LONDON MATHEMATICAL SOCIETY
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2017 Survey of Postdoctoral Researchers in the Mathematical Sciences in the UK

Preamble

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The purpose

The following document describes some of the findings of the London Mathematical Society (LMS) 2017 survey of postdoctoral researchers in the mathematical sciences in the UK. The LMS has been becoming steadily more aware that there is little overall understanding of the postdoctoral activity in the country. We had a poor understanding of the size of the population, their distribution in subject area and geographical terms, their origin and their source of funding. Accordingly the LMS conducted a survey in Autumn 2017 with a census date of 31 October 2017 to give a snapshot of postdoctoral researchers in mathematical science departments in the UK. The findings are extremely interesting, but will come into full strength as part of a recurrent survey conducted every few years to reveal trends.

The process

The LMS wrote to individual Heads of Department asking them to supply information about the postdoctoral researchers in their department. They were asked for data about gender, nationality, home department, country of UG degree, field of interest and source of funding, with reassurances about the confidentiality of detailed information. The initial request was followed up with several reminders and then collated and processed in 2018.

Returns

We are very grateful to the 52 departments that responded to the survey. The level of detail given was not uniform, in some cases because of concerns about confidentiality, but we have made an effort to include information appropriately where possible. On the other hand, there were 53 returns in Mathematical Sciences to REF2014, several involving more than one department. Of the departments involved in a REF2014 return, 12 did not respond to the LMS survey; a bare majority of these were small and would have little effect. Some of the most interesting conclusions involve comparison between the survey data and published outcomes from REF2014.

Headline

The single most striking figure in the survey is that the survey reported 756 postdoctoral researchers, which was much larger than we expected. Taking into account the departments who did not respond, the actual figure must be in the region of 800.

Throughout these charts, where the 'category unknown or unspecified' is not mentioned, the displayed percentages are proportions of those which did specify a category.

See the appendix for a list of symbols and labels used.

Nationality

CHARTS 1 AND 2

It is striking that only 25% were from the UK, and fully 43% were from EU outside UK (Chart 1). This proportion is remarkably uniform across the 32 departments with EU postdocs. The very low number from the USA is also striking. These figures cannot be isolated from earlier stages of the pipeline, especially the quality and quantity of PhD students available from the various national systems. Whatever the cause, the fact that 75% of postdocs are from outside the UK is a serious risk to the health of UK mathematics, since the supply can be disrupted by external political and economic factors. Nevertheless, the highly international make-up of the cohort indicates a very competitive job market, and consequent excellent quality of the postdoc population.

The regional chart (Chart 2) is also interesting, since it seems to suggest the nationality breakdown is fairly uniform. However, with surprising consistency, the further north you go, the greater the percentage of UK nationals in the postdoc population. But, reinforcing the point about uniformity of EU presence made above, the main decline in the north occurs in the population from "other" countries.

Nationality information was not supplied for 36% of the cases: the percentages given are of those who stated a nationality.

Northern Ireland has been omitted to preserve anonymity.

Chart 1. Nationality

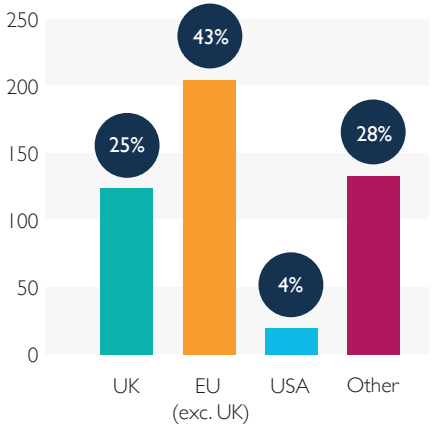
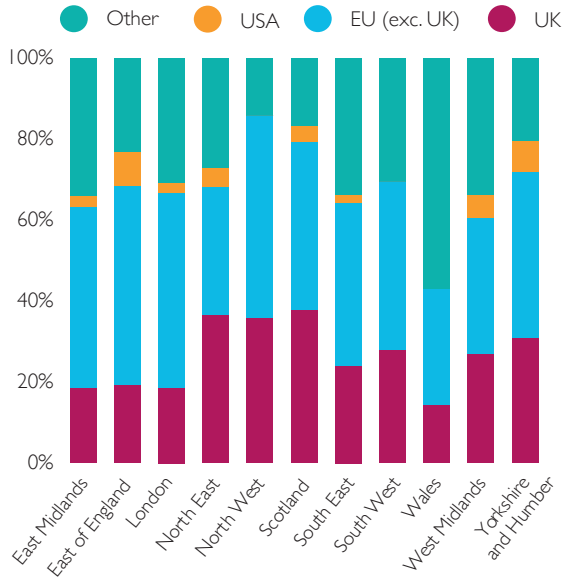


Chart 2. Nationality by region



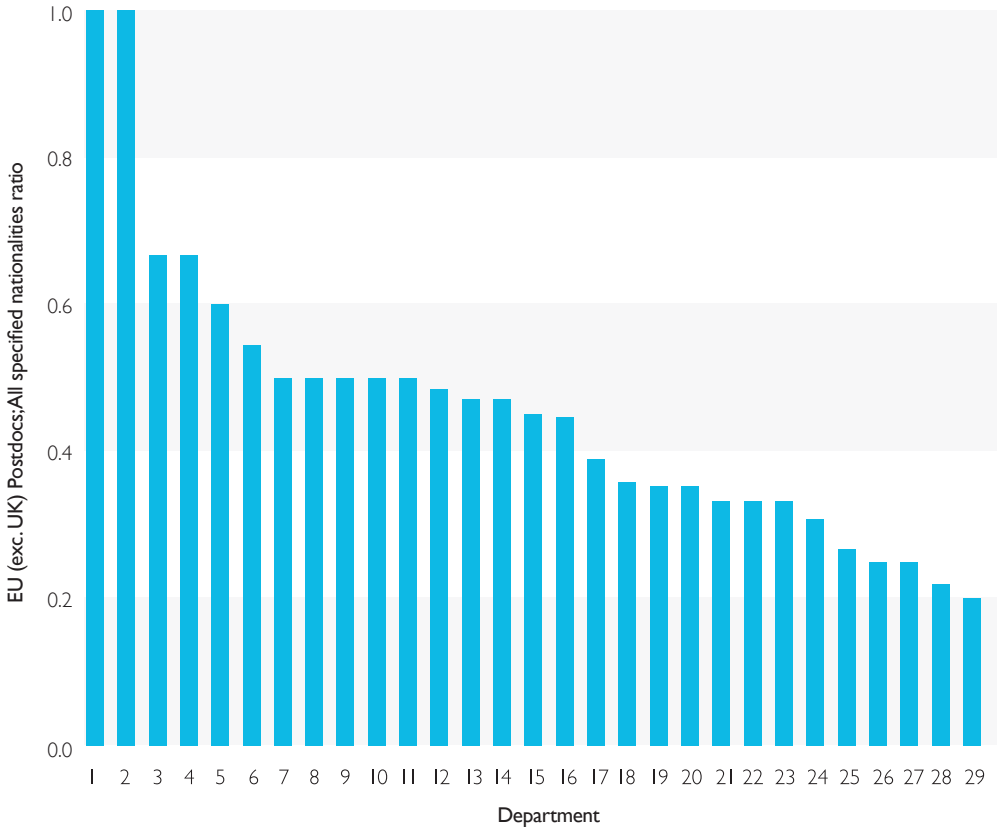
Departmental ratio of EU (non-UK) postdocs to all postdocs with specified nationalities

CHART 3

The most striking feature of this chart is that there is relatively little deviation from the 43% proportion noted above. Only 5 units fall below 30%, and of these, the lowest ratio corresponds to a small unit. The two departments with all postdocs from the EU together have 8 postdocs.

