How much is too much?

Cross-subsidies from teaching to research in British universities

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About the Author

Vicky Olive is a postgraduate student studying for an MPhil in Economics at University College, Oxford, where she previously studied Philosophy, Politics and Economics. Vicky has also spent time working for the Department for Business on migration and international students.

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The author and HEPI are responsible for any errors or opinions herein.

Because a number of different official sources are used for information on UK research spending, not all the figures in this report are directly comparable with one another even when they purport to cover the same areas.

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Foreword

David Coombe, Director of Research, LSE

Research remains underfunded in the UK despite more than a decade of enhanced 'full economic cost' funding and students are picking up the bill. That is the stark message of this report. Significant injections of new cash into the science and research budget in recent years, with promises of more to come – essential though they are – could make matters worse, not better. The problem is not only in the volume of funding; it is the practice of research funders to demand more than they are willing to pay for.

Institutions have no real choice but to accept the terms offered. Few can turn down grants which serve their missions and enhance their reputations. But as every Finance Director knows, with each grant comes yet further strain on already-stretched institutional research infrastructure. When that deficit amounts to £3.3 billion per annum – and when it is seen to be growing every year – the problem can no longer be ignored.

Why has this happened?

- Because commitments set out over a decade ago to move towards full economic costing of research have broken down. Indeed, they are in reverse, and at an accelerating rate.

- Because a shift in funding towards challenge-led approaches unintentionally changes the nature of Research Councils from research funder to research contractee.

- Because funders have lost all sight of the problem, and increasingly seek match funding, intent on maximising bang for their buck with no regard for the long-term implications.

Perhaps this is all most apparent in the funding rules for the new Global Challenges Research Fund (GCRF), where higher education institutions are expected to contribute from their own resources and where government should have recognised that for them to effectively match fund the UK's aid budget and contribute directly to international development efforts is unreasonable and unnecessary. That this benefits the developing economies and not the UK's is either a sign of altruism (by government, on behalf of institutions), or more likely of policymakers' inability to shake out of ingrained habits.

This report sounds the alarm that UK research cannot continue to be funded on such unsustainable principles. UK research is a huge success story, but we are in danger of contributing to what Lord Sainsbury warned was 'a race to the bottom' rather than a race to the top. The report is full of facts that should bring us up sharply. Perhaps the most shocking (though not to finance directors) is that over a quarter of research is unfunded and that teaching bears the brunt of this: 'teaching [income] funded 13 per cent of all UK university research in 2014/15; almost £1 in £7 spent on research came from surpluses on teaching.' At a time when undergraduate tuition fees are under scrutiny, the need to resolve the problems from the angle of teaching becomes compelling.

The current policy of HEFCE ('to secure levels of public funding for higher education that are sufficient to meet the full costs of activities for a specific volume') is in tatters. It cannot be sensible

to muddle along, robbing Peter to pay Paul. The creation of two funding bodies in place of one (UKRI and OfS) provides opportunity to do so. Neither should preside over a funding model in which one underfunds and jeopardises research sustainability while the other risks exploiting students. Both have the regulatory power to ensure that institutions operate their research and teaching activities sustainably in a TRAC-compliant way and to regulate a market in which institutions are forced to compete for research funding on price and to over-trade on research – the very problems full economic costing was introduced to solve.

It is my hope this report will act as a catalyst in bringing together all the key parties to map out a more sustainable funding framework for the future. The quality of UK research is second (almost) to none; it makes a significant contribution to the future of humanity and our planet, to growth and productivity, to quality of life and wellbeing and it makes a significant contribution to the careers of academics and the reputation of institutions. It is critical that its funding should be managed on a sustainable basis if we are to retain our place in the future.

Preface by Nick Hillman

Some of the key arguments in this paper are well known. For example:

- the UK Government does not fund the full economic cost of university research, despite a commitment to do so over a decade ago;
- the shortfall is partly made up by international students, who pay more than the full economic cost of being taught; and
- students are asking more questions than ever before about cross-subsidies within their institutions.

What is different about this publication is that it brings a greater level of detail to the debate – and in an accessible form. Vicky Olive shows just how big the shortfall in research spending is, what the consequences of failing to address it are and how the student voice might be heard in the debate.

In the past, and despite the best efforts of BUFDG (the British Universities' Finance Directors' Group), there has been a gap between the financiers and the policymakers. The former have produced the data but the latter have not always engaged with the numbers fully, hampered in part by the limited transparency of the TRAC (Transparent Approach to Costing) exercise.

The end result has been less well-informed conversations in the corridors of power about the right level of support for the UK's world-class research base, at least when compared with other important areas of public spending.

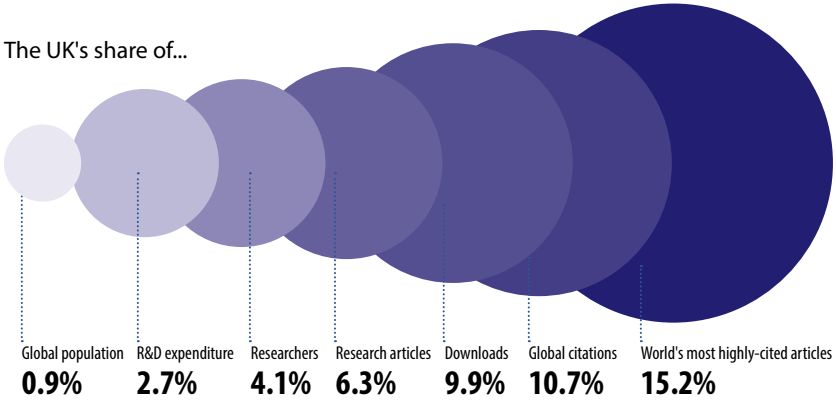
So we are producing this report now in the hope that it helps to shape the backdrop to future fiscal events, such as the next spending review.

