments.

In order to allow a more comprehensive view on student numbers, this document also contains up-to-date Commonwealth data on completions of mathematical sciences degrees in Appendix 1.

The survey responses presented in this document are grouped – as much as possible - by existing university alignments: Group of Eight (Go8), Australian Technology Network (ATN), Regional Universities Network (RUN), Innovative Research Universities (IRU) and 'unaligned' universities.

A list of participating universities is contained at the back of this document in Appendix 2. AMSI wishes to thank all participants for their generous cooperation.



Geoff Prince

AMSI Director

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Please note that rounding may have produced totals greater than 100%

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SUMMARY OF FINDINGS

The 2014 survey responses build on the data collected in the previous years and mostly confirm the possible trends and developments identified in previous years:

- The number of academic staff in the mathematical and statistical sciences at universities is possibly on the rise again after being hard hit in the last two decades, but the picture is uneven. The average number of staff per department has not changed over the past 4 years (the dip in 2013 was caused by a much larger participation of “small” departments with few staff members). However, the total number of staff in the 18 departments for which we have data from 2011 to 2014 has risen by nearly 80 FTE combined. If we compare staff numbers in 2014 in these departments with 2011, 13 departments have more staff than in 2011, and 5 departments have fewer staff. The increase seems to be in “Research only” and to a lesser extent “Teaching only” staff – “Teaching and Research” staff have remained stable.
- The academic workforce remains predominantly male, and the proportion of females reduces with the level of seniority. In 2014, about 32% of reported casuals were female which decreased to 29% at level A, 31% at level B, and 25% at level C. This drops significantly to 19% at level D and 9% at level E. It is important to remember that these data only provide a snapshot; longitudinal data collection is required to adequately assess developments of the female proportion of mathematical staff as careers progress. Nevertheless, if we compare female staff proportions with 2012, we see a slight increase of the proportion of female staff in nearly every seniority level, which is encouraging.
- If the proportion of level E staff in a department is higher than the proportion of staff at level D or even C then the profile is top-heavy. It is perhaps a function of the lower participation rate in the 2014 survey that the staffing profile is less top-heavy than in last year’s survey. Go8 university level E staff are still more numerous than level D, but overall the proportion of level D and E staff is the same, and is outnumbered by level B and C.
- Casual staff perform the majority of tutorial teaching (66%). The proportion of lecture teaching by casuals increased slightly – 12% against 9% in 2012 and in 2013.
- The most prevalent major offered was in Applied Mathematics, which was offered by 71% of all surveyed universities. Second most prevalent is a combined major stream in Mathematics and Statistics (46%), followed by a major in Statistics (42%). Of the 25 departments providing data for this survey, 2 departments – small departments in non-AMSI member universities - reported not offering a major at all in the mathematical and statistical sciences.
- Engineering and Computer Science remain the top areas of service teaching, but third place has been alternating between Biological Sciences and Physical Sciences over the past few years – with both Biological and Physical Sciences now sharing third place in terms of importance, with Environmental Sciences in 4th place.
- For some departments reliable data on undergraduate student numbers are hard to obtain, and in general these data can be quite volatile from year to year. With this in mind, it seems that average enrolment data overall have been quite constant, however with a widening gap between Go8 and other universities in 2014 in 1st and 3rd year numbers. There certainly appears to have been no decline in numbers of undergraduate students overall, but this is one area where yearly data collection is vital to better understanding of what is happening over the longer term.
- In general departments have easy access to accurate figures for higher degree enrolments, however the lower participation rate in 2014 means that the data are less reliable, in particular Masters by Coursework data- the supposed drop in average numbers is most likely not a real drop. The overall average enrolment in higher degrees has remained fairly constant over the 4 year period.

- Among undergraduate students, the proportion of male domestic students has remained very constant over the past 4 years, remaining around 55-57%. About 30-34% overall was female. However, since quite a few departments were not able to obtain gender and domestic/international break downs for their undergraduate population, caution is warranted.
- The profile breakdowns for higher degree student populations have been much easier to obtain. With regard to the Honours student population, overall the proportional breakdown has been quite constant, however the proportion of female Honours students has declined considerably at Go8 universities in favour of male (domestic) students, while at other universities things seem to be going in the other direction. Similarly, the PhD enrolment breakdown seems constant when looking at all universities taken together, but at Go8 universities the male proportion has been on the rise, while at other universities the female proportion has been going up. It is also worth noting that a very significant portion of female PhD students are coming from overseas and the domestic enrolment of PhD students has been stagnant. This confirms anecdotal reports.
- The higher degree completion numbers by field of study in 2013 highlight differences in emphasis on Pure Mathematics, Applied Mathematics and Statistics in the different types of degrees. Masters by Research degrees focus solely on Pure and Applied Mathematics. A very significant proportion of Masters by Coursework degrees are in Statistics.
- The research data again show that research funding and activity is very much skewed towards Group of Eight universities; they are by far the most successful at securing ARC funding, the most significant recipients of Commonwealth research funding in general, and as a consequence the most important employers of ARC funded research staff – mostly at levels A and B.
- In the period 2012-2014 the number of students identifying as Aboriginal and/or Torres Strait islander has fluctuated wildly. It is

not clear whether this is due to reporting by the students or by the departments participating in the survey, or both. More interesting is the increase of staff in mathematics and statistics departments identifying as Aboriginal and/or Torres Strait islander, from 1 in 2012 to 4 in 2014. The individual replies by universities on their gender, socio-economic and indigenous policies have been supplied on an identifiable basis, as this information is normally publicly available and supplied for the benefit of the AMSI community.

ACADEMIC STAFF NUMBERS

Average number of staff per department in the mathematical and statistical sciences 2011-2014

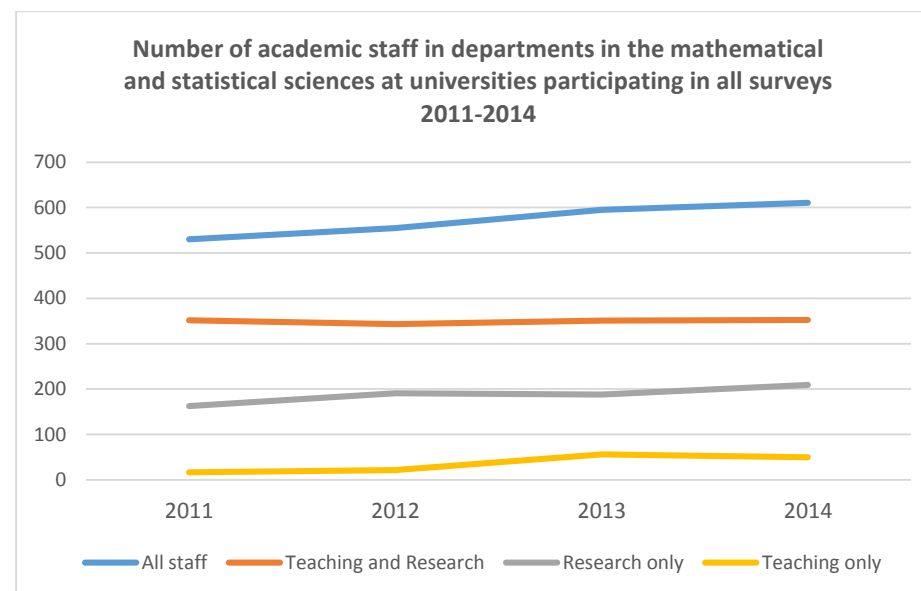
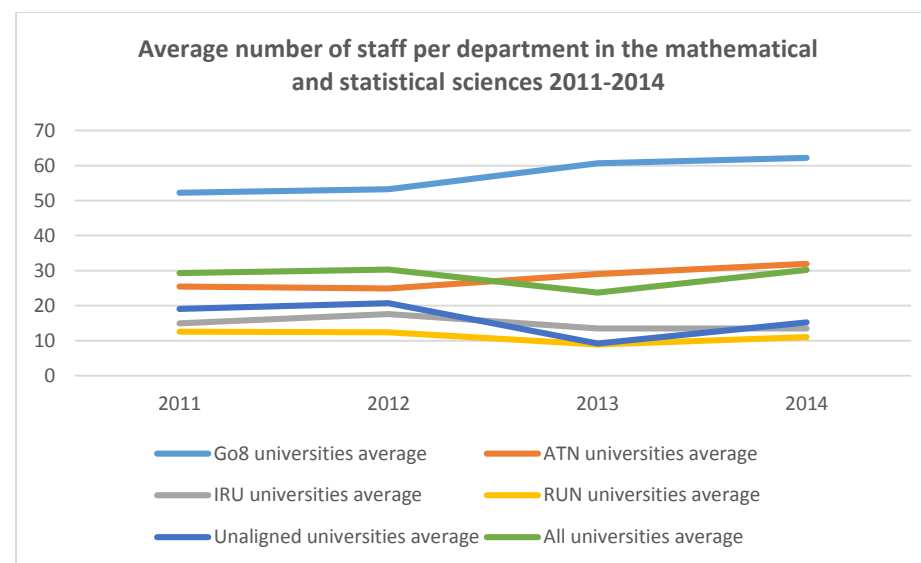
	2011	2012	2013	2014
Go8 universities average	52	53	61	62
ATN universities average	25	25	29	32
IRU universities average	15	18	13	13
RUN universities average	13	12	9	11
Unaligned universities average	19	21	9	15
All universities average	29	30	24	30

The lower average in 2013 is caused by the higher response rate among small universities.

Number of academic staff in departments in the mathematical and statistical sciences at universities participating in all surveys 2011-2014

	2011	2012	2013	2014
Teaching only	16	21	56	49
Research only	162	191	188	209
Teaching and Research	351	343	351	352
All staff	530	555	595	610

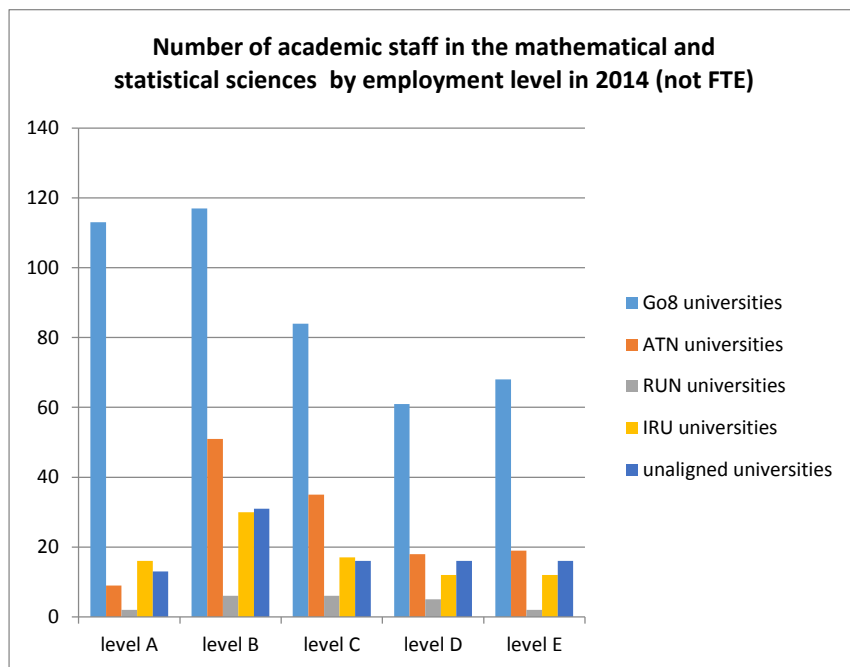
In the period 2011-2014, 18 universities have supplied staffing data for all years. Of these universities, 13 employed more staff in 2014 than in 2011, and 5 employed fewer staff than in 2011.