There were 8 small departments with some postdocs but none from the EU, and the remainder did not specify the origin of their postdocs.

Chart 3. EU (exc. UK) postdocs: All specified nationalities ratio by department



Funding Source

CHART 4

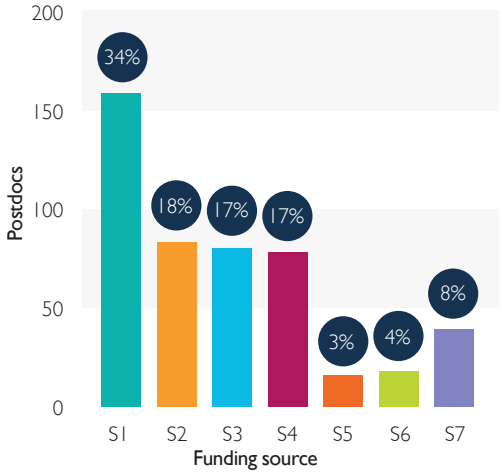
The sources of funding are gathered together into groups S1-S8, see the appendix.

The diversity is rather encouraging. S1 (EPSRC) (at 34%) is twice as big as any other category, with S2 (EU) (18%), S3 (Other Research Councils) (17%) and S4 (Own Institution) (17%) being the other main categories. In several of the larger departments the amount of EU and EPSRC funding is about the same. The effect of losing EU funding is likely to be significant.

Although EPSRC funding is the largest single source, it is only one third of the total number. This shows one should not conflate "all externally funded UK mathematical sciences research" (let alone "all UK mathematical sciences research") with "all UK mathematical sciences research which is EPSRC-funded".

The proportion with unspecified funding source was 38%. All percentages are a proportion of those with specified funding source.

Chart 4. Funding source



Field against funding source

CHARTS 5 AND 6

The mathematical fields are divided into 16 groups F01-F16, and the sources of funding are gathered together into groups S1-S8, see appendix.

This is rather interesting, but perhaps harder to draw general conclusions. Generally, the patterns conform to expectations, but it represents significant progress to be able to give quantitative evidence for this.

Main pattern: Proportion of F12 (Statistics, Applied probability and OR) funded by Industrial sponsors (S5) is much higher than any other sponsors.

Lesser patterns:
(1) High proportion of F06 (Mathematical physics and integrable systems) funded by S3 (RCUK other than EPSRC)
(2) High proportion of F03 (Number Theory) funded by S6 (mostly ATI and Heilbronn)
(3) Low proportion of F01 (Algebra, algebraic geometry and category theory) funded by S3 (RCUK other than EPSRC) or by S5 (industrial sponsors)

Those with unspecified funding source and unspecified field have been removed. All percentages are a proportion of those specified. Reassurance: the specified fields of postdocs with unspecified funding source were in similar proportions to those with specified funding sources.

Chart 5. Funding source by field

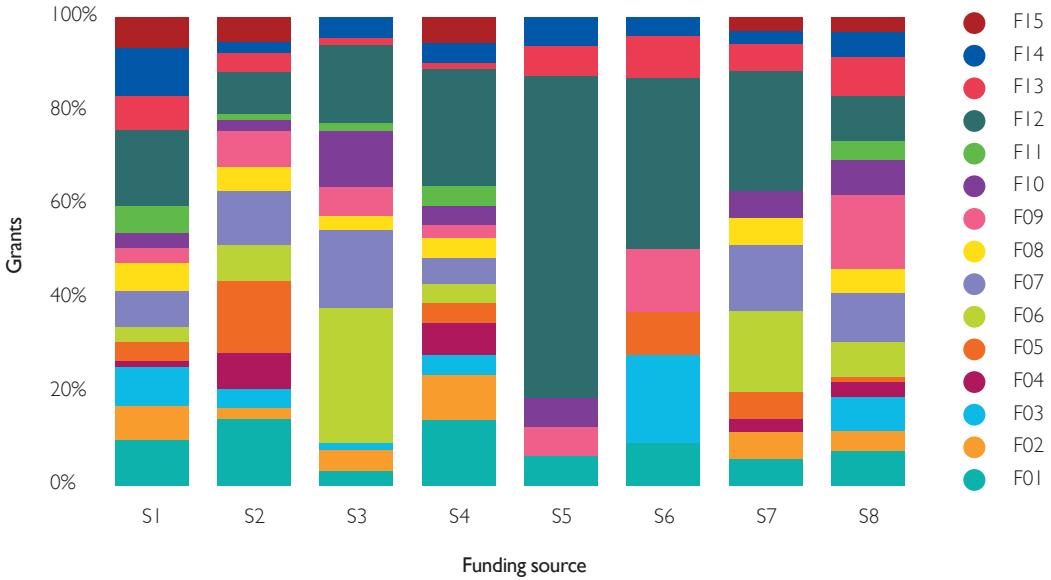
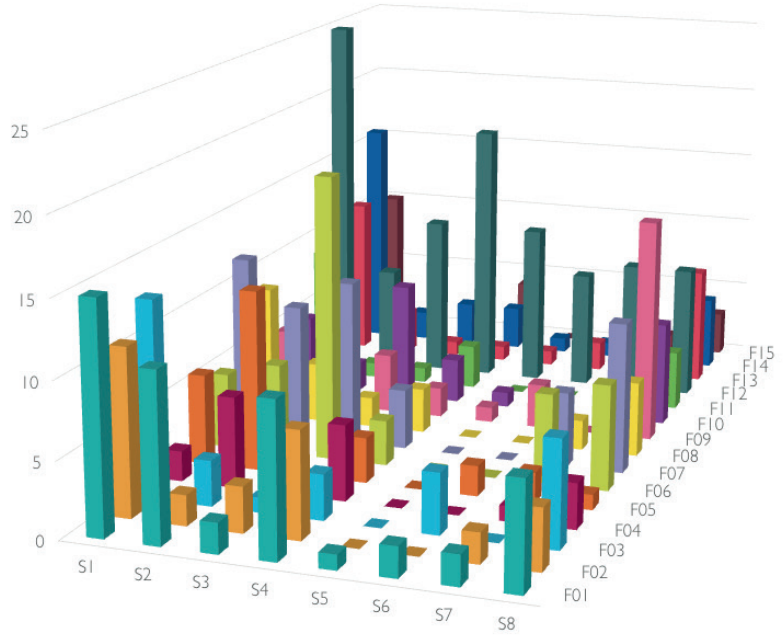


Chart 6. Postdocs by funding source and field



Funding source by field

CHARTS 7 AND 8

The mathematical fields are divided into 16 groups F01-F16, these groups are collected into 4 blocks FB1-FB4, and the sources of funding are gathered together into groups S1-S8, see appendix.