We believe decisions taken then need to recognise that:

- research has been underfunded against the commitments that were made on introducing full economic costing more than a decade ago;
- there could be serious unintended consequences – for example, in terms of regional disparities – from squeezing research funding; and
- spending freezes – in cash or real-terms – have gone as far as they can without causing serious and irreparable damage to our national research base.

To date, the UK's research base has been remarkably efficient. Research undertaken by Elsevier for the UK Government published in 2013 famously showed the UK had 0.9 per cent of the global population, 3.2 per cent of the world's research and development expenditure and 4.1 per cent of researchers, but produced 6.4 per cent of all research articles, 9.5 per cent of research article downloads, 11.6 of citations and 15.9 per cent of the world's most highly-cited articles. That record has since deteriorated somewhat as shown below.

UK's research input and output 2014



Source: Elsevier for the Department for Business, Energy and Industrial Strategy, *International Comparative Performance of the UK Research Base 2016,* 2017, p11

The way to protect to improve things cannot be to spend less. Indeed, maintaining our strengths in an ever more competitive global research environment and given the relatively new challenges posed by Brexit, must mean more resources being put to even better use.

Introduction

UK universities rank among the best in the world, and the UK is a strong performer on the global research stage. The UK has 12 universities in the top 100 universities worldwide and three in the top 10, according to the 2018 *Times Higher Education* World Rankings.[1] UK universities attract students and researchers from across the globe: in 2015/16, 30 per cent of academic staff and 20 per cent of students came from non-UK backgrounds.[2]

The UK punches above its weight as a research nation.[3] UK government spending on research and development as a proportion of gross domestic product (GDP) is 1.7 per cent and has been consistently below the Organisation for Economic Co-operation and Development (OECD) average. Yet the UK is a top performer on the global stage in producing research of the highest quality. In 2014, the UK was ranked first by field-weighted citation impact (an indicator of research quality).[4] The UK is a highly-productive research nation in terms of articles and citation outputs per researcher and per unit of research and development expenditure.[5] For example, in terms of citations per pound spent, UK research productivity is 3.6 times the world's average.[6]

Yet research is underfunded across the UK, challenging both the long-term sustainability of the higher education sector and the UK's position as a global competitor in research and higher education. The latest Transparent Approach to Costing (TRAC) data published by the Higher Education Funding Council for England (HEFCE) for 2014/15 show a research deficit of almost £3.3 billion across the sector in the UK, amounting to 37 per cent of research income.[7] This has traditionally been filled from non-publicly-funded teaching surpluses (mostly from

international students) and other income, including activities such as consultancy and technology transfer. **On average, over the duration of their degree, each non-EU student contributes over £8,000 to UK research.**[8] However, there is no guarantee that these sources of income will continue to be available in sufficient quantities to fill the gap in research funding.

How much do non-EU students contribute to UK research?

On average, in the UK:

- fees for non-EU students are £13,461 per year;
- institutions make a surplus of 28 per cent on non-publicly funded teaching, which goes towards subsidising UK research;
- the surplus per non-EU student per year is £3,770; and
- non-EU students study for 2.13 years.

So, on average, over the course of their degree, each non-EU student contributes over £8,000 to UK research.

For the UK higher education sector to maintain the strong global position and for the UK to continue to benefit from its universities as now it is not sufficient for universities to balance their accounts in the short-term; they must be financially sustainable in the medium to long-term. **In 2014/15, the UK higher education sector had a sustainability gap of £1 billion**: the difference between the actual surplus and the surplus required to cover long-term costs.

The Financial Sustainability Strategy Group aims to help the UK higher education sector understand and manage its academic

and financial sustainability. They identified sustainability as being:

> *strategic and forward-looking about [the] delivery of the chosen strategies and activities of the institution in the expected circumstances in the medium term.*[9]

While research is loss-making, it must be subsidised by other income streams, which means this income is not available for use on infrastructure and other long-term investments necessary for the UK to continue to meet the global challenges of higher education. The Financial Sustainability Strategy Group suggested that not investing sufficiently in the financial sustainability of universities could damage the international standard of UK higher education, 'the opportunities for current and future generations of students and threaten our national success and influence'.[10]

There are strong incentives for university staff to invest in research rather than teaching, even though research is loss-making. University league tables, nationally and internationally, are largely based on research performance. Researchers' career progressions have depended mostly on their research output, such as papers and citations, rather than teaching.

However, students are increasingly demanding more information on where their tuition fees go and better value for money, which may or may not include subsidising research at the current level. Moreover, the introduction of the Teaching Excellence Framework (TEF) alongside the Research Excellence Framework (REF) puts new pressure on, and within, universities to excel in both teaching and research, rebalancing incentives somewhat in favour of teaching. The separation of HEFCE's teaching and research roles through the formation of the new

Office for Students (OfS) and UK Research and Innovation (UKRI) is also likely to produce to additional questions over the validity of cross-subsidies from teaching to research, particularly from public funds.