STAFF PROFILE IN 2014

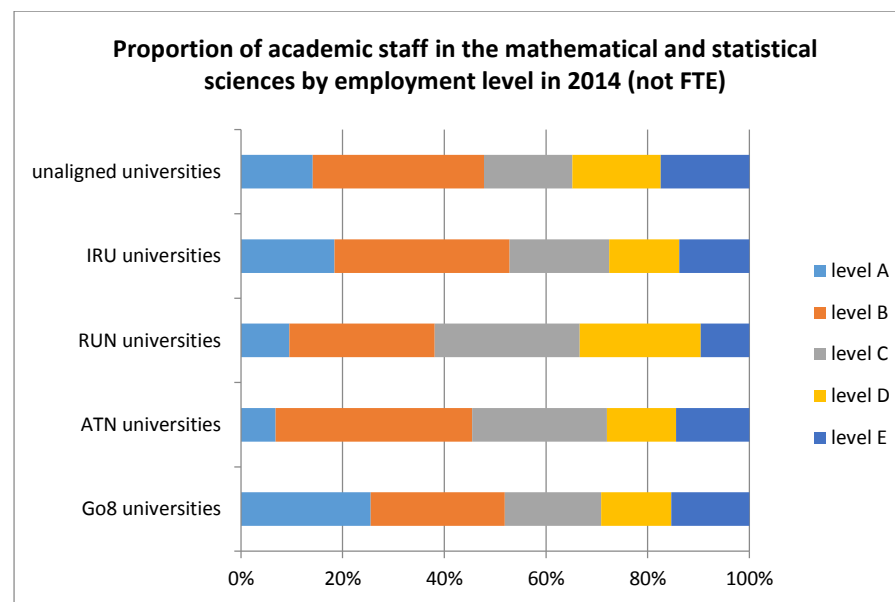
Number of academic staff in the mathematical and statistical sciences by employment level in 2014 (not FTE)

	level A	level B	level C	level D	level E
Go8 universities	113	117	84	61	68
ATN universities	9	51	35	18	19
RUN universities	2	6	6	5	2
IRU universities	16	30	17	12	12
unaligned universities	13	31	16	16	16



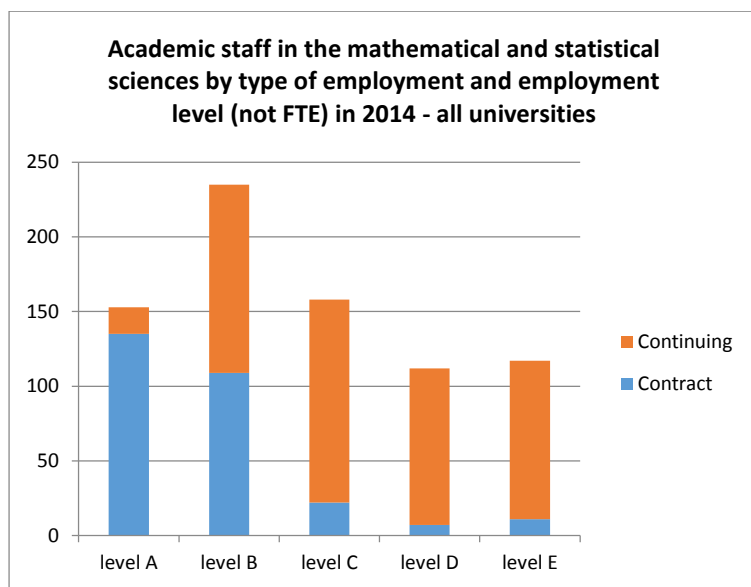
Proportion of academic staff in the mathematical and statistical sciences by employment level in 2014 (not FTE)

	level A	level B	level C	level D	level E
Go8 universities	26%	26%	19%	14%	15%
ATN universities	7%	39%	27%	14%	14%
RUN universities	10%	29%	29%	24%	10%
IRU universities	18%	34%	20%	14%	14%
unaligned universities	14%	34%	17%	17%	17%



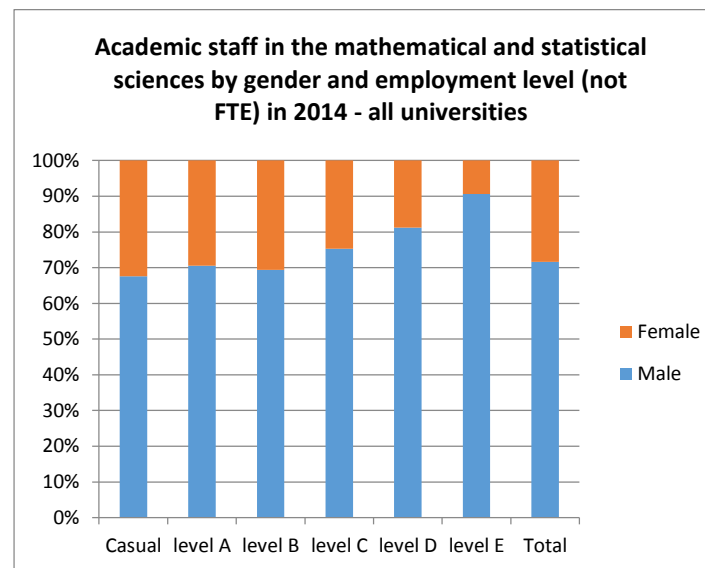
Academic staff in the mathematical and statistical sciences by type of employment and employment level (not FTE) in 2014 - all universities

	Contract	Continuing	Total
level A	135	18	153
level B	109	126	235
level C	22	136	158
level D	7	105	112
level E	11	106	117



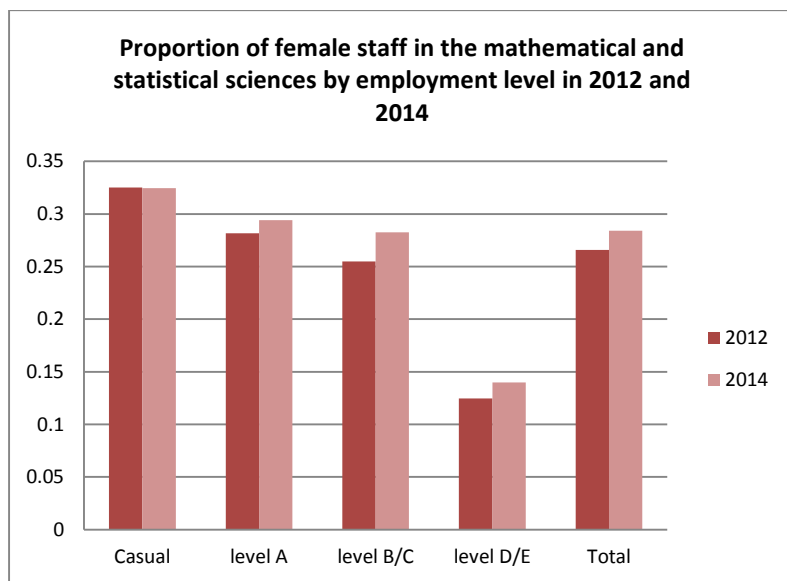
Academic staff in the mathematical and statistical sciences by gender and employment level (not FTE) in 2014 - all universities

	Male	Female	Female %
Casual	539	259	32%
level A	108	45	29%
level B	163	72	31%
level C	119	39	25%
level D	91	21	19%
level E	106	11	9%
Total	1126	447	28%



Proportion of female staff in the mathematical and statistical sciences by employment level - 2012 and 2014 compared

	2012	2014
Casual	33%	32%
level A	28%	29%
level B/C	25%	28%
level D/E	12%	14%
Total	27%	28%



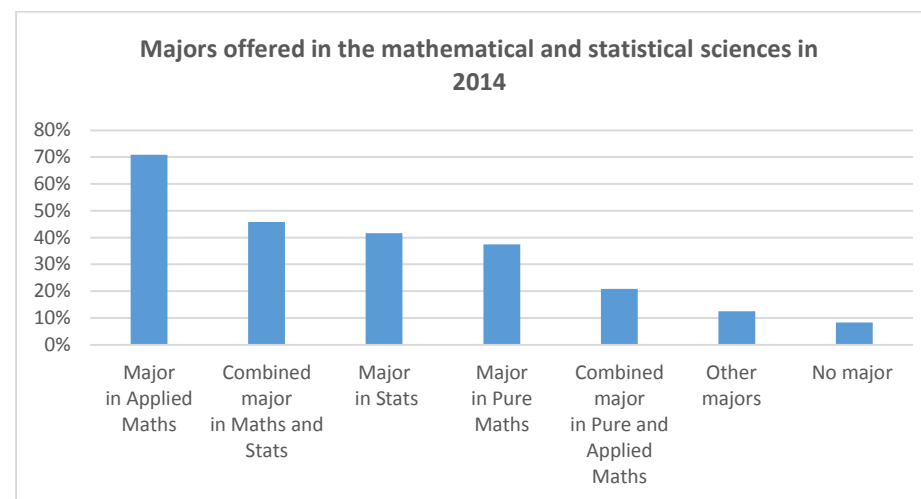
TEACHING IN 2014

Majors offered in the mathematical and statistical sciences in 2014

% of university departments offering:

Major in Applied Maths	71%
Combined major in Maths and Stats	46%
Major in Stats	42%
Major in Pure Maths	38%
Combined major in Pure and Applied Maths	21%
Other majors	13%
No major	8%

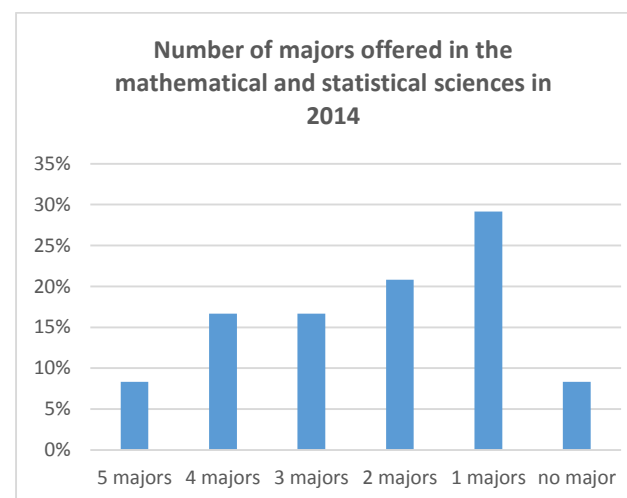
Other majors reported: Decision Science, Quantitative Risk, Oceanography, Statistics and Operations Research



Number of majors offered in the mathematical and statistical sciences in 2014

% of universities offering:

5 majors	8%
4 majors	17%
3 majors	17%
2 majors	21%
1 majors	29%
no major	8%



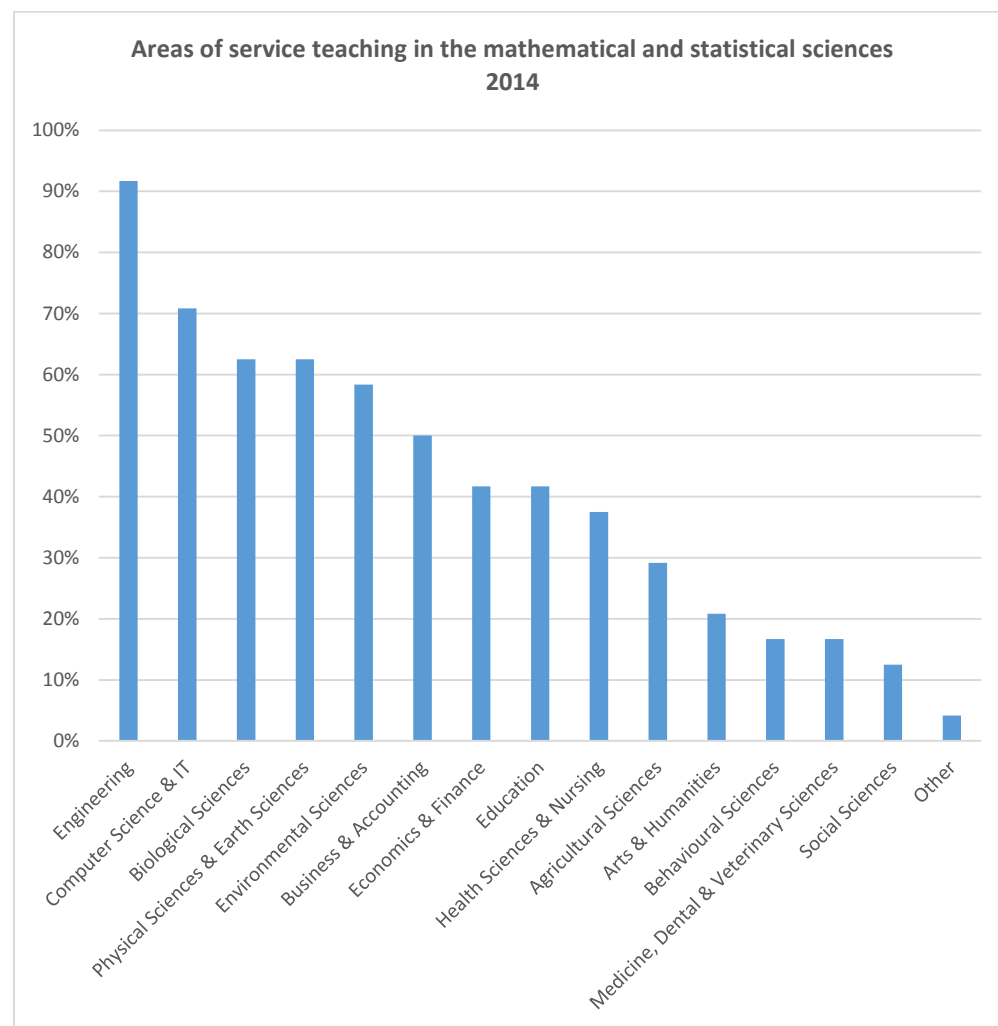
Proportion of departments of mathematical and statistical sciences offering service subjects in the areas below in 2014

Engineering	92%
Computer Science & IT	71%
Biological Sciences	63%
Physical Sciences & Earth Sciences	63%
Environmental Sciences	58%
Business & Accounting	50%
Economics & Finance	42%
Education	42%
Health Sciences & Nursing	38%
Agricultural Sciences	29%
Arts & Humanities	21%
Behavioural Sciences	17%
Medicine, Dental & Veterinary Sciences	17%
Social Sciences	13%
Other	4%

Teaching by academic and casual staff in the mathematical and statistical sciences in 2014

	tutorial hours all staff	tutorial hours casual staff	% of total taught by casuals
Average all universities	117	78	66%

	lecture hours all staff	lecture hours casual staff	% of total taught by casuals
Average all universities	68	8	12%