The pie chart of funding source by field shows bigger slices for F01 (Algebra, algebraic geometry and category theory), F06 (Mathematical physics and integrable systems), F12 (Statistics, applied probability and OR), but it is hard to draw conclusions without comparing with the population of mathematicians, or indeed the importance of funding.

The pie charts showing the distribution of funding across blocks of fields show that the blocks are fairly equal, but this probably just reflects a rational division into blocks. When it comes to individual departments, the field breakdowns are certainly interesting, but it is not easy to detect patterns.

The proportion with unspecified field was 27%. The proportion in the unspecified field block was 27%.

Chart 7. Postdocs by field

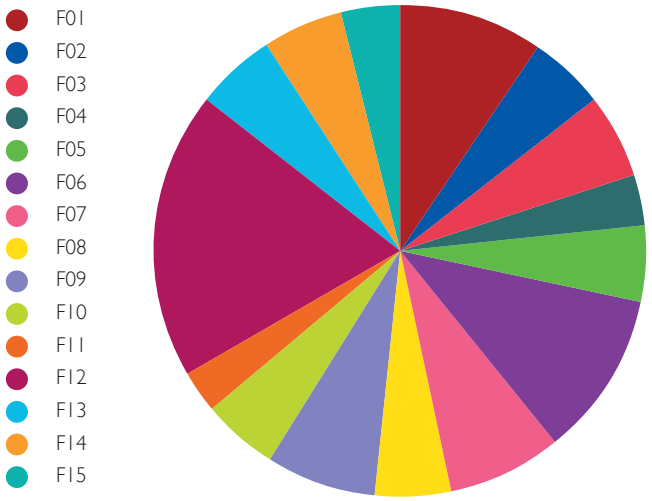
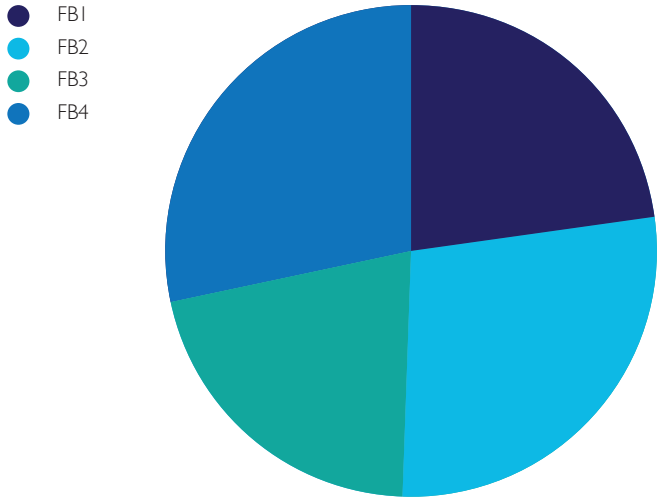


Chart 8. Postdocs by field block



Number of staff returned in REF2014 against the number of postdocs

CHARTS 9 AND 10

One needs to be cautious in interpreting these numbers since some departments were much more selective than others in REF returns. Another distortion is that the independent postdocs may also contribute to REF FTE. The 5 departments with largest REF submissions lying along the horizontal axis are departments that did not respond to the postdoc survey. Where separate departments made a joint REF submission their postdoc returns were combined.

Starting with the scatterplot (Chart 9), the data is quite well approximated by a line. It seems that there are typically very few postdocs in departments with less than 20 FTE REF returns, and the slope makes 1 postdoc per 2.4 research active staff look like a rather general trend across all sizes. The most striking feature is the 4 very large departments.

Turning to the numbers (Chart 10), the largest ratios (over 7) represent departments with very few postdocs, but in many cases this corresponds to a low volume of activity overall, and the small numbers involved mean that little can be deduced. The main message seems to be that modal departments (24) have 2-4 research active staff per postdoc, with a smaller number (8 departments) having 5-8 research active staff per postdoc.

In Chart 10, we have omitted departments not making a REF submission or not responding to the postdoc survey.

Chart 9. Postdocs per department by department REF FTE

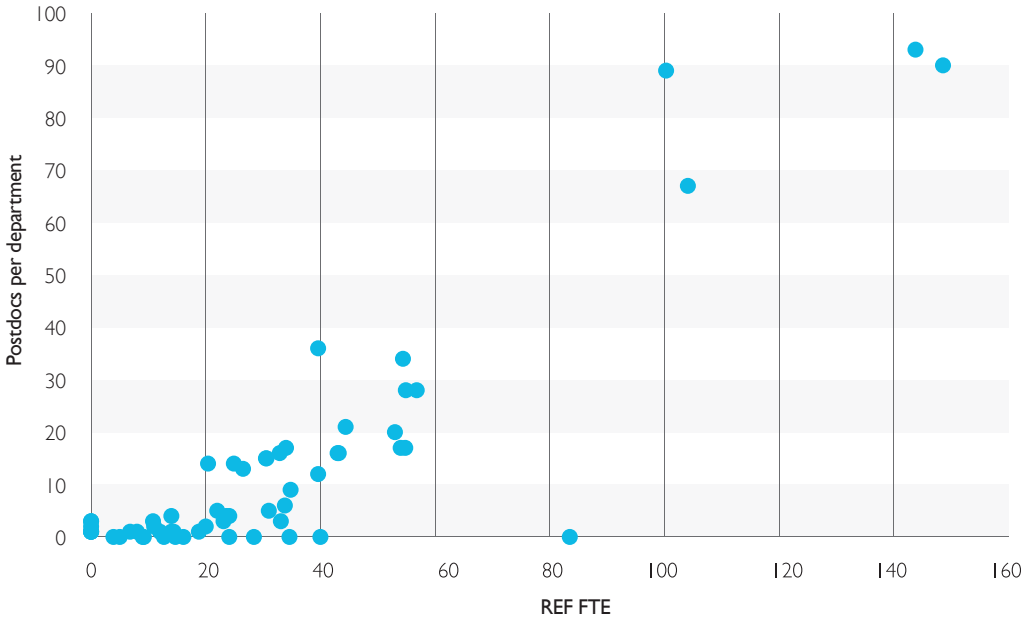
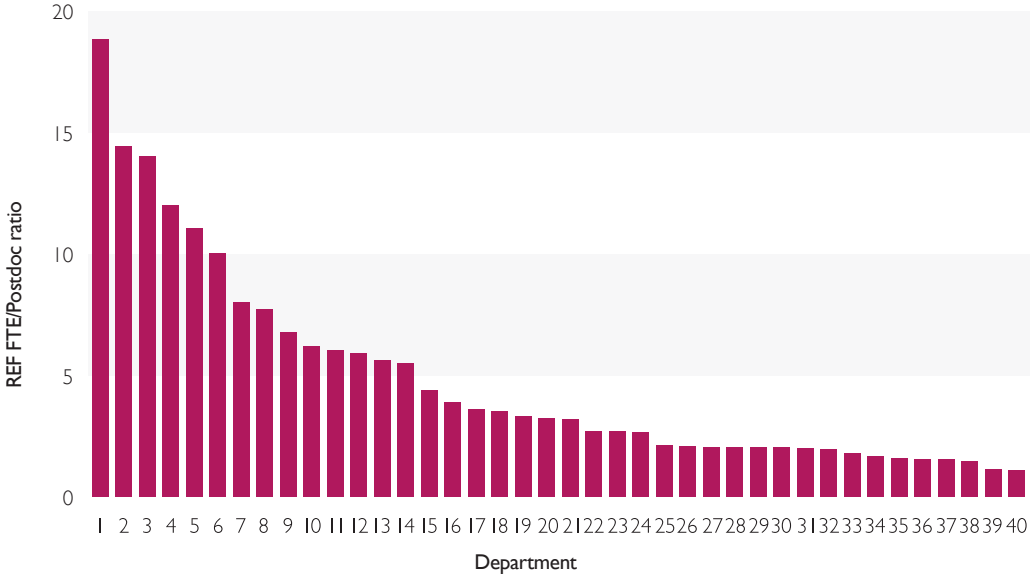