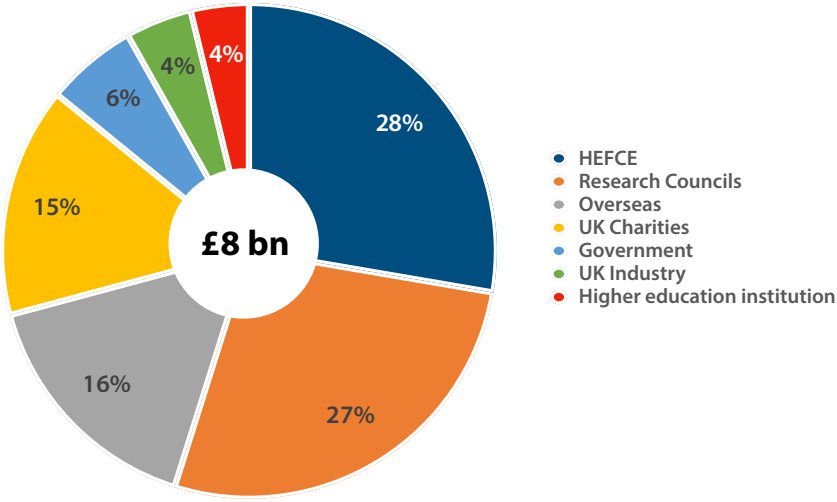
The challenge for government and universities is to identify their research priorities and values and to make a long-term plan to fill the research gap to ensure the UK higher education system is financially sustainable, and that our research base is contributing to future economic prosperity and people's wellbeing across the world.

About UK research funding

In 2015, total research and development (R&D) expenditure was £31.6 billion, 1.7 per cent of GDP. Of this, £8 billion (25 per cent) was spent by higher education institutions and £20.9 billion (66 per cent) by industry.[11]

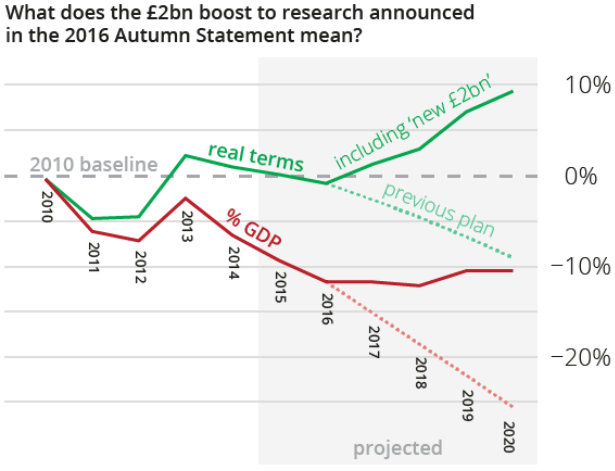
Within higher education, £4.9 billion (61 per cent) came from the government. This includes £4.4 billion of spending through the science and research budget for Research Councils and the funding councils, as well as spending for projects commissioned by government departments.[12]

Sources of research funding in UK universities 2015/16



Source: Office for National Statistics, *UK gross domestic expenditure on research and development (R&D) 2015*, 2017 https://www.ons.gov.uk/economy/governmentpublicsectorandtaxes/researchanddevelopmentexpenditure/datasets/ukgrossdomesticexpenditureonresearchanddevelopment

The Coalition Government ring-fenced the science and research budget (which excludes departmental research budgets) in cash-terms at £4.6 billion in the 2010 Comprehensive Spending Review. Since 2015, the ring-fence has been maintained in real terms, rising each year with inflation. So in 2015/16, it was £4.7 billion. An additional £1.1 billion has been invested in capital for R&D each year since 2015. In the 2016 Autumn Statement, the Government committed to an additional £4.7 billion of funding for research and development, to be delivered by 2020/21 – an extra £2 billion a year by the end of this Parliament.[13]



The UK's 'dual funding' system for university research is made up of project grants, distributed by the seven Research Councils, which amounted to £2.7 billion in 2015/16, and Quality-Related (QR) block grants, distributed by the funding councils on the basis of the Research Excellence Framework, which totalled £1.6 billion in England.[14] Although HEFCE is being

replaced, this dual funding system will continue because the new UK Research and Investment body will comprise the seven Research Councils and Research England, which will take on HEFCE's old research functions. Indeed, the dual nature of the support is guaranteed in Section 103 of the Higher Education and Research Act 2017.

In 2014/15, 14 per cent of research income came from the EU. The relative importance of EU funding differs by discipline and institution. This funding is at risk from the decision of UK voters to leave the EU, although several non-EU countries participate in EU science networks and receive EU funding for research. Even if this were not an option for the UK, the Government could opt to increase research spending to compensate.[15]

Other facts and figures

In the financial year 2014/2015, total income across UK higher education institutions was £32.4 billion of which £17.9 billion came from teaching and £8.8 billion from research.[16] The full economic costs (which include both direct and indirect costs) were £33.5 billion, of which £16.4 billion were for teaching and £12.1 billion for research.