STUDENT ENROLMENTS IN 2014

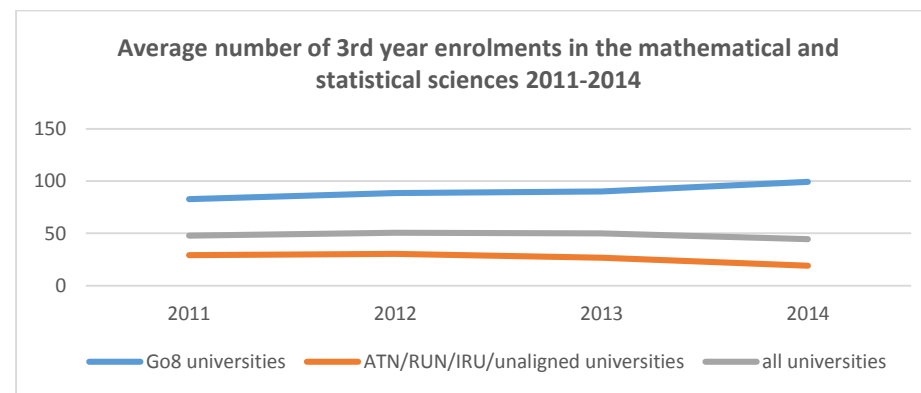
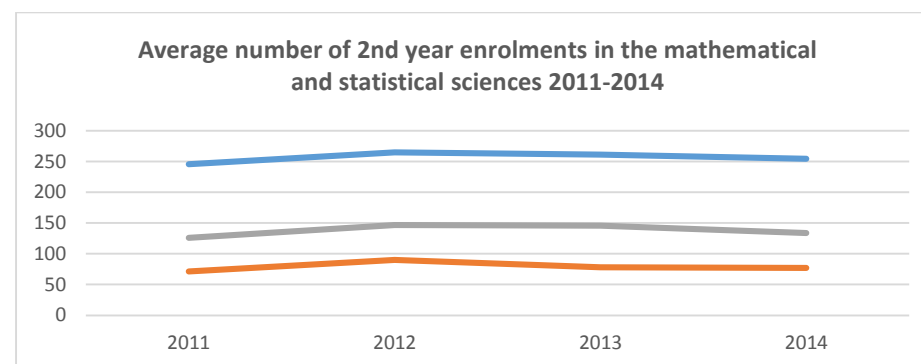
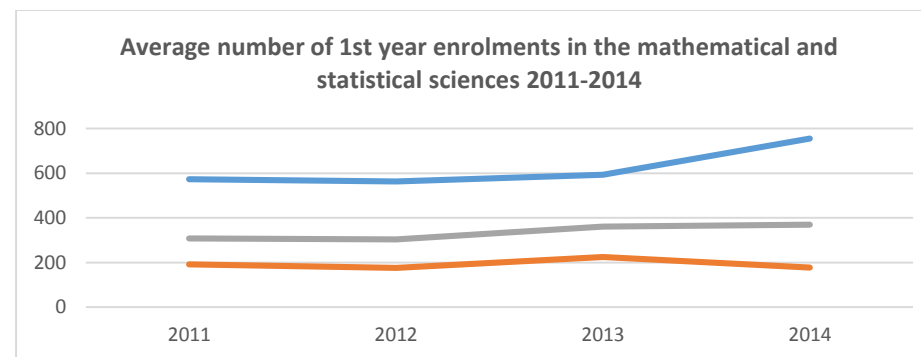
UNDERGRADUATE ENROLMENTS

Reported undergraduate enrolments in the mathematical and statistical sciences in 2014 (in EFTSL)

	1st year	2nd year	3rd year
Total Go8 universities	5280	1781	695
Total ATN/RUN/IRU/unaligned universities	2489	1155	287
Total all universities	7769	2936	981

Average number of undergraduate enrolments in the mathematical and statistical sciences per university 2011-2014 (in EFTSL)

	2011	2012	2013	2014
1st year				
Go8 universities	573	562	594	754
ATN/RUN/IRU/unaligned universities	192	176	225	178
all universities	308	303	361	370
2nd year				
Go8 universities	246	265	261	254
ATN/RUN/IRU/unaligned universities	71	90	78	77
all universities	126	147	146	133
3rd year				
Go8 universities	83	89	90	99
ATN/RUN/IRU/unaligned universities	29	31	27	19
all universities	48	51	50	45



HONOURS AND HIGHER DEGREE ENROLMENTS

Reported Honours and Higher Degree enrolments in the mathematical and statistical sciences in 2014 (in EFTSL)

	Honours	Masters by Coursework	Masters by Research	PhD
Total Go8 universities	91.3	142	42	314
Total ATN universities	6.42	11.15	4.6	52.7
Total RUN universities	2.5	11	0	4
Total IRU universities	17.5	10.5	2.7	54.4
Total unaligned universities	11	13.62	2.5	47.75
Total all universities	128.72	188.27	51.8	472.85

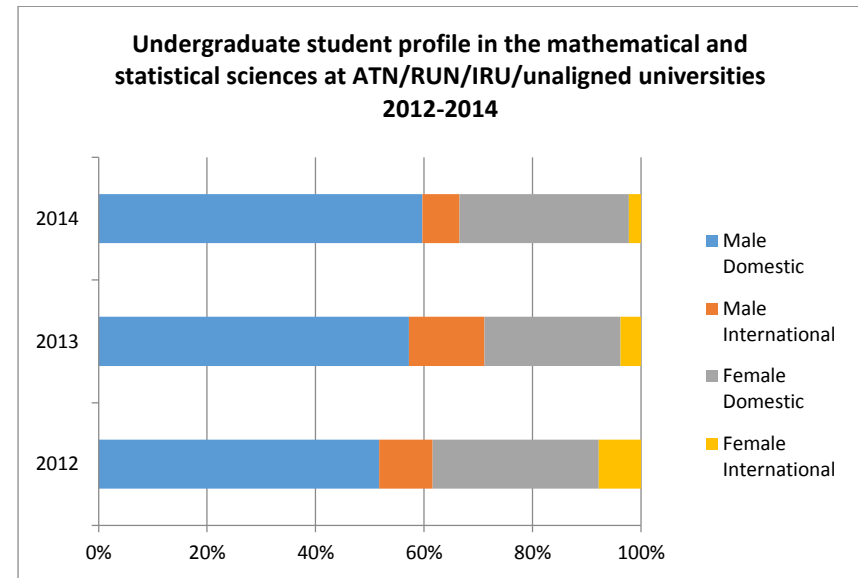
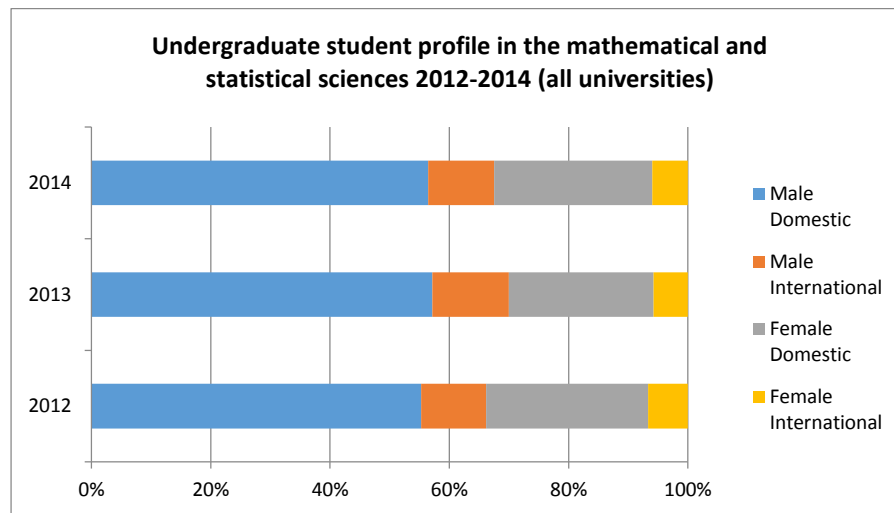
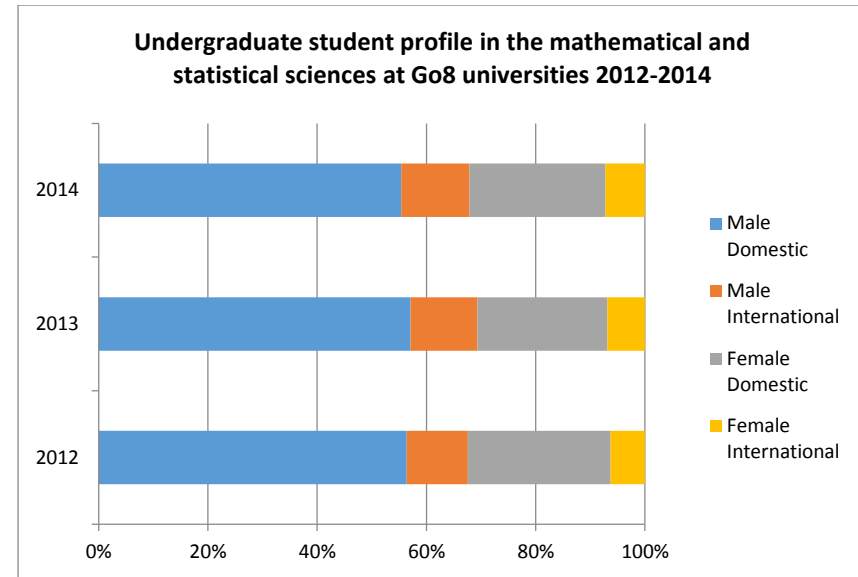
Average Honours and Higher Degree enrolments in the mathematical and statistical sciences per university 2011-2014

	2011	2012	2013	2014
Honours				
Average Go8 universities	15	14	13	15
Average ATN universities	5	5	5	3
Average RUN universities	<1	<1	5	1
Average IRU universities	5	6	3	3
Average unaligned universities	2	3	3	2
Average all universities	7	7	6	6
Masters by Coursework				
Average Go8 universities	20	19	16	20
Average ATN universities	25	32	53	6
Average RUN universities	1	<1	2	4
Average IRU universities	2	3	1	2
Average unaligned universities	7	6	4	2
Average all universities	12	13	14	8
Masters by Research				
Average Go8 universities	5	4	4	6
Average ATN universities	2	2	2	2
Average RUN universities	0	<1	0	0
Average IRU universities	2	2	1	<1
Average unaligned universities	1	1	1	0
Average all universities	2	2	2	2
PhD				
Average Go8 universities	36	38	37	45
Average ATN universities	26	29	24	26
Average RUN universities	9	7	6	1
Average IRU universities	7	11	10	9
Average unaligned universities	15	14	9	8
Average all universities	21	23	18	21

STUDENT PROFILES IN 2014

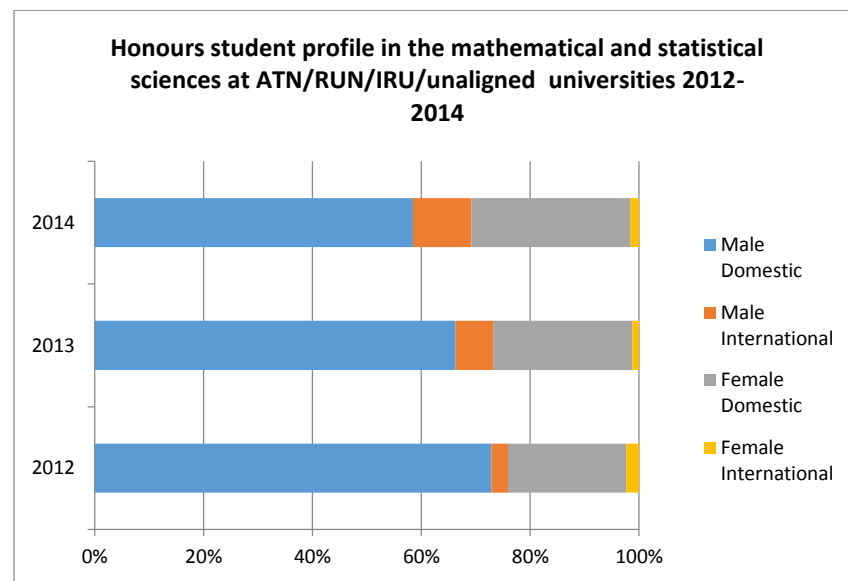
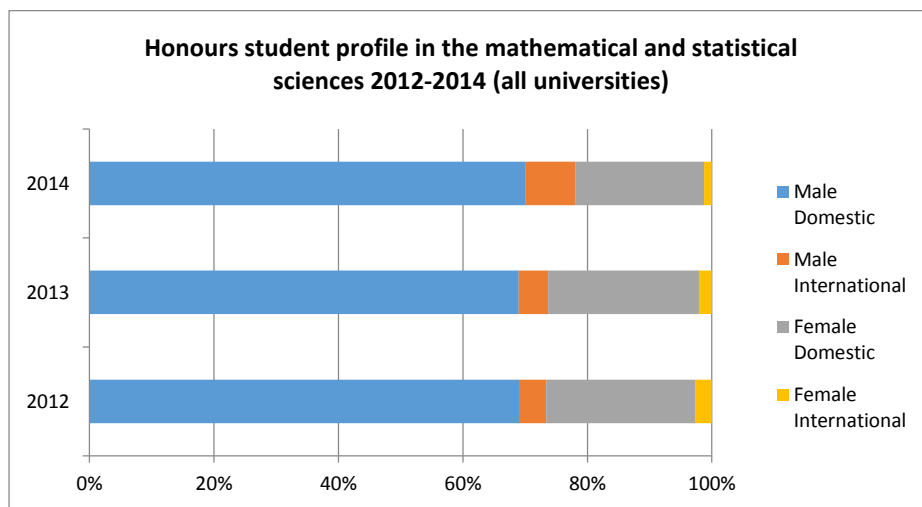
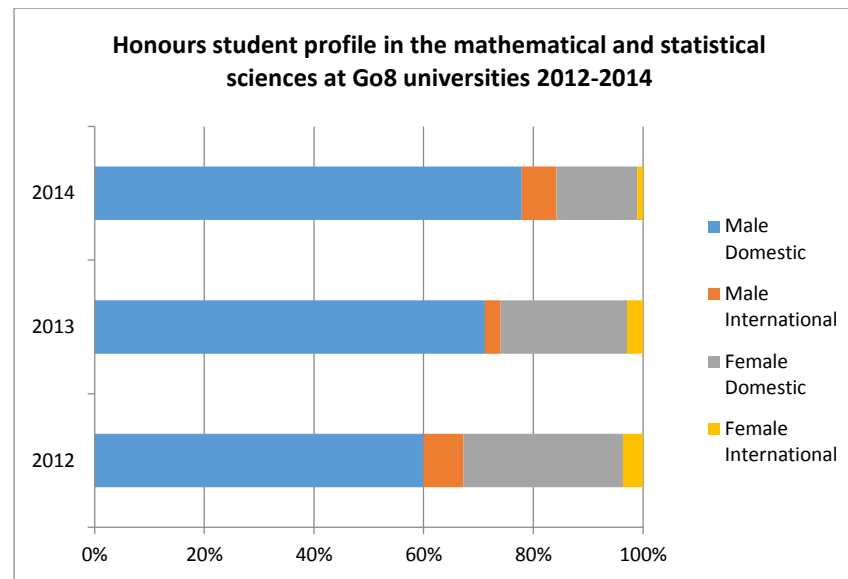
Undergraduate student profile in the mathematical and statistical sciences by gender and domestic/international status 2011-2014