Chart 10. REF: Postdoc ratio



Number of Postdocs against REF GPA

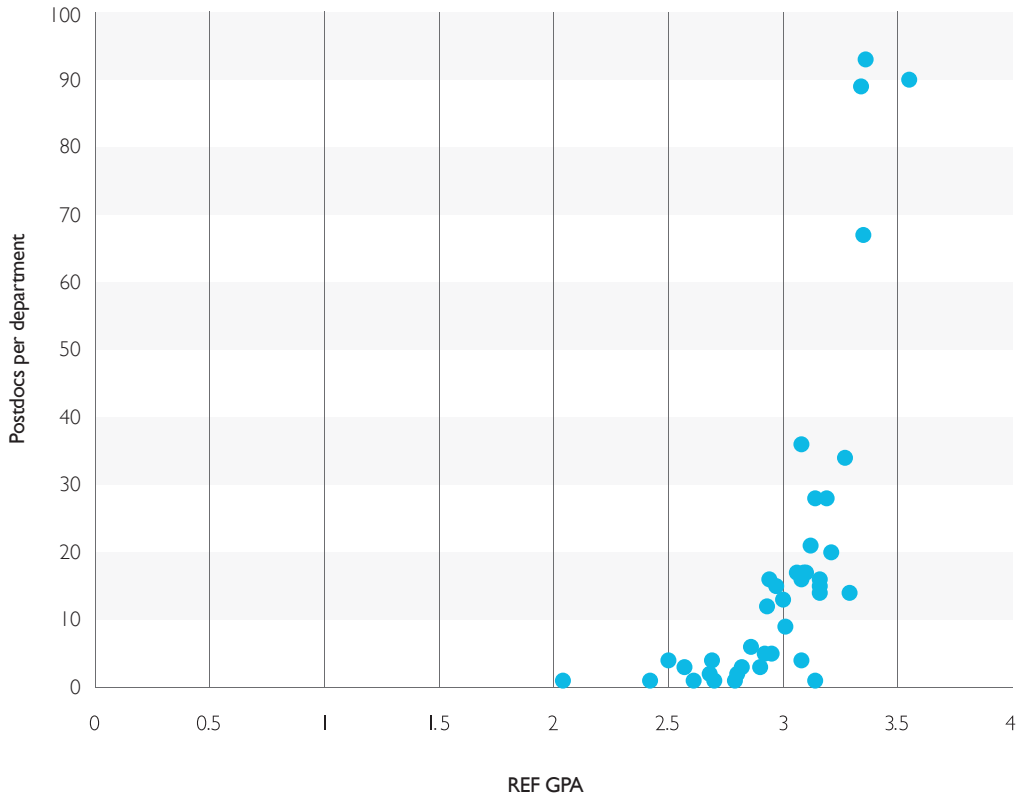
CHART 11

This chart shows the number of postdocs in a department against the REF GPA (i.e. the average of the overall REF profile), and it may be the most striking chart yet. The story seems to be that departments with a REF GPA below 2.8 attract very few postdocs, whether because of reputation or lack of funding. After that the numbers increase very fast, starting in a fairly linear way with a slope of about 6.6 postdocs per 0.1 GPA, and then the four departments with the highest GPA are outliers well above that slope. This is entirely in line with expectations: postdocs will want to go to departments with the highest level of research activity they can and funding agencies will want to support this.

There are also several feedback loops in operation: (A) having many postdocs helps generate a high REF GPA; (B) high REF GPA generates income and is attractive to potential postdocs; (C) income permits growth and improved environment. The correlation of size and performance in REF2014 outcomes provides some evidence these lead to real effects. The feedback loops are probably benign at a departmental level in that they reward success, but the tendency to concentration of resources may have some negative effects nationally.

Departments not making a REF submission or not responding to the postdoc survey have been omitted.

Chart 11. Postdocs per department by REF GPA



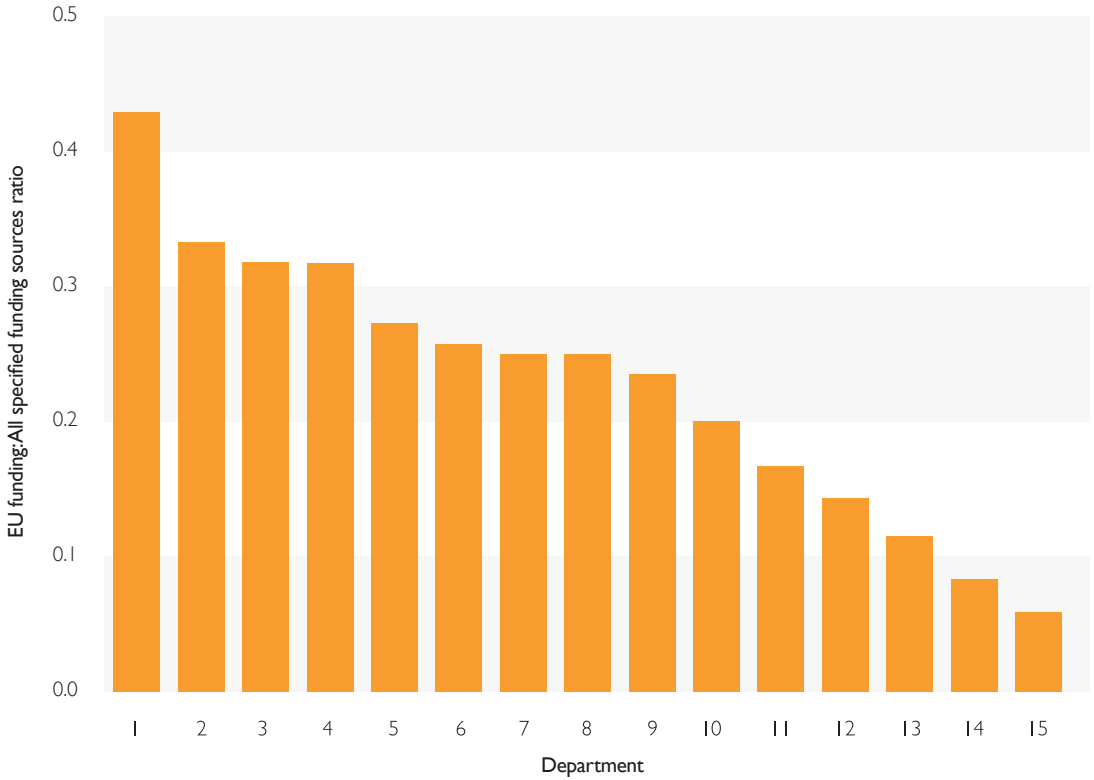
EU funding of postdocs: all specified postdoc funding

CHART 12

The average is 16%, but here there is a very wide variation around this value from 12% to almost 50%. As previously noted, this will probably affect most those departments with large numbers of ERC-funded fellows. The chart compares **numbers** of postdocs funded not **income**.