There was a research deficit of almost £3.3 billion, 37 per cent of research income. In contrast, teaching made a surplus, with non-publicly-funded teaching making a surplus of about £1.3 billion (28 per cent of income). Publicly-funded teaching (largely home and EU students) across the UK covered its costs overall, although this headline finding masks substantial cross-subsidies from some disciplines to others.[17]

UK higher education institution income and full economic costs

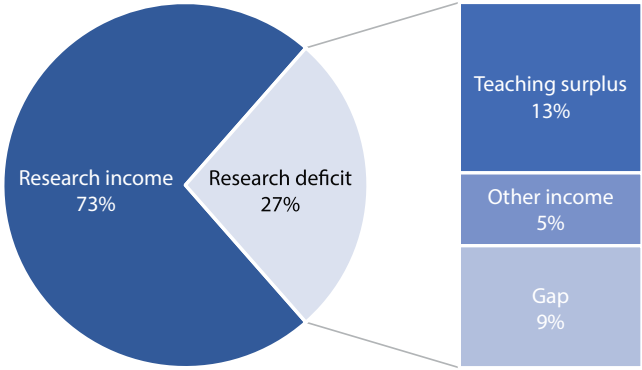
	Teaching		Research	Other	Total
	Publicly-funded	Non-publicly-funded			
Income (£B)	13.3	4.6	8.8	5.7	32.4
Full economic costs (fEC) (£B)	13.1	3.3	12.1	5.0	33.5
fEC recovery 2014/15 (income as % of costs)	**101.7**	**139.0**	**72.9**	**112.9**	**96.7**
fEC recovery 2013/14 (income as % of costs)	101.6	136.8	74.8	108.8	96.6

Source: Higher Education Funding Council for England, *TRAC income and costs by activity 2014-15,* 2016. See: http://www.hefce.ac.uk/data/year/2016/tracincome/ Although we acknowledge that TRAC is not without problems, addressing the concerns surrounding TRAC are beyond the scope of this paper.

Universities, like most large institutions, use surplus income in some areas to subsidise deficits in others. **The surplus from teaching funded 13 per cent of all UK university research in 2014/15. Almost £1 in £7 spent on research came from surpluses on teaching.**

The size of the cross-subsidy differs between universities. This is due to factors such as an institution's research intensity, its number of non-EU students, its international fee levels and the proportion of high-cost subjects taught. High-cost subjects are identified by HEFCE as those costing more than £7,500 per student per year to teach on average, such as Medicine, Engineering, Science and Agriculture.[18] HEFCE provides funding to English institutions to cover (some or all of) the additional costs, and the Scottish Funding Council does the same for Scottish institutions. However, universities tend to make a loss on teaching high-cost subjects and have to subsidise them from lower-cost, classroom-based subjects.

UK Research Income Sources 2014/15

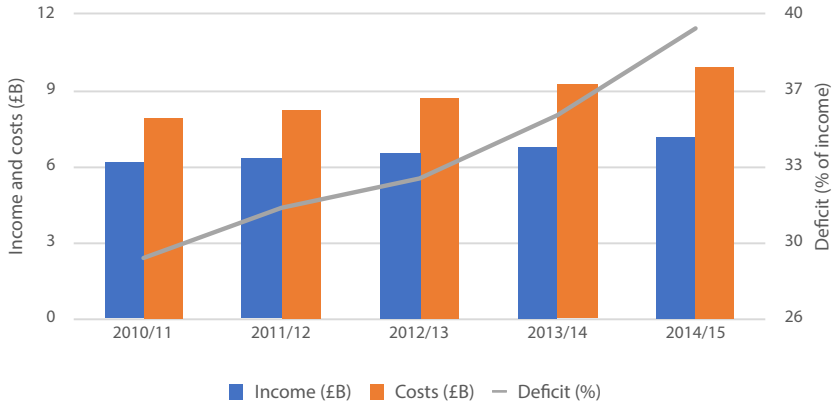


Source: Higher Education Funding Council for England, TRAC income and costs by activity 2014-15, 2016. See: http://www.hefce.ac.uk/data/year/2016/tracincome/

The research deficit is not a new phenomenon but it has grown in recent years as costs have risen more quickly than income. In 2010/11, the research deficit in England was 29 per cent (£1.8 billion). It has risen steadily each year to 40 per cent (£2.8 billion) in 2014/15. This demonstrates the systemic underfunding of research, which requires universities to cross-subsidise from other income to fund research, putting pressure on their other roles, such as providing high-quality teaching and their ability to contribute directly to the social and economic vibrancy of their local communities.

Furthermore, in 2014/15 the UK higher education sector had a sustainability gap of over £1 billion, identified in TRAC as the difference between the actual operating surplus and the target sustainability surplus required to cover long-term costs.[19] This should be a cause for concern for the sector, since without long-term investment in infrastructure and capital, as well as the short-term spending on its core functions, UK universities will stagnate while the rest of the world forges ahead. In fact, we are already losing out relative to other countries, who are forging ahead in terms of research. For example, 'Italy now has more articles per researcher than the UK and all other comparator countries … and its field-weighted citation impact is set to rise above both the UK and Canada if current trends are maintained'.[20]

Research income, costs and deficit (England only)

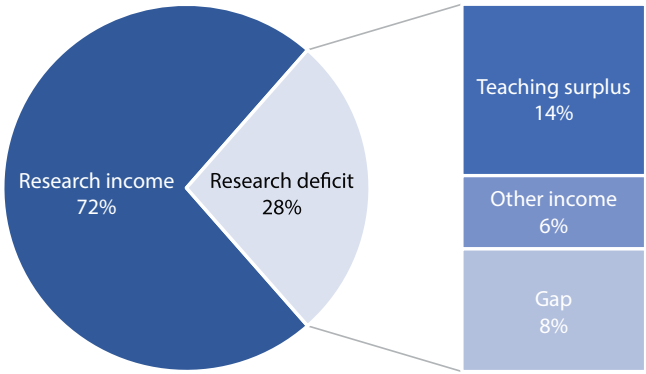


Source: Higher Education Funding Council for England, TRAC income and costs by activity 2014-15, 2016. See: http://www.hefce.ac.uk/data/year/2016/tracincome/