		Male Domestic	Male International	Female Domestic	Female International
Go8 universities	2012	56%	11%	26%	6%
	2013	57%	12%	24%	7%
	2014	55%	12%	25%	7%
ATN/RUN/IRU/unaligned universities	2012	52%	10%	31%	8%
	2013	57%	14%	25%	4%
	2014	60%	7%	31%	2%
All universities	2012	55%	11%	27%	7%
	2013	57%	13%	24%	6%
	2014	56%	11%	26%	6%



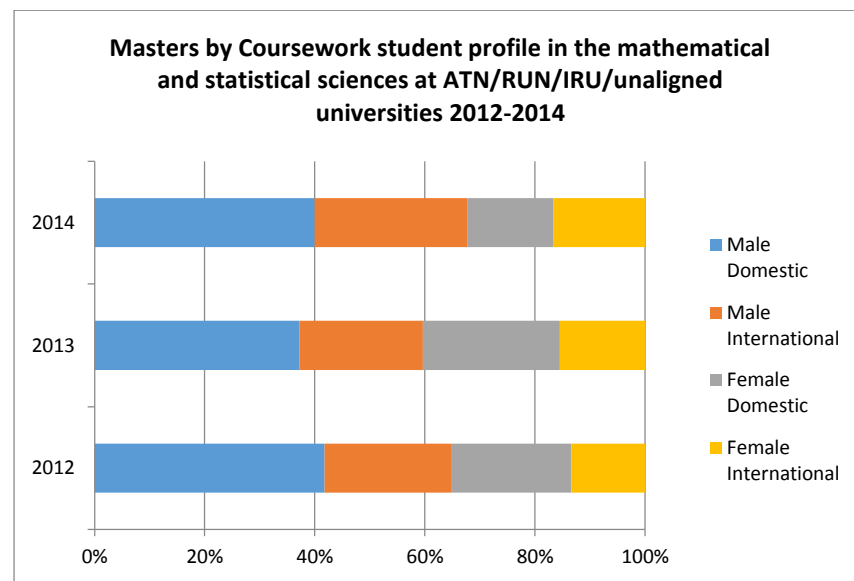
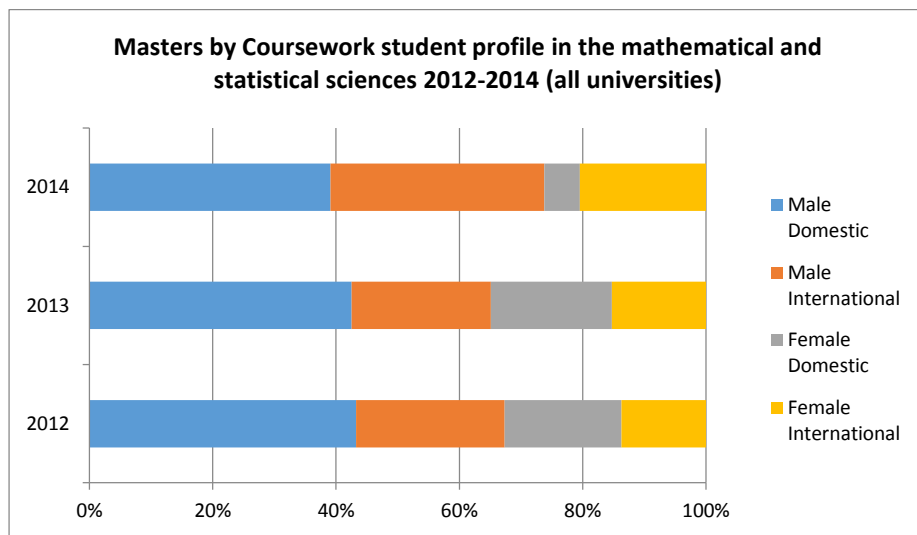
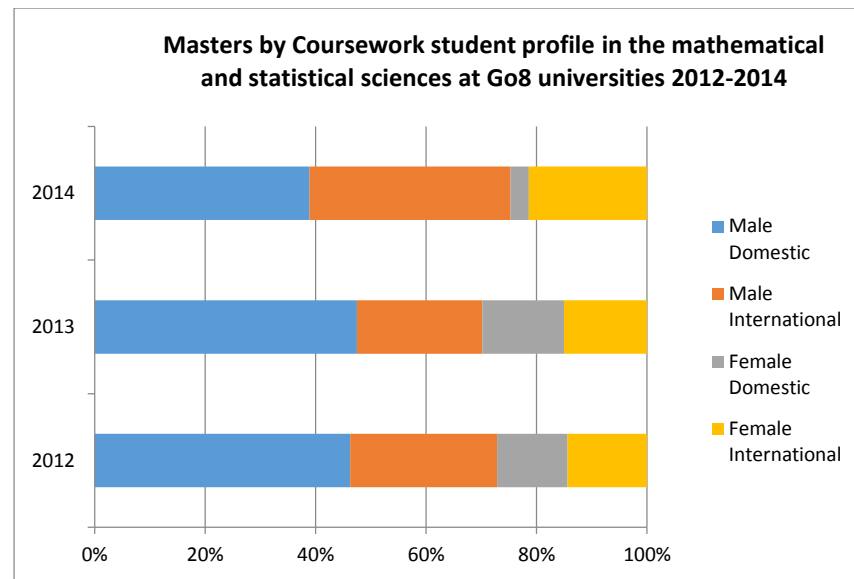
Honours student profile in the mathematical and statistical sciences by gender and domestic/international status 2011-2014

		Male Domestic	Male International	Female Domestic	Female International
Go8 universities	2012	60%	7%	29%	4%
	2013	71%	3%	23%	3%
	2014	78%	6%	15%	1%
ATN/RUN/IRU/unaligned universities	2012	73%	3%	22%	2%
	2013	66%	7%	26%	1%
	2014	58%	11%	29%	2%
All universities	2012	69%	4%	24%	3%
	2013	69%	5%	24%	2%
	2014	70%	8%	21%	1%

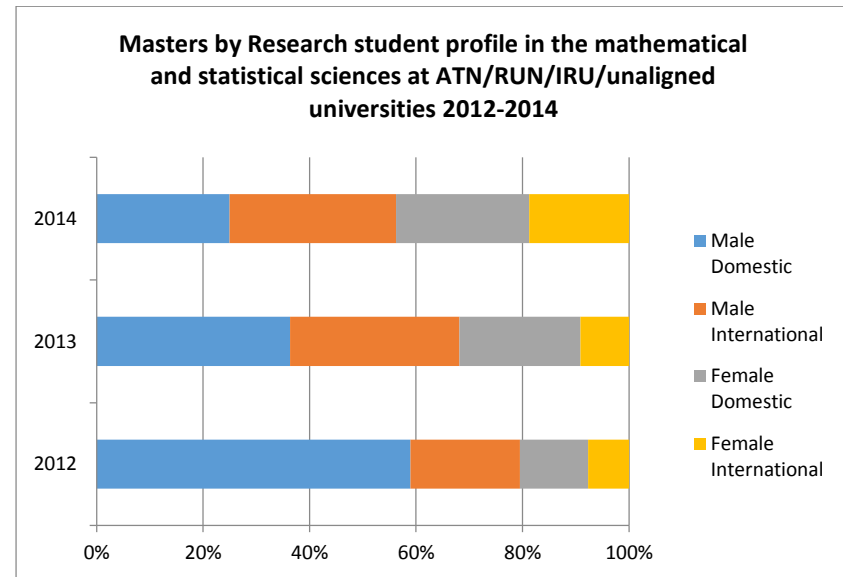
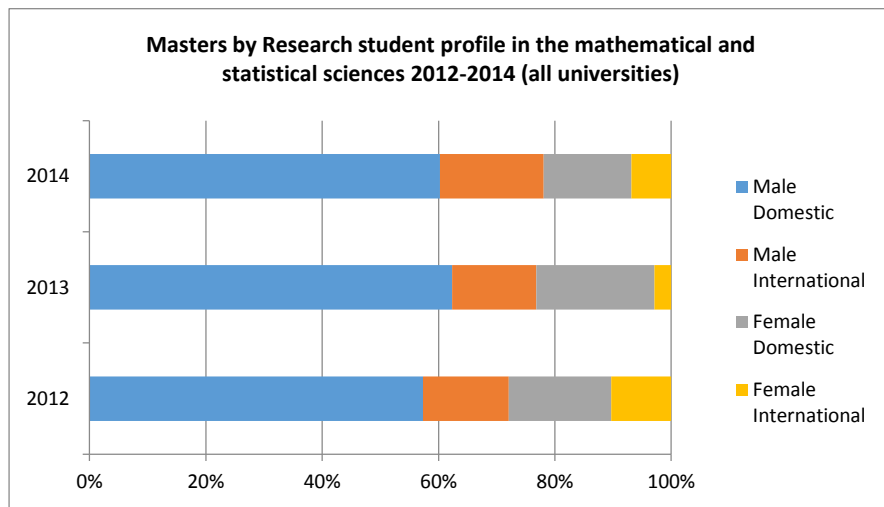
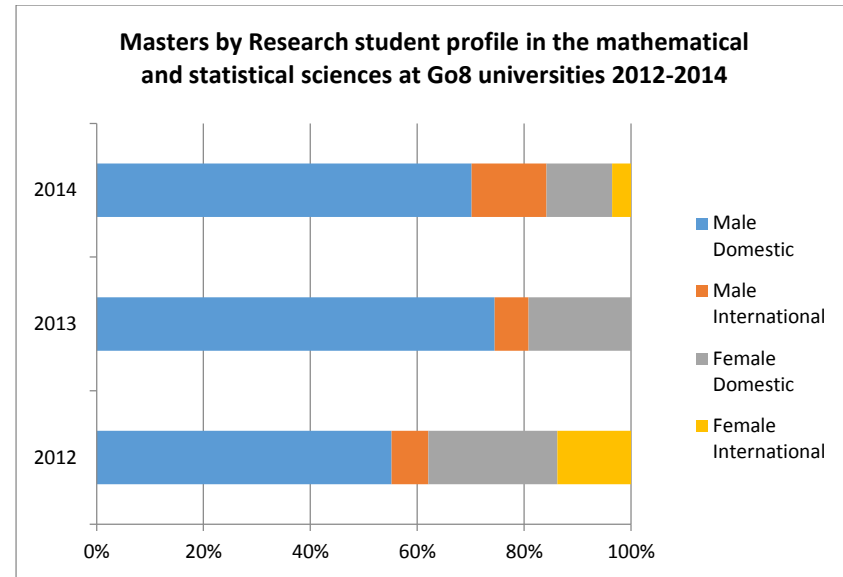


Masters by Coursework student profile in the mathematical and statistical sciences by gender and domestic/international status 2011-2014

		Male Domestic	Male International	Female Domestic	Female International
Go8 universities	2012	46%	27%	13%	14%
	2013	47%	23%	15%	15%
	2014	39%	36%	3%	21%
ATN/RUN/IRU/unaligned universities	2012	42%	23%	22%	13%
	2013	37%	22%	25%	15%
	2014	40%	28%	16%	17%
All universities	2012	43%	24%	19%	14%
	2013	43%	23%	20%	15%
	2014	39%	35%	6%	20%