40 departments specified funding sources and 15 had some funding from the EU. These 15 departments submitted in 903 Category A FTE staff to REF2014 compared to the mathematical sciences total of 1,871 Category A FTE staff submitted.

Chart 12. EU funding: All specified funding ratio by department



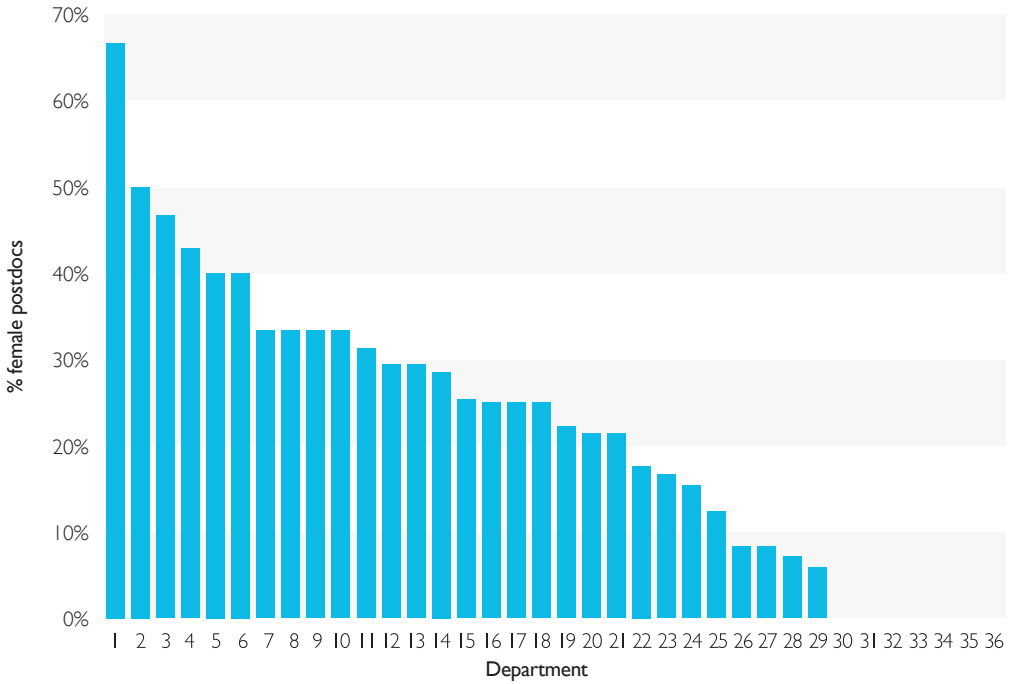
Gender balance by department

CHART 13

The overall average gender balance is 23%F. The chart excludes departments with just one postdoc, but shows that 6 departments have a ratio under 17%F, 5 have a ratio of under 10%F and 7 have 0%F. These figures must be a cause of concern. On the other hand it is more encouraging that 21 departments have ratio of over 20%F, and of these 10 departments have a ratio of over 33%. The two highest percentages come from very small numbers. Of departments with more than one postdoc none had female postdocs but no male postdocs.

The national ratio amongst mathematical sciences academics is 21%F. The proportion of postdocs where gender is not specified is 12%. Almost all departments who gave details of any sort about their postdocs did specify gender.

Chart 13. % Female postdocs within individual departments



Gender balance by field

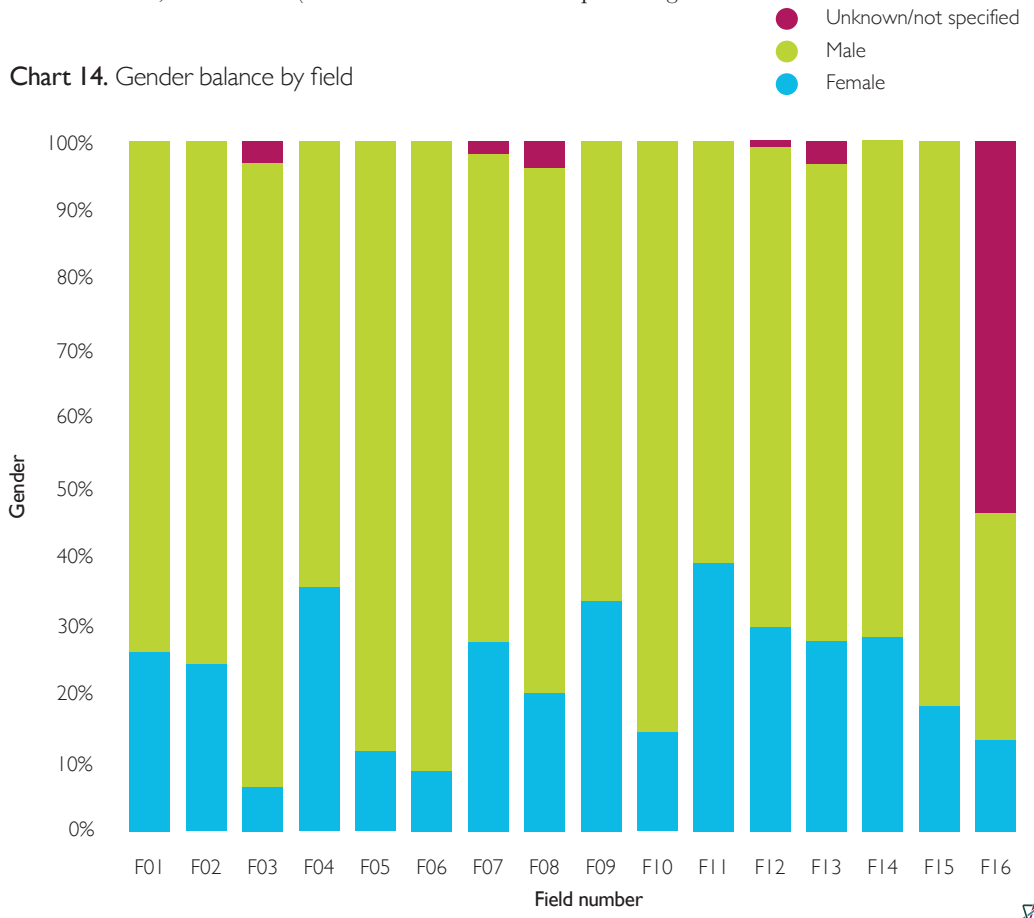
CHART 14

The mathematical fields are divided into 16 groups F01-F16, see appendix.