England

English higher education institutions accounted for 84 per cent of total UK university income in 2014/15, and 81 per cent of research income. England achieves a similar level of recovery of the full economic costs as the UK as a whole (71.8 per cent of research costs compared to 72.9 per cent in the UK as a whole). **The research deficit in England was £2.8 billion (40 per cent of income), of which £1.4 billion (14 per cent) was made up from surpluses on teaching.**

England research subsidies 2014/15

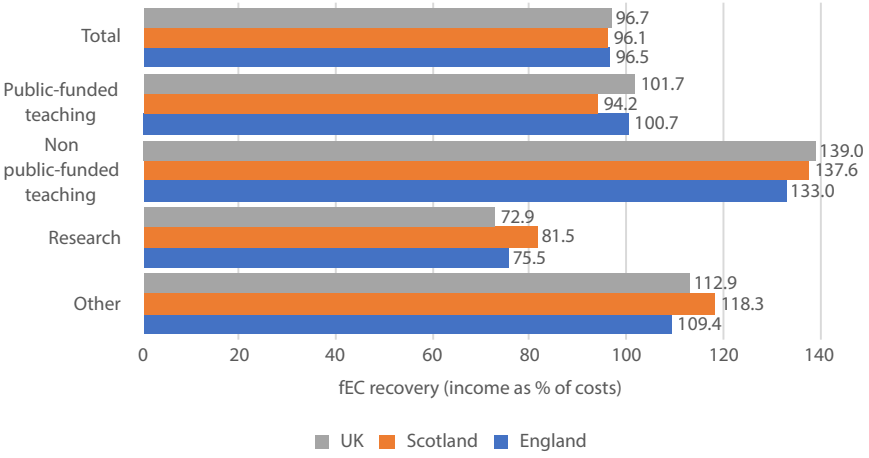


Source: Higher Education Funding Council for England, TRAC income and costs by activity 2014-15, 2016. See: http://www.hefce.ac.uk/data/year/2016/tracincome/

Scotland

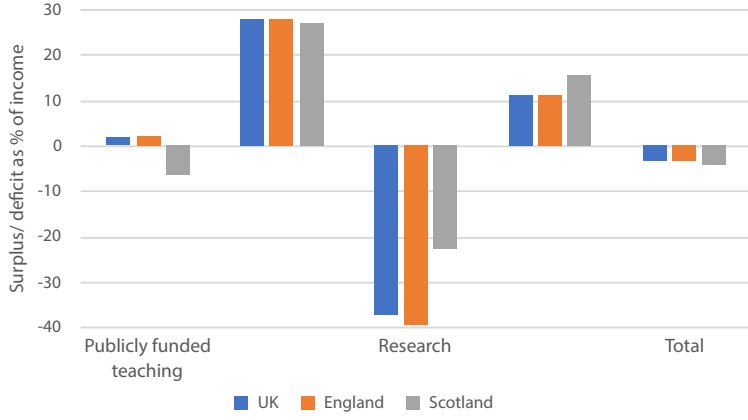
The income of Scottish higher education institutions accounts for 11 per cent of total UK university income, but because Scottish institutions are disproportionately strong in research they receive 13.7 per cent of total UK university research income. Scottish universities face a smaller research deficit than English universities: 23 per cent compared to 40 per cent in 2014/15. However, they also make a deficit on publicly-funded teaching of 6 per cent. This is due to the different funding system for undergraduates. (Scottish and EU undergraduate students in Scotland pay no tuition fees, but universities received an average of £7,000 to teach each one from the Scottish Funding Council).[21] On 'Other' income sources, which includes commercial and trading activities, Scottish universities make 15.5 per cent surplus compared to 11.5 per cent in England.[22] Yet the general picture is comparable in Scotland and England, as illustrated by the following charts.

fEC recovery in England and Scotland 2014/15



Sources: Higher Education Funding Council for England and Scottish Funding Council, *TRAC data 2014/15*

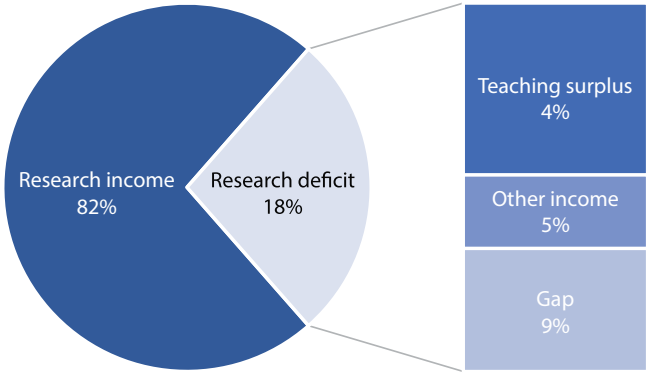
Surplus and deficits in the UK, England and Scotland 2014/15



Sources: Higher Education Funding Council for England and Scottish Funding Council, *TRAC data 2014/15*

Since publicly-funded teaching makes a deficit in Scotland, to calculate the level of cross-subsidy between teaching and research we must make an assumption about how this deficit is filled. We assume that non-publicly-funded teaching subsidises publicly-funded teaching in Scottish universities to fill the £74 million deficit (6 per cent) so that teaching overall covers its costs. So the remaining £57 million of non-publicly-funded teaching income funds 4 per cent of research, compared to 14 per cent in English universities. **Less than £1 in £20 of teaching surplus funds research in Scotland.**[23]