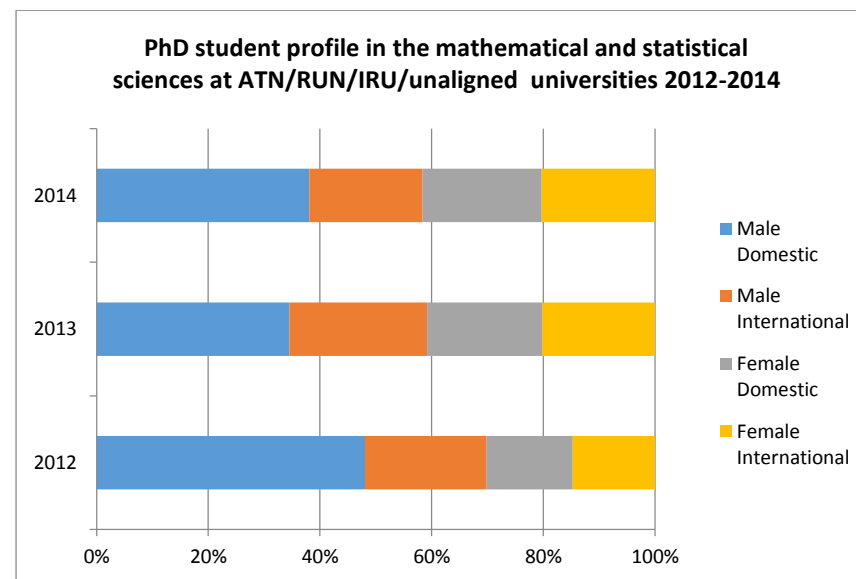
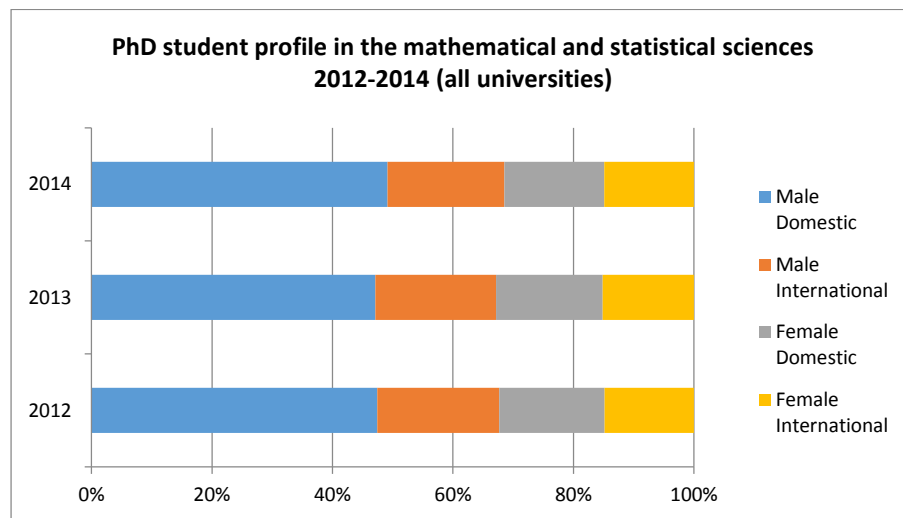
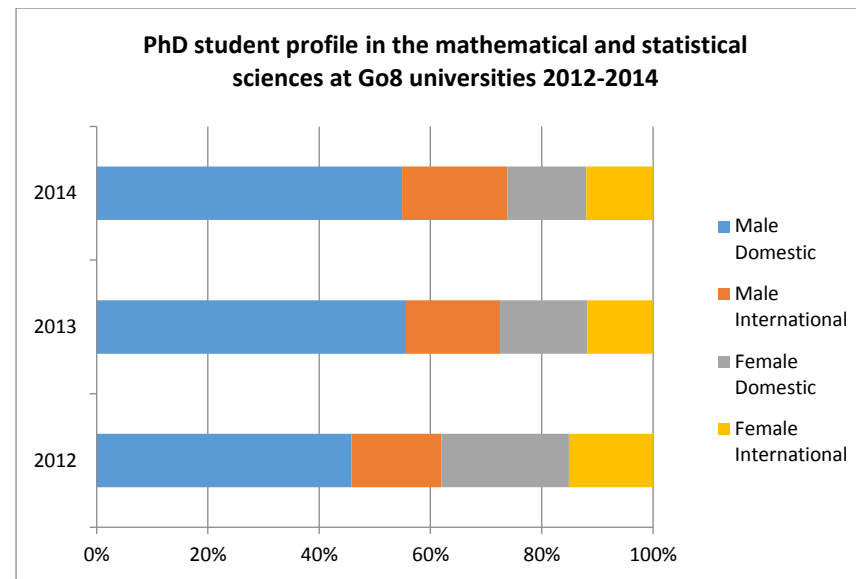


Masters by Research student profile in the mathematical and statistical sciences by gender and domestic/international status 2011-2014					
		Male Domestic	Male International	Female Domestic	Female International
Go8 universities	2012	55%	7%	24%	14%
	2013	74%	6%	19%	0%
	2014	70%	14%	12%	4%
ATN/RUN/IRU/unaligned universities	2012	59%	21%	13%	8%
	2013	36%	32%	23%	9%
	2014	25%	31%	25%	19%
All universities	2012	57%	15%	18%	10%
	2013	62%	14%	20%	3%
	2014	60%	18%	15%	7%



PhD student profile in the mathematical and statistical sciences by gender and domestic/international status 2011-2014

		Male Domestic	Male International	Female Domestic	Female International
Go8 universities	2012	46%	16%	23%	15%
	2013	56%	17%	16%	12%
	2014	55%	19%	14%	12%
ATN/RUN/IRU/unaligned universities	2012	48%	22%	15%	15%
	2013	35%	25%	21%	20%
	2014	38%	20%	21%	20%
All universities	2012	47%	20%	17%	15%
	2013	47%	20%	18%	15%
	2014	49%	19%	17%	15%



HIGHER DEGREE COMMENCEMENTS AND COMPLETIONS

PhD and Masters by Research commencements and completions in the mathematical and statistical sciences 2011-2014

	PhD commencements				PhD completions			
	2011	2012**	2013**	2014*	2011	2012**	2013**	2014*
Total Go8 universities	91	88	71	77	54	43	52	54
Total ATN universities	23	40	28	17	20	14	11	7
Total RUN universities	7	1	2	4	7	4	3	1
Total IRU universities	14	15	19	11	4	7	10	10
Total unaligned universities	18	9	24	20	20	9	10	18
Total all universities	153	153	144	129	105	77	86	90

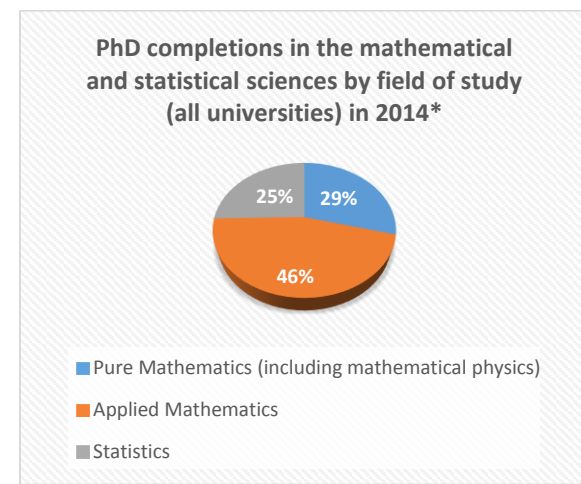
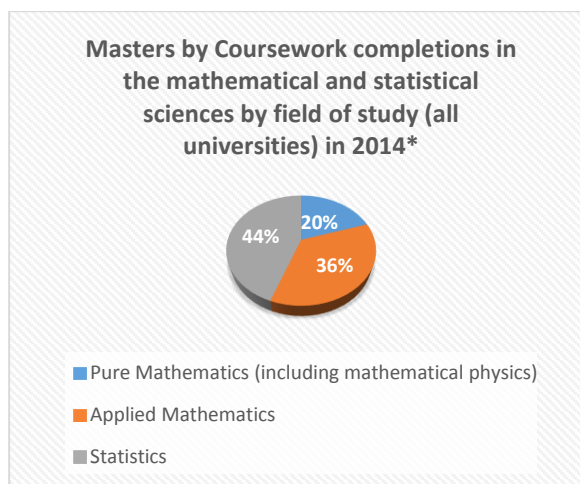
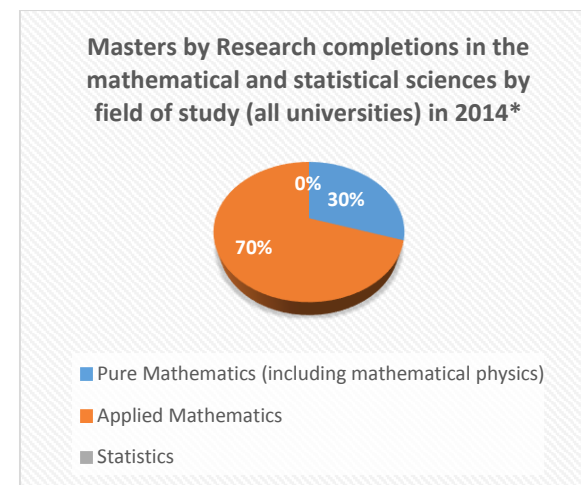
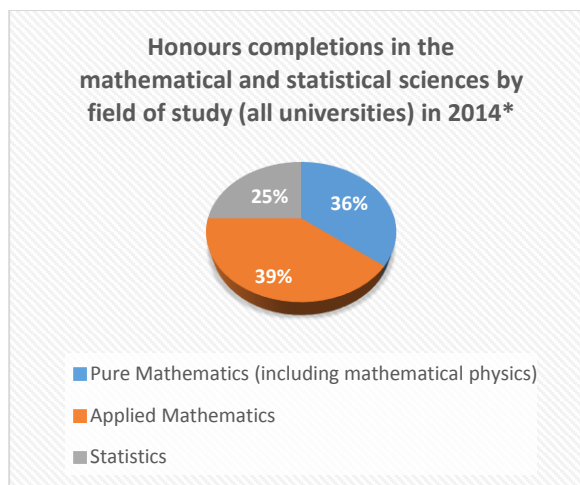
	Masters by Research commencements				Masters by Research completions			
	2011	2012**	2013**	2014*	2011	2012**	2013**	2014*
Total Go8 universities	12	17	13	18	8	13	9	9
Total ATN universities	3	6	8	4	0	1	0	0
Total RUN universities	0	0	0	0	0	0	0	0
Total IRU universities	5	2	0	3	0	2	2	1
Total unaligned universities	4	1	3	2	0	0	1	4
Total all universities	24	26	24	27	8	16	12	14

*These are projected figures for 2014. The 2015 AMSI Survey will ask for final figures for 2014.

** Based on final figures, unless not supplied- in which case projected figures supplied in the previous year were used.

Higher Degree completions in the mathematical and statistical sciences by field of study (all universities) in 2014*

	Pure Mathematics (including mathematical physics)	Applied Mathematics	Statistics
Honours	40	44	28
Masters by Coursework	9	16	20
Masters by Research	3	7	0
PhD	23	36	20



PhD commencements and completions in the mathematical and statistical sciences by gender and domestic status in 2014* (all universities)

	Commencements	Completions
Male domestic	55	40
Female domestic	19	12
Male international	34	16
Female international	21	22
Total	129	90

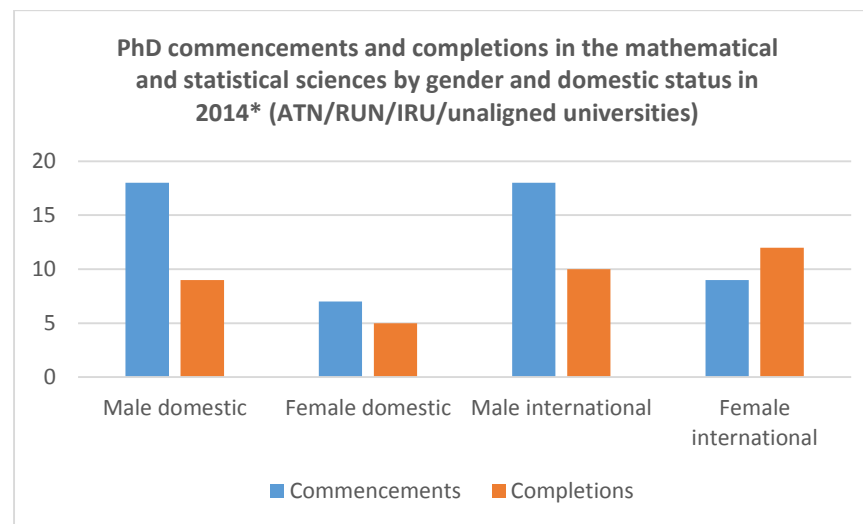
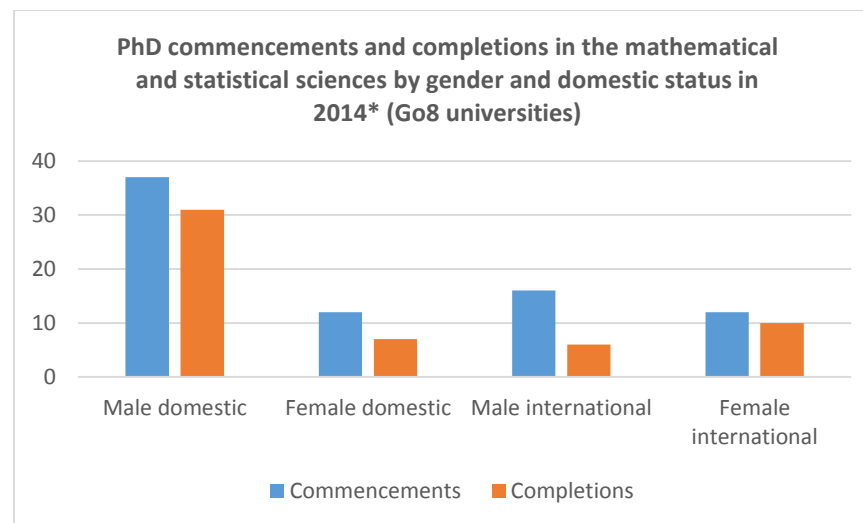
PhD commencements and completions in the mathematical and statistical sciences by gender and domestic status in 2014* (Go8 universities)