The overall gender balance is 23% female, but the chart shows a large variation. At the high end we have 38% in F11 (Industrial mathematics), 35% in F04 (Combinatorics, Logic) 33% in F09 (Modelling), with F12 (Statistics, Applied probability and OR) only slightly lower at 29%. At the low end, 11% in F05 (PDEs and analysis), 10% in F06 (Mathematical physics and integrable systems), and 6% in F03 (Number theory).

There were 216 postdocs in F16 (unknown or unspecified field). Only 12% of postdocs had unspecified gender.

Chart 14. Gender balance by field



Postdoc numbers by region

CHARTS 15, 16 AND 17

Departments have been divided into regions as recorded in the appendix.

Chart 15 clearly shows very high concentrations of postdocs in London and the south east. In order to make comparisons, one should perhaps divide by a measure of size appropriate to the purpose. We have chosen to use the number of mathematical sciences staff returned to REF2014 from the region (Chart 16), giving the ratios shown in Chart 17.

Northern Ireland has been omitted to preserve anonymity.

Chart 15. Postdoc numbers by region

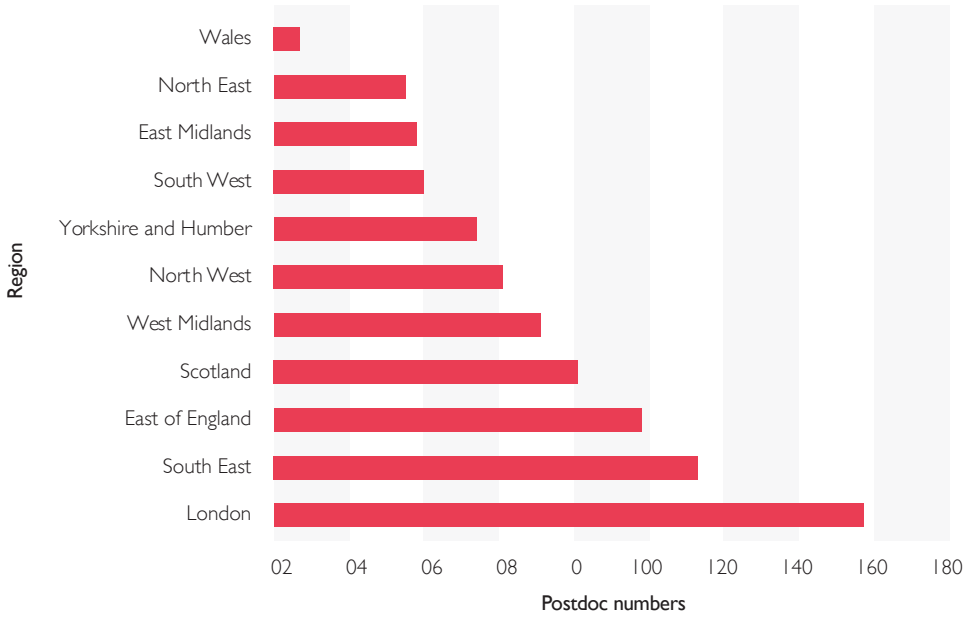


Chart 16. REF FTE by region

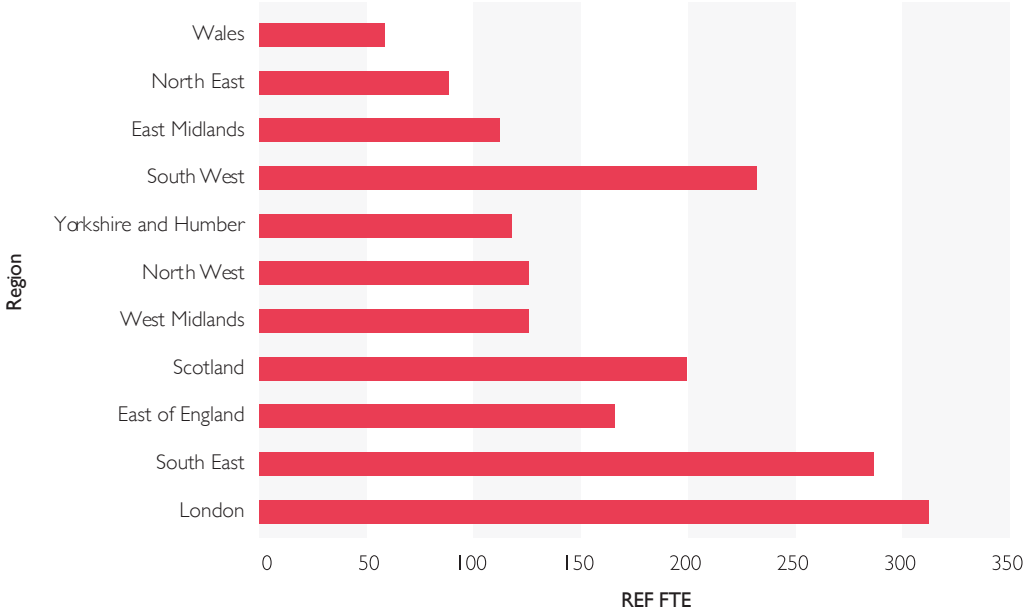
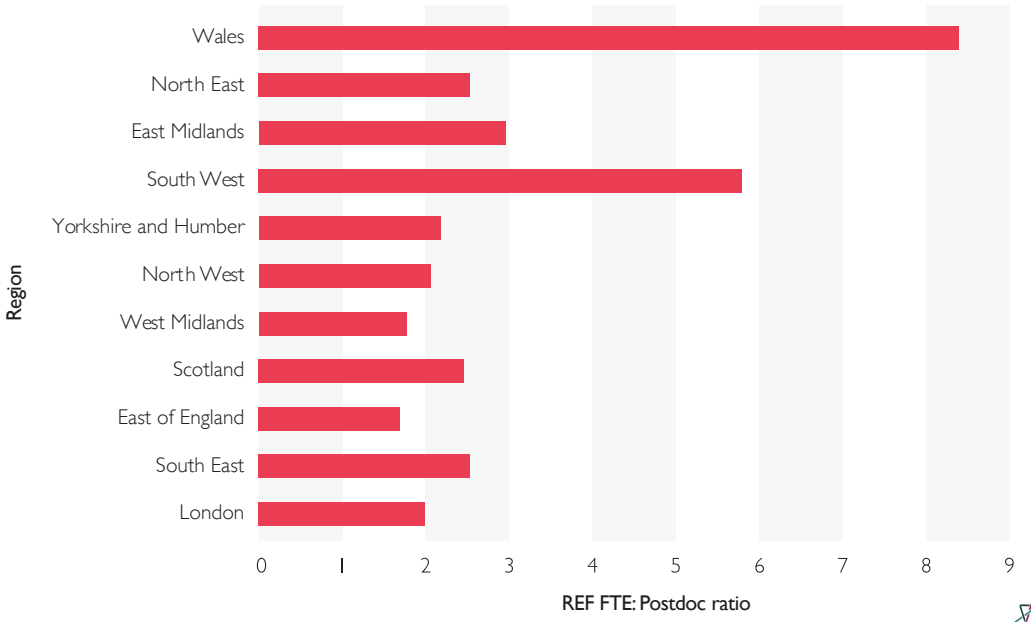