Scotland research income sources 2014/15



Source: Scottish Funding Council, *TRAC 2014-15* http://www.sfc.ac.uk/governance/institutional-finance-governance/institutional-finance/university-finance/transparent-approach-costing.aspx

Oxbridge

The University of Oxford and the University of Cambridge differ from other universities in that the collegiate system provides an additional and separate stream of income and costs not included in TRAC – plus the two institutions are more financially secure. Furthermore, their teaching style based on small group tutorials increases the cost of teaching. The annual average cost of teaching an Oxbridge undergraduate student is said to be at least £16,000 (including the cost to colleges).[24]

Oxford and Cambridge subsidise research and teaching from other sources. They have additional sources of income that are not available to other institutions on the same scale, such as larger donations and legacies and trade benefits – for example, the University of Oxford received £120 million from Oxford University Press in 2014/15. This income plugs some of the gap in the cost of teaching as well as research.

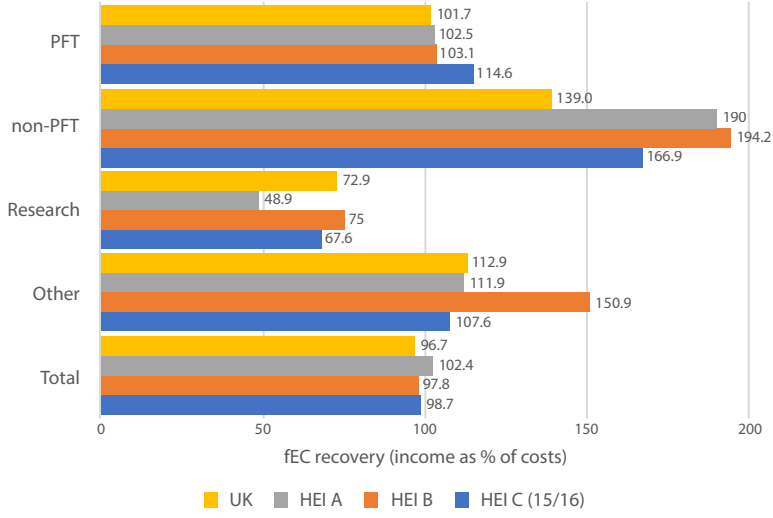
University of Oxford, 'Finance and funding', accessed 26 November 2017 https://www.ox.ac.uk/about/organisation/finance-and-funding?wssl=1

Case Studies

Case studies from three research-intensive universities show that although there are differences within the sector across the metrics, the general conclusions are consistent. Recovery of the full economic cost of research is well below 100 per cent, and this gap is cross-subsidised by income from other sources. Non-publicly-funded teaching (non-PFT) makes a large surplus, while publicly-funded teaching (PFT) and

other activities generally recover slightly more than the full economic cost.

Recovery of full economic cost 2014/15

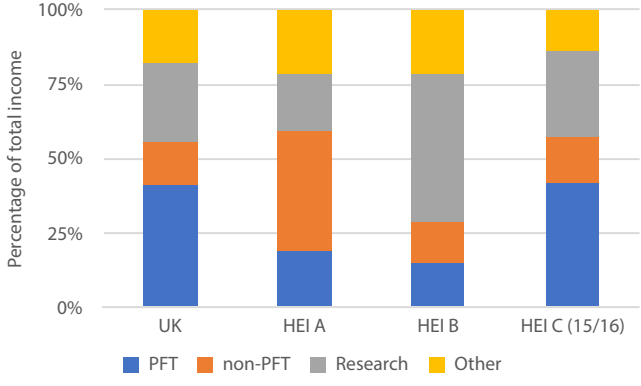


Sources: TRAC data 2014/15 and private data

In two of the three universities, and across the sector as a whole, more than half of *income* comes from teaching (publicly-funded and non-publicly-funded) but in all of the universities, and the sector as whole, less than half of *expenditure* is on teaching.

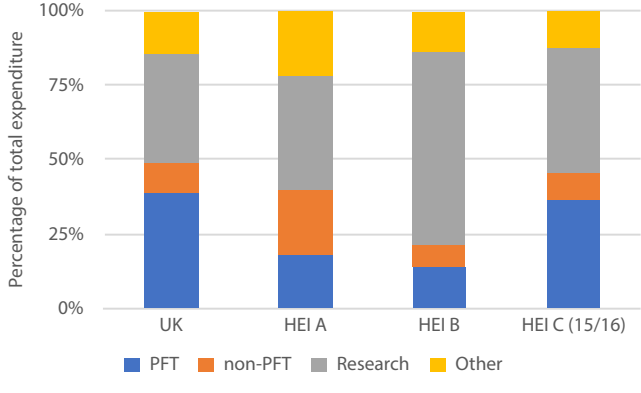
These three research-intensive universities generally spend more on research than the UK average.

Breakdown of income 2014/15



Sources: TRAC data 2014/15 and private data

Breakdown of expenditure 2014/15



Sources: TRAC data 2014/15 and private data

History of Full Economic Costing

Full economic costing (fEC) has been described as:

> *a means of estimating the cost that the University would incur if it were investing in its resources and infrastructure at a level appropriate to ensure that it could continue to survive and maintain its capacity in the long term.*[25]

The full economic cost includes:

- **directly-incurred costs** – items or services incurred or purchased specifically for a project, such as research staff who work only on one research project and equipment only for that project;
- **directly-allocated costs** – costs of shared services and facilities used by the project, such as a proportion of the Principal Investigator's salary and the cost of running the department or laboratory; and
- **indirect costs** – not directly related to any one project and include central administrative and service costs such as the cost of human resources and library facilities.