	Commencements	Completions
Male domestic	37	31
Female domestic	12	7
Male international	16	6
Female international	12	10
Total	77	54

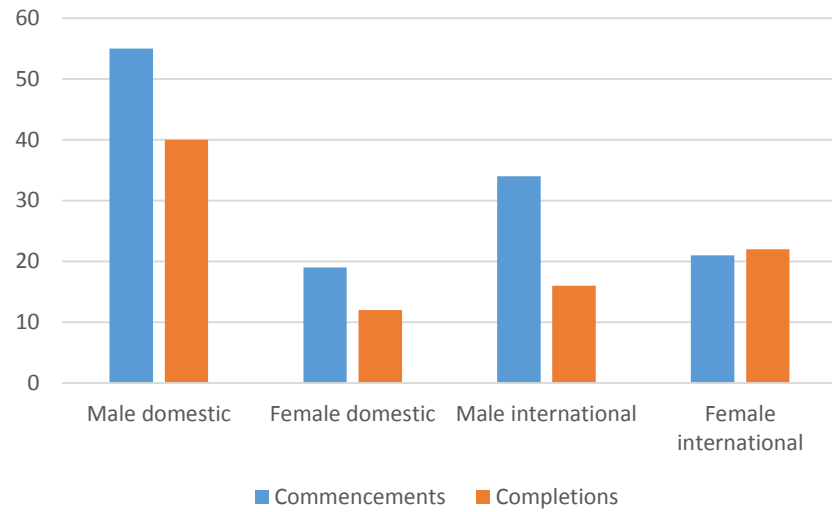
PhD commencements and completions in the mathematical and statistical sciences by gender and domestic status in 2014* (ATN/RUN/IRU/unaligned universities)

	Commencements	Completions
Male domestic	18	9
Female domestic	7	5
Male international	18	10
Female international	9	12
Total	52	36

*These are projected figures for 2014. The 2015 AMSI Survey will ask for final figures for 2014.



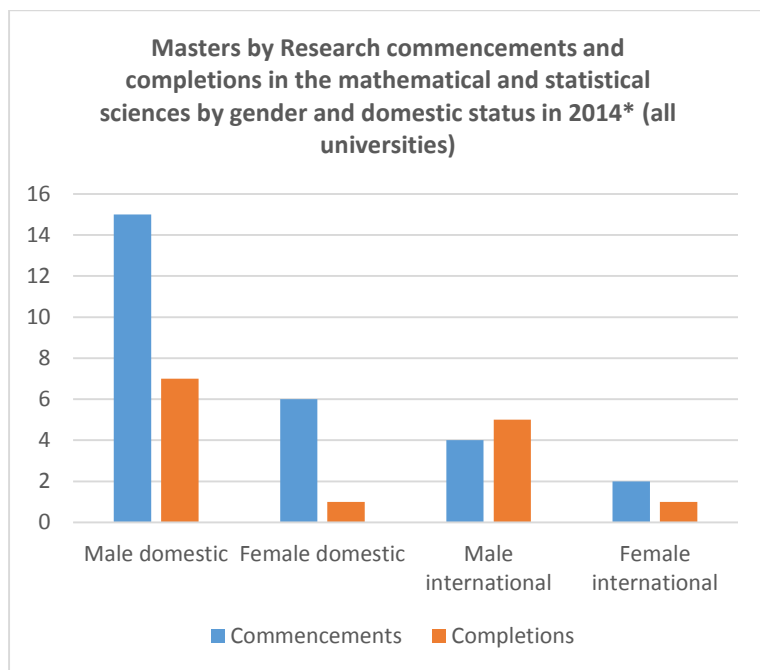
PhD commencements and completions in the mathematical and statistical sciences by gender and domestic status in 2014* (all universities)



Masters by Research commencements and completions in the mathematical and statistical sciences by gender and domestic status in 2014* (all universities)

	Commencements	Completions
Male domestic	15	7
Female domestic	6	1
Male international	4	5
Female international	2	1
Total	27	14

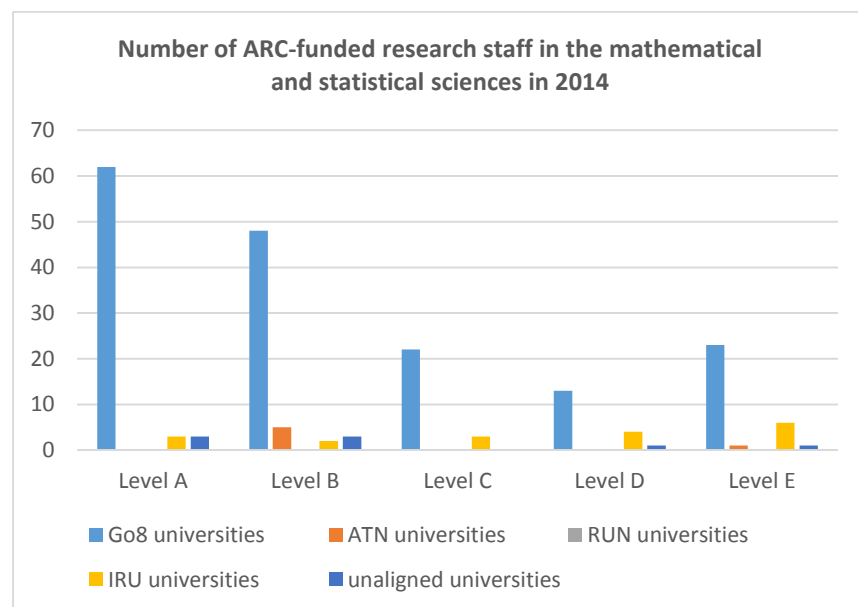
*These are projected figures for 2014. The 2015 AMSI Survey will ask for final figures for 2014.



RESEARCH

Number of ARC-funded research staff in the mathematical and statistical sciences in 2014 (not FTE)

	Level A	Level B	Level C	Level D	Level E
Go8 universities	62	48	22	13	23
ATN universities	0	5	0	0	1
RUN universities	0	0	0	0	0
IRU universities	3	2	3	4	6
unaligned universities	3	3	0	1	1
all universities	68	58	25	18	31



Number of grants held in the mathematical and statistical sciences in 2012-2014

	Discovery Projects			Linkage projects			OLT Grants and Fellowships		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
Go8 universities	139	159	133	14	12	15	2	3	3
ATN universities	14	12	14	6	2	2	1	1	1
RUN universities	3	3	3	0	0	0	0	0	1
IRU universities	12	13	13	3	3	3	0	0	1
unaligned universities	11	11	9	1	1	3	0	0	2
all universities	179	198	172	24	18	23	3	4	8

Estimated success rate in securing ARC funding in the mathematical and statistical sciences

	2010-2012	2011-2013
Go8 universities	31	33
ATN universities	17	20
RUN universities	33	33
IRU universities	21	13
unaligned universities	8	10
all universities	24	20

Number of departments holding a formal research agreement in the mathematical and statistical sciences with one or more government agencies

	2012	2013	2014
Go8 universities	3	3	3
ATN universities	1	1	1
RUN universities	0	0	0
IRU universities	0	1	1
unaligned universities	1	1	1
all universities	5	6	6

Number of departments undertaking external research consultancies in the mathematical and statistical sciences

	2012	2013	2014
Go8 universities	4	5	6
ATN universities	2	2	2
RUN universities	0	0	0
IRU universities	2	2	3
unaligned universities	1	1	1
all universities	9	10	12

Number of universities maintaining a funded statistical consulting service in 2014

Go8 universities	5
ATN universities	0
RUN universities	2
IRU universities	1
unaligned universities	2

all universities	9
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Average number of international visitors to departments of mathematical and statistical sciences

	2012	2013	2014
Average Go8 universities	90	60	46
Average ATN universities	5	6	12
Average RUN universities	9	2	5
Average IRU universities	9	13	6
Average unaligned universities	8	8	10
Average all universities	28	27	18

Average number of research workshops/conferences in the mathematical and statistical sciences

	2013	2014
Average Go8 universities	6	4
Average ATN universities	1	0
Average RUN universities	1	1
Average IRU universities	2	1
Average unaligned universities	1	2
Average all universities	3	2

EQUITY AND DIVERSITY IN 2014

Staff and students identifying as Aboriginal and Torres Strait Islander

	2012		2013		2014	
	Staff	Students	Staff	Students	Staff	Students
All universities	1	33	3	225	4	103

Measures you or your university have taken in the following areas (2014):

Low socioeconomic status

Griffith University: see <http://www.griffith.edu.au/student-equity-services>

Monash University: see <http://www.monash.edu.au/access/assets/pdf/social-inclusion-strategy.pdf>
and <http://www.monash.edu.au/study/apply/special-admissions/seas.html>

University of Adelaide: A number of scholarships are available

University of Newcastle: The University of Newcastle is the largest provider of enabling programs in Australia, offering one third of the nation's Commonwealth supported places.

University of South Australia: Northern suburbs outreach to schools

Gender balance

Murdoch University: We have a high number of upper level undergraduate and honours students in the Maths and Stats Major - more women than men (at a guess). I believe this is largely due to the excellent role models we have in our staff AND the demographic of more public school students than private (who go mainly to UWA). Not sure why but it seems we attract good women undergraduates who follow through.

Swinburne University of Technology: A somewhat easier promotion to a higher academic level for female staff as well as a preferential female representation in various governing university bodies

University of Adelaide: Marta Sved Scholarship to the best female student entering the BMathSci

University of New South Wales: We run an annual Girls Do the Math day for female High Schools students. We offer two undergraduate scholarships to only female students.

University of Newcastle: All committees must have a membership of no less than 33 per cent of each gender. The University of Newcastle has strategies to achieve appropriate gender representation.

University of South Australia: Hypatia scholarships

University of Southern Queensland: see GoWest <http://www.usq.edu.au/go-west>

Aboriginal and Torres Strait Islander

Charles Darwin University: School of Indigenous studies is established.

La Trobe University: This summer the subject Data-based Critical thinking (a subject in our department) will be delivered to local high school Indigenous students in a new pathway program to promote entry in to La Trobe courses.

University of Adelaide: see <http://www.adelaide.edu.au/scholarships/undergrad/aboriginalislander/>

University of Newcastle: The Wollotuka Institute is committed to the advancement and leadership of Indigenous education at a local, national and global level. The Institute has got offices located also at the Central Coast Campus at Ourimbah and at Port Macquarie Campus. All campuses sustain strong relationships with the Traditional Custodians and wider communities to ensure mutual outcomes are achieved.