Chart 17. REF: Postdoc ratio by region



Postdoc gender balance by region

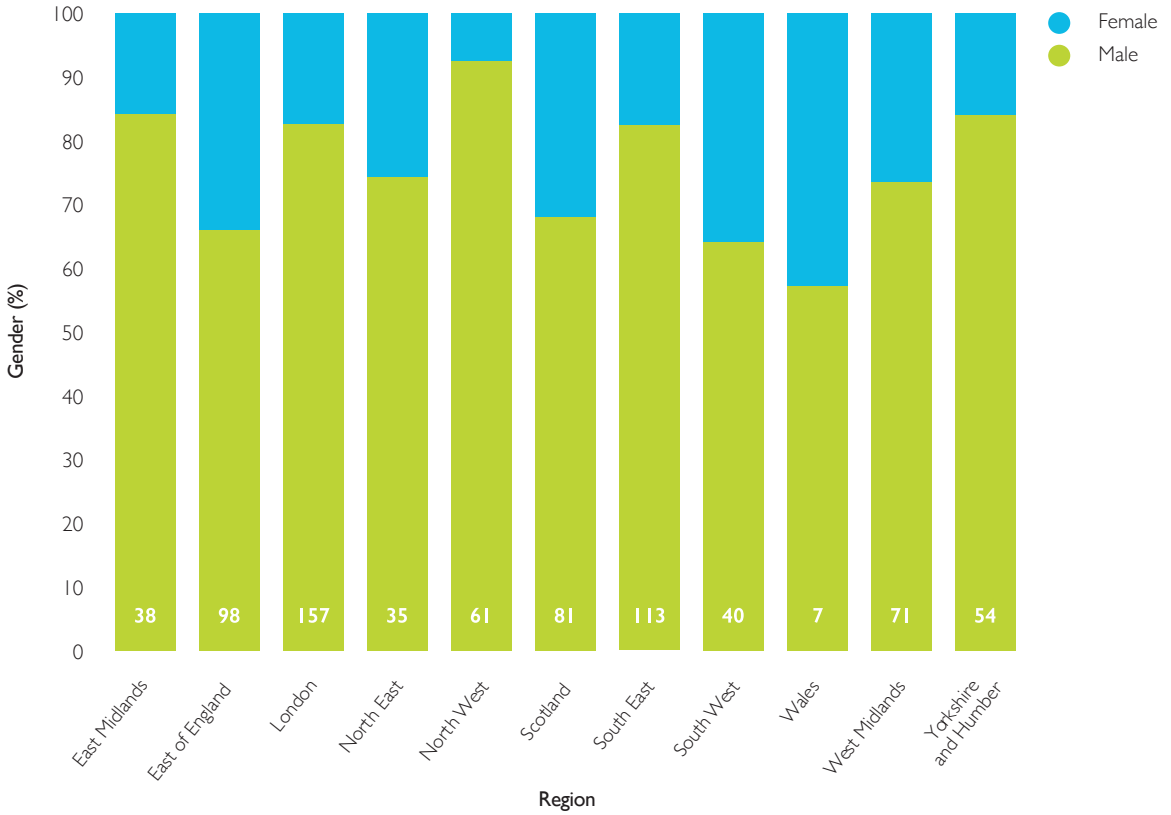
CHART 18

Departments have been divided into regions as recorded in the appendix

These figures are presented without comment. The number in each region is recorded at the base of the appropriate tower.

The proportion of postdocs where gender is not specified is 12%. The pattern of these is such that full information is unlikely to change the proportions significantly.

Chart 18. Gender balance by region



Funding source by region

CHARTS 19, 20 AND 21

The sources of funding are gathered together into groups S1-S8 and departments have been divided into regions: see the appendix.

Chart 19 shows the proportions from each funding source by region, and Chart 20 the number of postdocs funded from each funding source by region. Chart 21 normalises the columns in Chart 20 by REF FTEs returned.

The very large S1 (EPSRC) from Wales is striking as are the largish S2 (EU) from West Midlands and Yorkshire and Humber. The large S4 (Institutional) in East of England is striking but not surprising. The large S3 (RCUK not EPSRC) in South West is also notable.