Full economic costing of publicly-funded research projects was considered by the UK Government in the *Science and Innovation Investment Framework 2004–2014*, published in July 2004, which showed a commitment to move towards full economic costing over the next decade:

> *Proposals to Research Councils will be made on a full economic cost basis, funded at a higher proportion of that cost than at present, from September 2005. Thereafter, the Government will provide resources over subsequent*

> *spending review periods to enable Research Councils to provide close to the full economic costs of their university-conducted research by early in the next decade, thus enabling universities to invest more of their core funding in supporting projects from other external funders and their own self-directed work.*[26]

Other research sponsors, including industry partners and government departments, were also expected to move towards funding the full economic cost of research that they commissioned, depending on the extent to which the research provided wider public benefits. HEFCE and other Funding Councils would also provide additional block grants with the intention of filling the gap in charity-supported research.

In September 2005, the UK Research Councils adopted this full economic costing approach and agreed to pay 80 per cent of the fEC, which represented a substantial increase in research funding. Other government departments also committed to moving to funding projects on this basis.[27]

In April 2009, Professor Alan Alexander chaired a report reviewing the impact of fEC in which he found that:

> *almost all measures of HEI [Higher Education Institution] sustainability have significantly improved during the current decade, with a major part of this increase being due to the introduction of fEC payments by Research Councils and other funders. ... While research funding has markedly increased, and most of the metrics used to measure financial and physical sustainability have recorded improvements, it is of concern that the Transparency Review for 2007/08 concluded that research*

> *makes an annual TRAC-adjusted deficit in excess of £2 billion. Operating surpluses have declined since 2005-06 for the major research active universities, and there is a risk that the current recession and the consequential movement in exchange rates, together with increases in university salary and utilities costs, may jeopardise the gains in physical and human sustainability which have been achieved.*[28]

In June 2010, Sir William Wakeham reviewed the sustainability and efficiency of fEC. Wakeham found that 'evidence at a national level from annual TRAC returns over several years suggests that the income which universities receive to carry out research is not fully covering the costs of undertaking this research'. He recommended that the 'volume of research being carried out by UK HEIs [higher education institutions] is monitored at a national level on an annual basis' to ensure any growth in research volume is sustainability funded.[29]

Additionally, Wakeham proposed a series of efficiency savings. Professor Ian Diamond conducted two efficiency reviews in 2011 and 2015. In total, £1.38 billion of efficiency savings in England were reported in 2011, with additional efficiencies totalling more than £1 billion between 2011/12-2013/14.[30] UK universities are a "top performer' in using resources effectively to deliver excellent outcomes in both teaching and research' but efficiency savings have their limits.[31]

Since 2010, even less of the full economic cost of publicly-funded research projects have been funded, as the effects of austerity hit. On average across the UK in 2014/15, Research Councils and industry funded at just 72 per cent of fEC, less than the 80 per cent of fEC that was committed to over a decade ago. Government departments funded at 78 per cent.

These levels of fEC recovery are representative of the past few years, which just as Alexander argued long ago may jeopardise the long-term sustainability of universities.[32]

Research sponsor types

	Recurrent funding council funding	Institution-own funded	Postgraduate research	Research Councils	Other government departments	EU	UK charities	Industry	Total research
Income (£m)	1,955	261	1,088	1,841	964	745	1,055	893	8,802
fEC (£m)		2,118	2,013	2,563	1,229	1,142	1,767	1,235	12,067
fEC recovery 14/15		**12.3**	**54.1**	**71.8**	**78.4**	**65.3**	**59.7**	**72.3**	**72.9**
fEC recovery 13/14		12.6	55.4	73.6	78.4	67.3	62.8	71.7	74.8

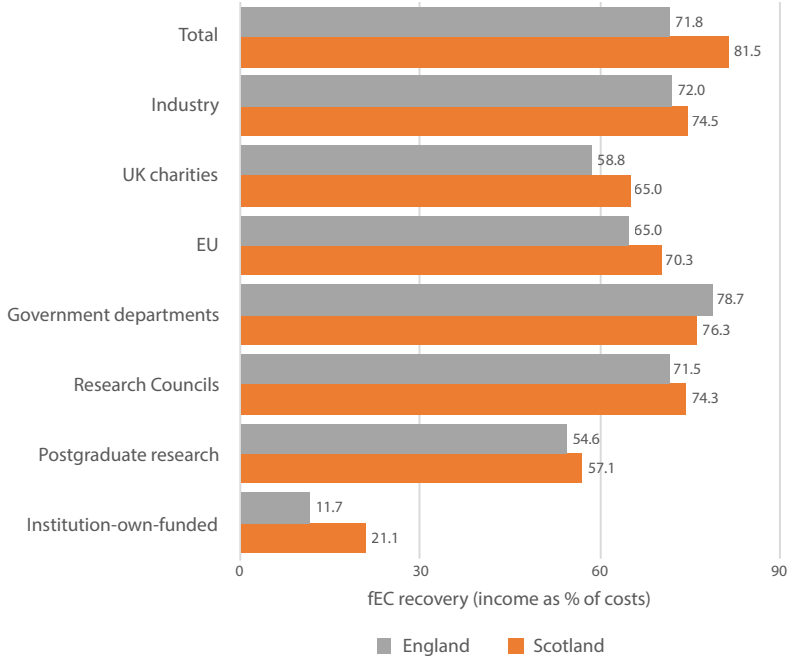
Source: Higher Education Funding Council for England, *TRAC income and costs by activity 2014-15*, 2016, excluding RDEC. See: http://www.hefce.ac.uk/data/year/2016/tracincome/