University of South Australia: Northern suburbs outreach to schools

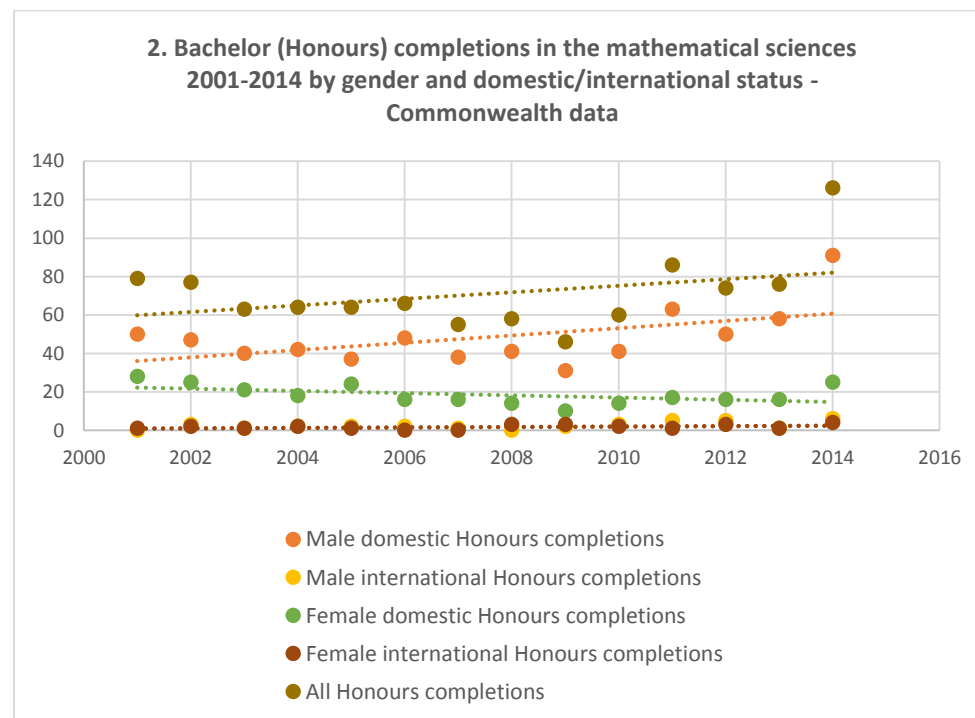
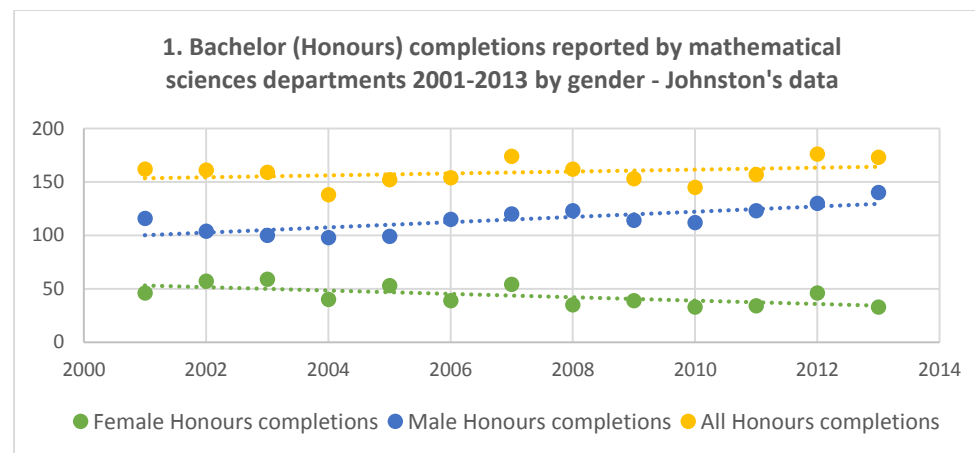
APPENDIX 1 – Honours and PhD completions

Peter Johnston at Griffith University has, on behalf of the Australian Mathematical Society, assembled longitudinal data on honours and higher degree completions in mathematics and statistics for many years. These data are an invaluable source of information. In addition, this year the Commonwealth Government Department of Education and Training has supplied AMSI with commencement and completion data in all degrees in the field of study of “mathematical sciences” for the period 2001-2014. The availability of 2 complementary datasets for honours and PhD degrees for the period 2001-2013 provides a good opportunity to identify some important trends in commencement and completions of these degrees.

HONOURS COMPLETIONS

The 2 datasets

At the time of writing, Peter Johnston’s data were available to us until the year 2013, going back several decades. The Commonwealth data cover the period 2001-2014. Our analysis therefore covers the period 2001-2013. The honours completions in both datasets are in graphs 1 and 2.



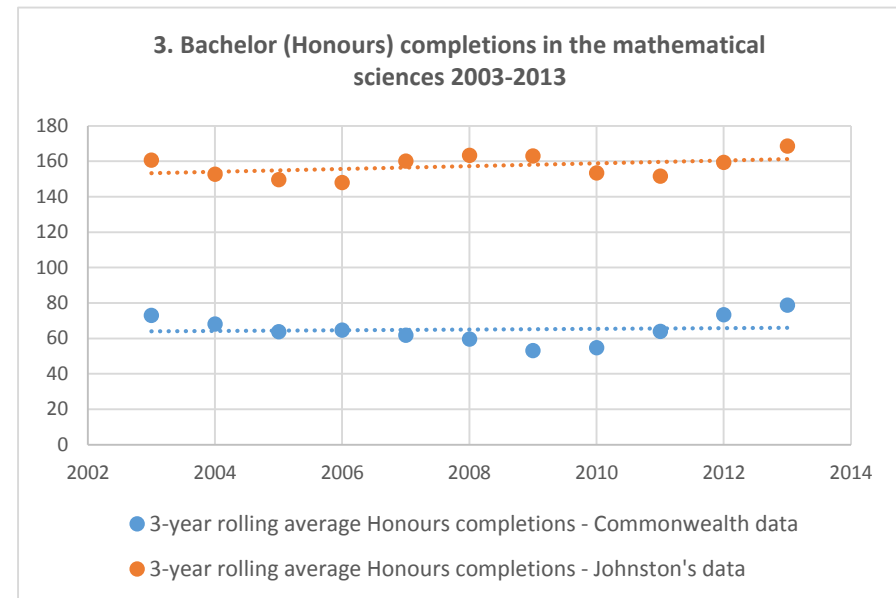
There are some important differences in the 2 datasets:

The data from the Commonwealth only cover Bachelor (Honours) completions in the field of study of “mathematical sciences”, NOT in Bachelor of Science or related degrees. Consequently, the data only capture the roughly 20 universities who have offered the “mathematical sciences” honours degree at any time in the period 2001-2014. The honours completion data from the department are therefore too low – for instance, they do not include at least 4 of the large Group of Eight universities.

In contrast, Peter Johnston’s data collection is founded on the delivery of honours completion numbers by departments of mathematics and statistics around the country (from 37 universities- although actual participation varies from year to year), giving a much more comprehensive overview of the number of honours degrees in mathematics and statistics even if these have been absorbed into more general science degrees. Peter Johnston’s data also include the degrees from the University of Melbourne in the “Melbourne model”. Consequently, these numbers are much higher and much more reliable.

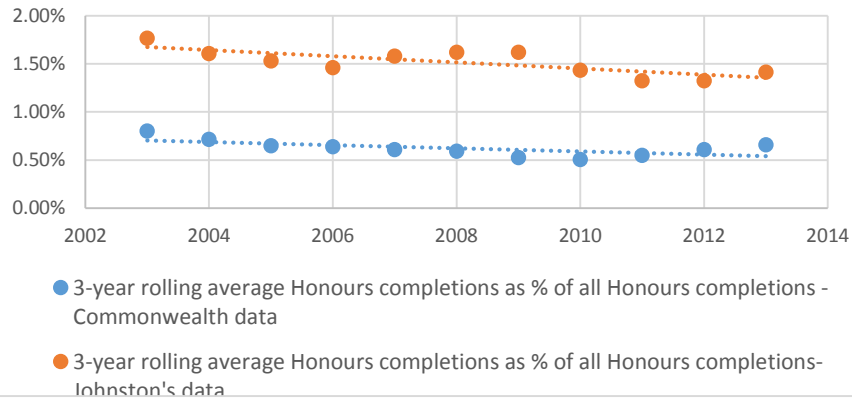
Peter Johnston’s data identify female and male completions, however not domestic and international components. Since the distinction between domestic and international students is important, AMSI has asked the Department to supply us female/male data categorised by domestic/international status as well, and in this sense the departmental data provide an important extra insight into the make-up of the honours student population.

Given the differences in the datasets, the trends that can be identified are remarkably similar. To identify trend, a 3-year rolling average was applied, and from this we can see that the honours completions numbers have been on a very slight upward trend in the last decade.



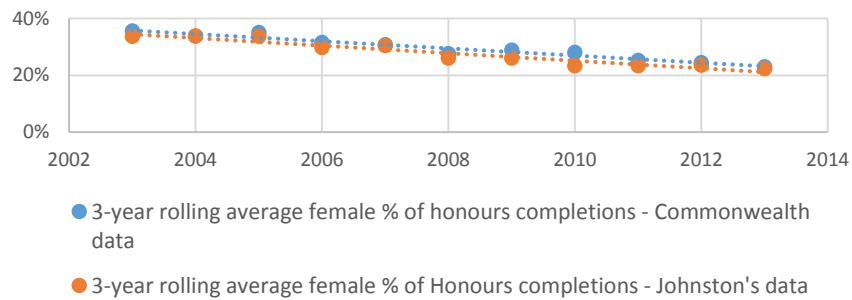
We need to keep in mind that overall, the number of university degree completions has increased considerably in the period 2001-2014. Has the increase in mathematical honours degree completions kept up with the increase in honours degrees in all fields of education? A 3-year rolling average was applied to the mathematical honours degrees as a proportion of honours degrees in all fields of education (the award completion numbers in all fields of education are publicly available from the Department of Education and Training). Both datasets show a downward trend, showing that a mathematical sciences degree has become less popular over time compared to degrees in other fields.

4. Bachelor (Honours) degrees in mathematical sciences as a proportion of honours degrees in all fields of education 2003-2013



Worryingly, both datasets also show that the female participation in honours degrees in mathematics has also declined in the decade 2003 to 2013. Again, a 3-year rolling average was applied to both sets of data, and the trend identified is clearly downward in both instances.

5. Female proportion of all honours degrees in mathematical sciences 2003-2013



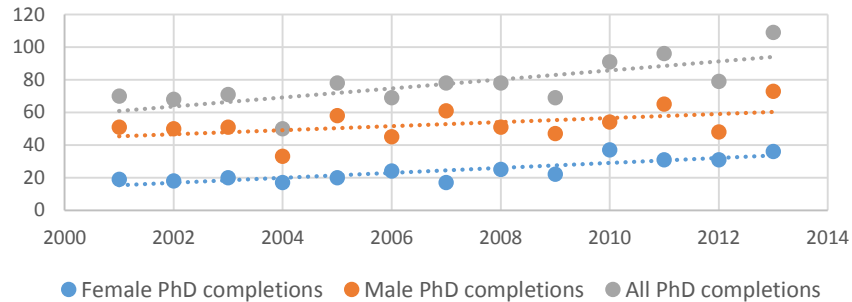
PhD COMPLETIONS

The 2 datasets

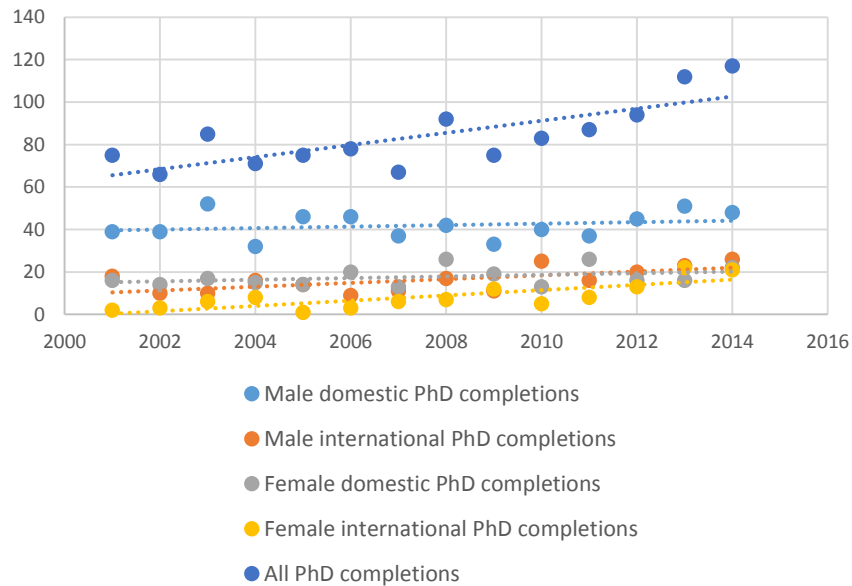
The PhD numbers from Peter Johnston's and the Department of Education and Training's data sets appear at first glance to lie much closer together than the honours data. However there are some important differences:

The Commonwealth data include 27 universities, so are much more representative than its honours data. Peter Johnston's data in principle include all universities, and thus you would expect Peter Johnston's completion numbers to be higher in most years. However, since his data collection relies on the voluntary participation of maths departments around the country, the actual response rate varies and there are a number of years where there must have been significant underreporting by the maths departments as the Commonwealth numbers are significantly higher (in 2003, 2004, 2008 and 2012 there was a difference of more than 10 completions). In other years, the Commonwealth numbers are lower: In 2007 the departmental numbers were lower by more than 10 students, and in 2010 and 2011 the difference was 8 and 9 students respectively. These fluctuations are high enough to result in differences in the trend lines for both datasets.