Chart 19. Funding source by region

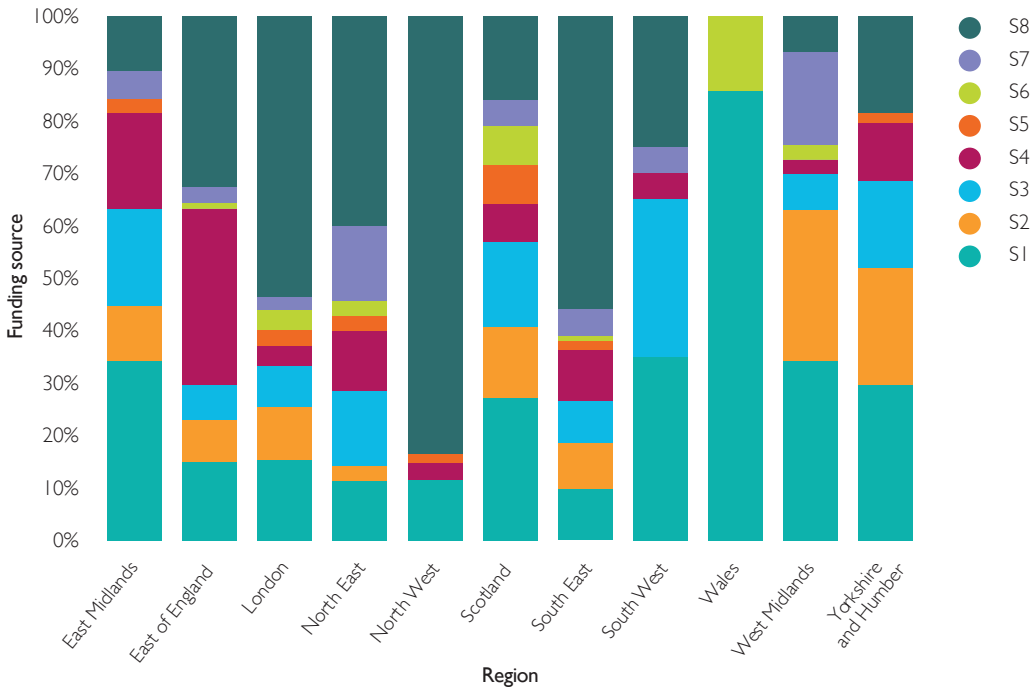


Chart 20. Funding source by region

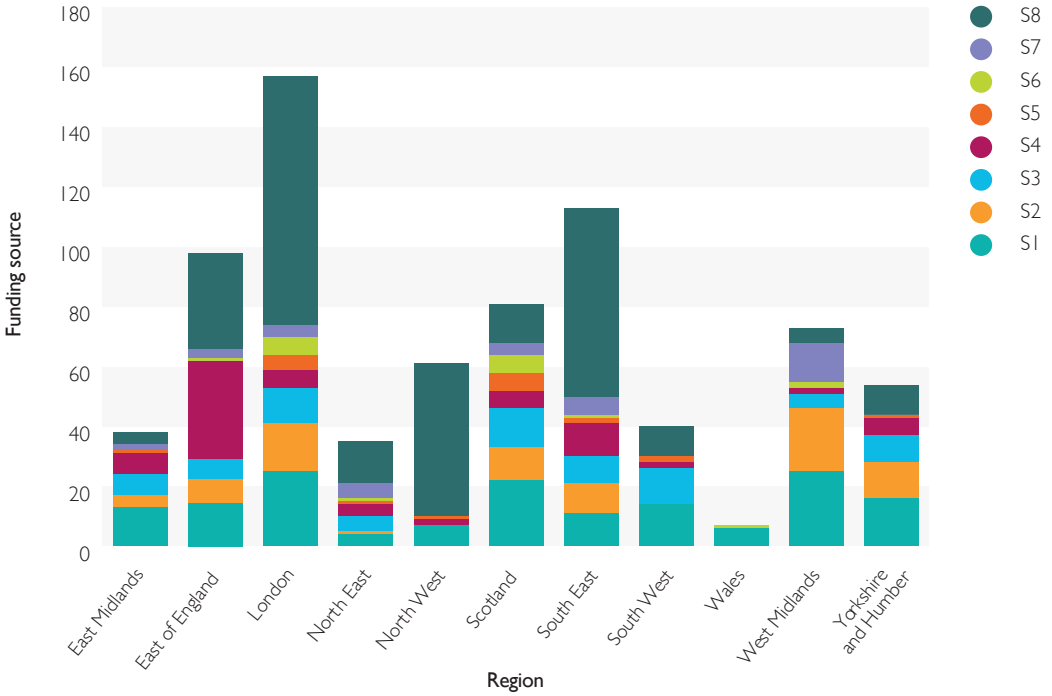
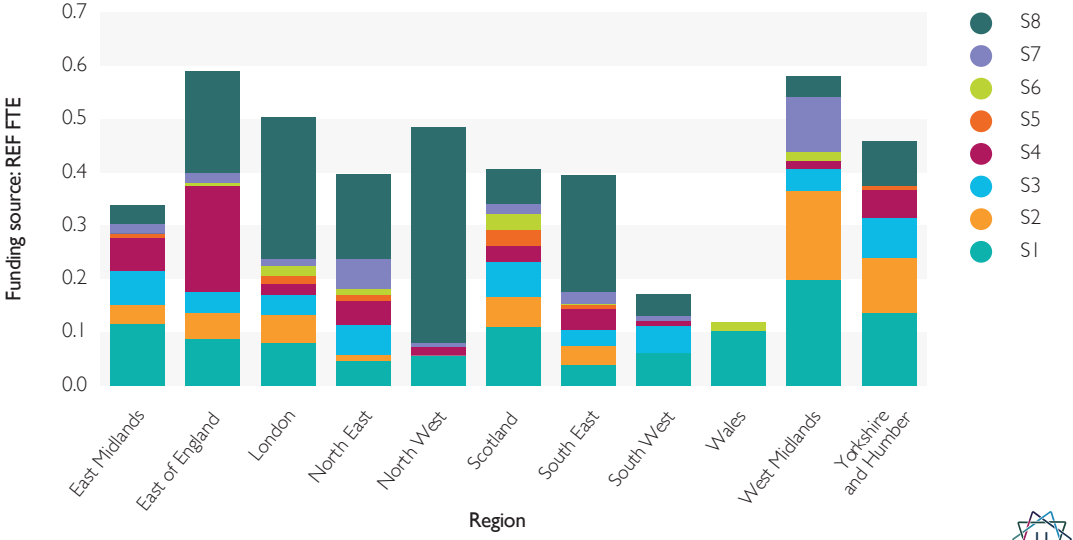


Chart 21. Funding source: REF FTE ratio by region



Appendix

Categories and blocks used in the survey.
The column of bold numbers gives the number of postdocs in the corresponding set.

Field numbers

F01	Algebra, algebraic geometry, category theory	**52**
F02	Differential geometry and topology	**27**
F03	Number theory	**30**
F04	Combinatorics, Logic	**17**
F05	PDEs and analysis	**27**
F06	Mathematical physics and integrable systems	**59**
F07	Continuum mathematics	**41**
F08	Numerical analysis	**26**
F09	Modelling	**40**
F10	Mathematical biology	**27**
F11	Industrial mathematics	**15**
F12	Statistics, Applied Probability and OR	**102**
F13	Data science	**28**
F14	Probability, sPDEs (or Financial)	**28**
F15	Dynamical systems	**21**
F16	Unknown or unspecified	**216**

Block Field numbers

FB1	F01, F02, F03, F04, F05, F15	**174**
FB2	F06, F07, F08, F09, F10, F11	**210**
FB3	F12, F13, F14	**158**
FB4	F16	**214**

Funding sources

S1	EPSRC	**159**
S2	EU	**83**
S3	BBSRC	**80**
	ESRC	
	MRC	
	NERC	
	STFC	
	Research council from another country	
	Royal Society	
	CRUK	
	Royal Astronomical Society	
S4	Institutional	**78**
S5	Industrial	**16**
	Innovate UK	
S6	ATI	**18**
	Heilbronn	
	Government	
	Scottish Funding Council	
S7	Charity	**39**
	Leverhulme	
	Gates	
	Simons	
S8	Unknown or unspecified	**283**

Country Blocks

CB1	UK	**130**
CB2	EU (non-UK)	**208**
CB3	USA	**25**
CB4	Other	**143**
CB5	Unknown	**250**

Regions

England	
London	Birkbeck
	Brunel
	City
	Greenwich
	Imperial
	King's College
	London Met
	LSE
	Royal Holloway
	QMUL
	UCL
South East	Brighton
	Kent
	Open
	Oxford
	Portsmouth
	Reading
	Surrey
	Sussex
South West	Bath
	Bristol
	Exeter
	Plymouth
	Southampton
	West of England
East Midlands	Leicester
	Loughborough
	Nottingham
West Midlands	Aston
	Birmingham
	Coventry
	Keele
	Warwick
East of England	Cambridge
	East Anglia
Yorkshire and Humber	Hull
	Leeds
	Sheffield
	Sheffield Hallam
	York
North East	Durham
	Newcastle
	Northumbria
North West	Chester
	Lancaster
	Liverpool
	Manchester
Scotland	Aberdeen
	Dundee
	Edinburgh
	Glasgow
	Heriot Watt
	St Andrews
	Stirling
	Strathclyde
Wales	Aberystwyth
	Cardiff
	South Wales
	Swansea
Northern Ireland	Queen's Belfast

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