**6. PhD completions in the period 2001-2013 by gender-
Johnston's data**

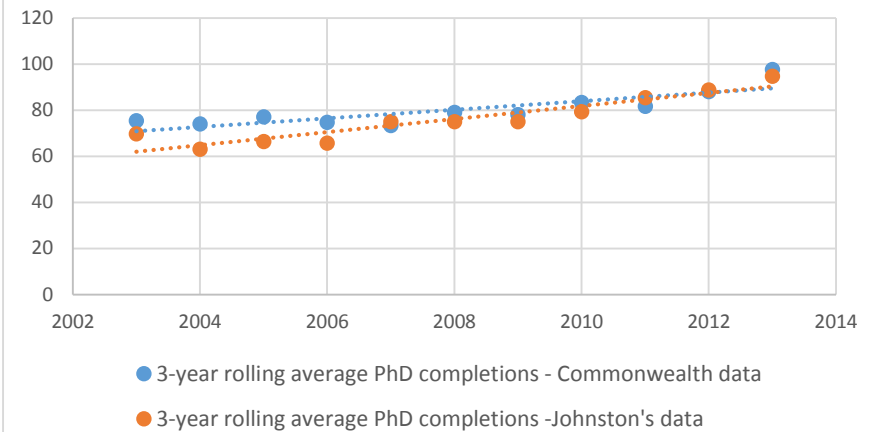


**7. PhD award completions in the mathematical sciences 2001-2014 by gender and domestic/international status -
Commonwealth data**



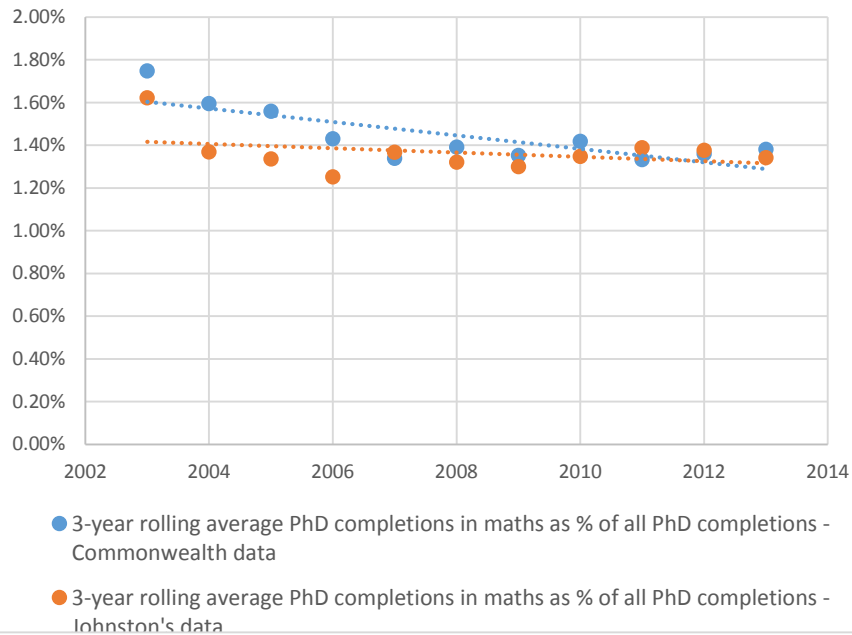
Applying a 3-year rolling average, it is clear that both datasets show an increase in PhD completions in the mathematical sciences in the years 2003-2013, however the slope of the increase is somewhat steeper for Peter Johnston's data.

8. PhD completions in the mathematical sciences 2003-2013

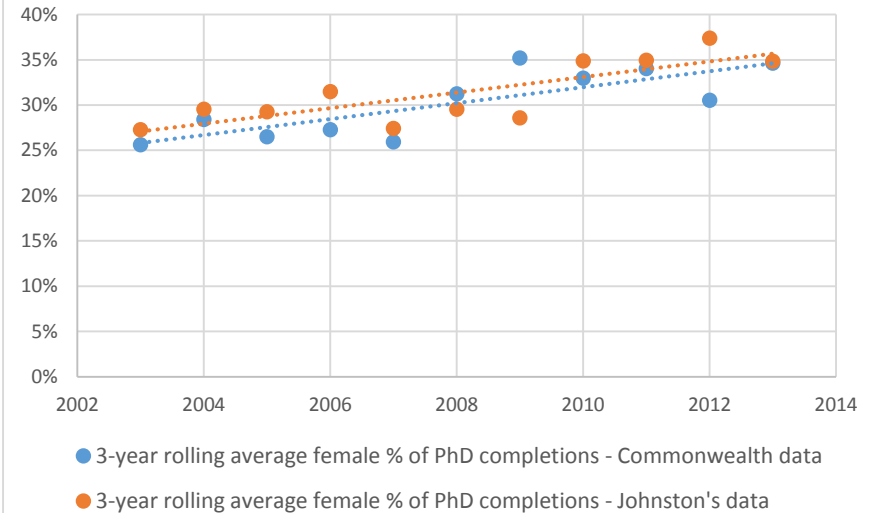


A 3-year rolling average was also applied to the mathematical PhD degrees as a proportion of PhD degrees in all fields of education to see if the increase has kept pace with the increase in PhD degrees in all fields of education. Both datasets show a downward trend (less so for Johnston's data), showing that PhD degrees in mathematical sciences are losing ground compared to degrees in other fields.

9. PhD degrees in mathematical sciences as a proportion of PhD degrees in all fields of education 2003-2013



10. Female proportion of all PhD degree completions in mathematical sciences 2003-2013

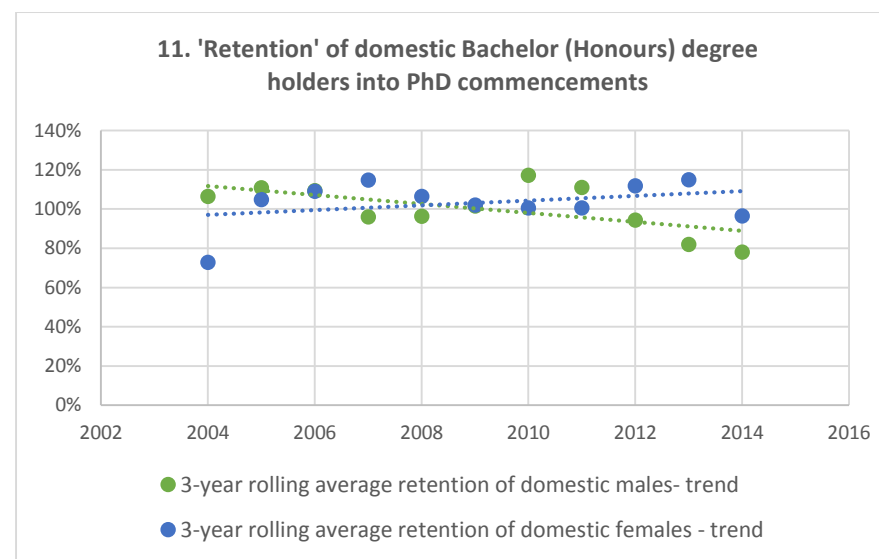


It is however extremely interesting to note that the female proportion of all PhD degrees in mathematical sciences has increased – the 3-year rolling average applied to both datasets very clearly point upwards in the same direction, in contrast with the honours completions which point to a decline. In the next paragraph we will look more closely at the female participation data.

THE PROPORTION OF FEMALES COMPLETING HONOURS AND PHD DEGREES

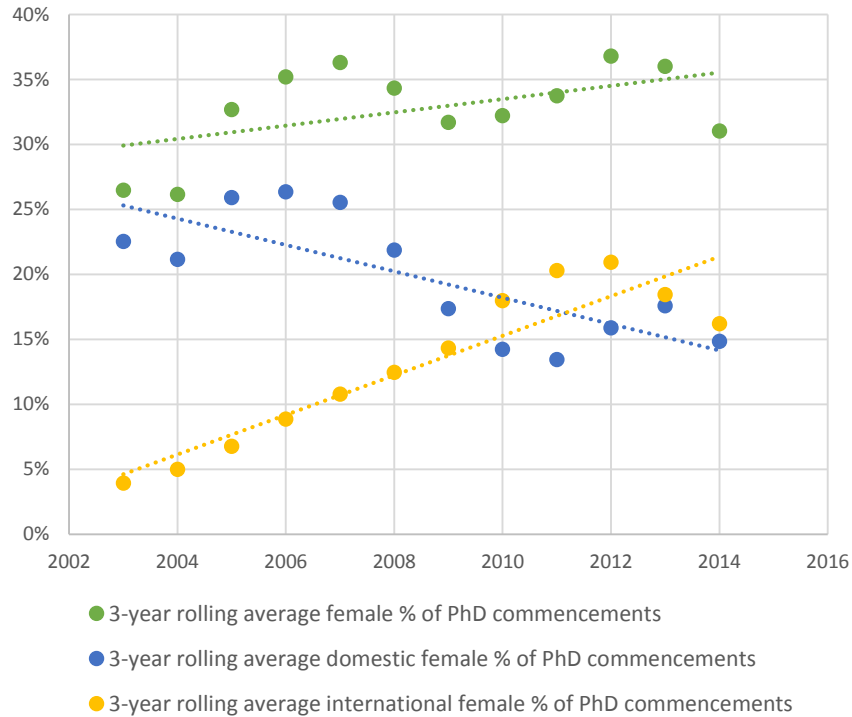
Given the fact that honours degree completions feed into PhD commencements, it is particularly important to know what the repercussions of the decline in female honours completions are for PhD numbers. It appears that the decline in female proportion of honours completions has not resulted in a decline in the proportion of PhD completions by females - at least not yet. We have used the Commonwealth data to make a few observations on the female participation in PhD degrees.

First of all, could it be that, relatively speaking, more female students who finish a mathematical honours degree go on and start a PhD in the mathematical sciences? To look at the “retention” of female versus male honours students into commencement of a PhD degree, it is important to realise that almost all honours students are domestic students (the proportion of international students is very low). Therefore it makes most sense to compare the domestic honours completions with domestic PhD student intake. For this we have to use the Commonwealth data (as these distinguish between domestic and international students). The graph below sets out the proportion of domestic male and female students finishing an honours degree in the mathematical sciences in year n against the PhD commencements of domestic students in year $n+1$. This graph is adjusted to allow for the fact that the Commonwealth honours numbers are too low compared to the PhD numbers. Given the fact that this analysis does not allow for variations in time passed between completion of an honours degree and the choice to start a PhD degree any conclusion can only be tentative: but it's certainly not impossible that the retention of domestic female honours degree holders into a PhD has become somewhat higher than for domestic males in the last few years.



A second hypothesis is that the female participation in PhD degrees is holding up because of higher participation by international female students. There certainly have been anecdotal reports to this effect. The PhD enrolment data collected via the AMSI University Survey also seem to indicate this is a distinct possibility, although these data do not go back long enough to establish if there is a trend. The two graphs 12 and 13 below set out the female proportion of PhD commencements and completions by domestic and international status (the top line represents the female proportion overall). A 3-year rolling average was applied to the percentage of females commencing and completing PhD degrees in the mathematical sciences, and both clearly show a very significant increase in the commencement and completion of PhD degrees by female international students.

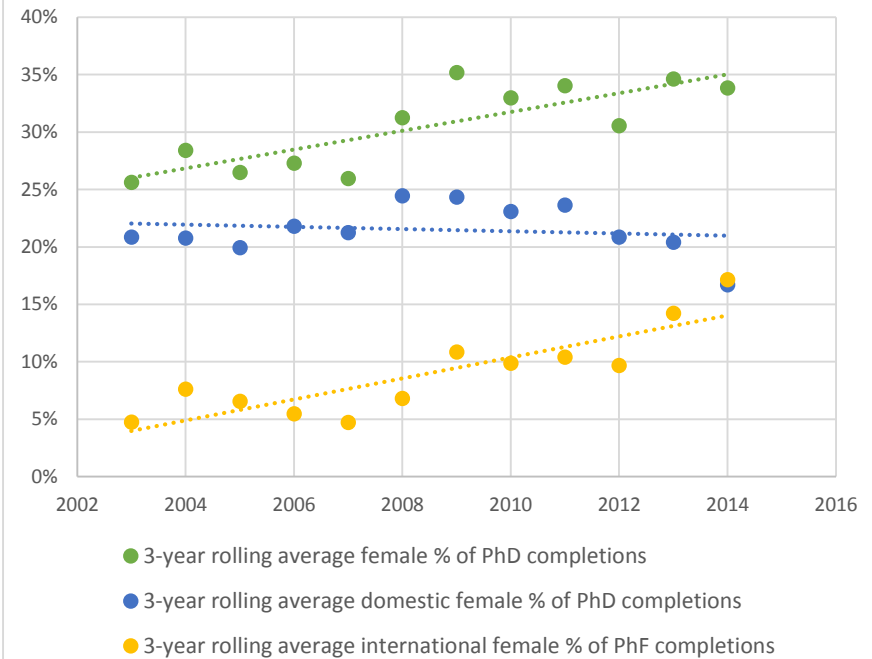
12. Female proportion of PhD commencements by domestic/international status 2003-2014



For domestic female students, the proportion of PhD *commencements* is going downwards (which is not surprising since the pool of potential domestic female PhD candidates is shrinking), however the proportion of PhD *completions* by domestic female students has not plummeted in the same way. This does again raise the possibility that, relatively speaking, more domestic female students complete a PhD in the mathematical

sciences once they have started. The question of higher retention of domestic female students, from honours into the start of a PhD, and from the start of a PhD into finishing one certainly warrants further investigation.

13. Female proportion of PhD degree completions in the mathematical sciences by domestic/international status 2003-2014



APPENDIX 2: List of respondents to the 2014 AMSI Survey by University grouping

Group of Eight (Go8)

Australian National University

Monash University

University of Adelaide

University of Melbourne

University of New South Wales (including ADFA)

University of Sydney

University of Western Australia

Australian Technology Network (ATN)

Curtin University

Queensland University of Technology

University of South Australia

Regional Universities Network (RUN)

University of New England

University of the Sunshine Coast

Innovative Research Universities (IRU)

Charles Darwin University

Flinders University

Griffith University

La Trobe University

Murdoch University

University of Newcastle

Unaligned

Bond University

Charles Sturt University

Deakin University

Swinburne University of Technology

University of Tasmania

University of Wollongong