The picture is similar in Scotland and England, although Scottish universities are somewhat better at recovering the full economic cost of research projects in general. In Scotland, across the sector, 82 per cent of research costs in 2014/15 were recovered, compared to 72 per cent in English universities in the

same year. Scotland recovered more of the costs on research where funding came from:

- **Research Councils** – 74 per cent recovery in Scotland compared to 72 per cent in England;
- **UK charities** – 65 per cent recovery in Scotland compared to 59 per cent in England; and
- **the EU** – 70 per cent recovery in Scotland compared to 65 per cent in England.

fEC recovery by research funding source (excluding QR funding) 2014/15

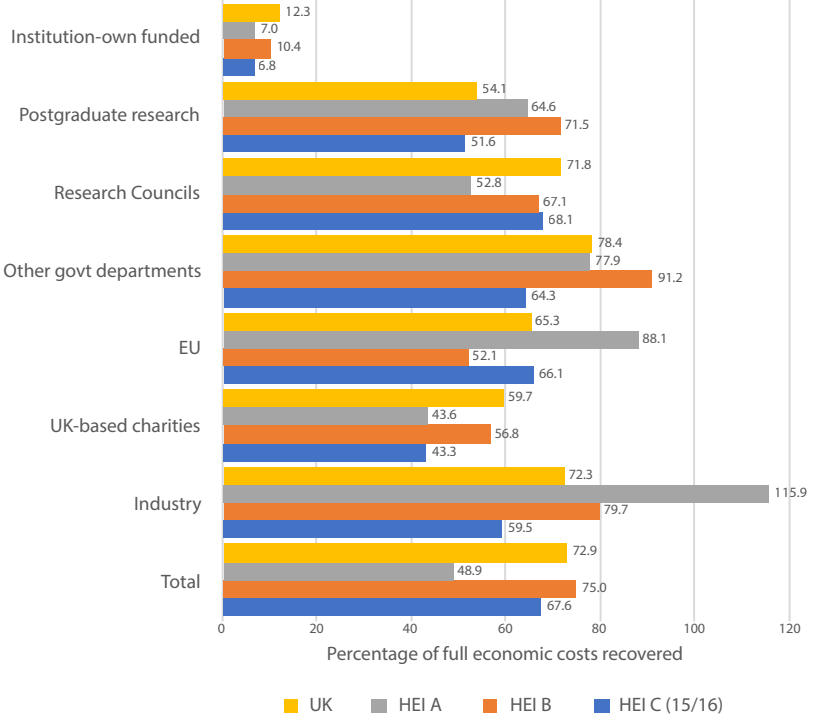


Sources: Higher Education Funding Council for England and Scottish Funding Council, TRAC data 2013/14 – 2014/15

Case studies

Our three case study higher education institutions (HEIs) generally reflect the wider picture. Although there are some relatively large differences in fEC recovery, the general trends hold: research is funded below the full economic cost. In particular, charity projects generally do not cover costs and Research Councils do not fund at 80 per cent fEC.

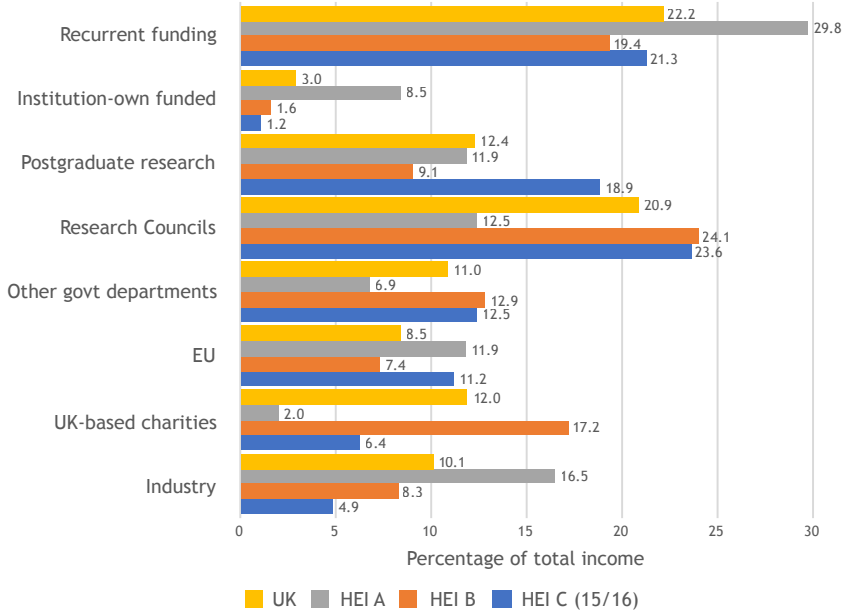
Recovery of full economic cost by research type 2014/15



Sources: TRAC data 2014/15 and private data

Across the three case study universities, Research Councils fund below 70 per cent, which is below the UK average. There is a big difference in fEC recovery between the institutions for research funded by other government departments, ranging from 64 per cent to 91 per cent, and by the EU, ranging from 52 per cent to 88 per cent. Charities consistently fund below 60 per cent while two of our three case study institutions do not recover the full economic cost on industry research.

Breakdown of research income 2014/15



Sources: TRAC data 2014/15 and private data

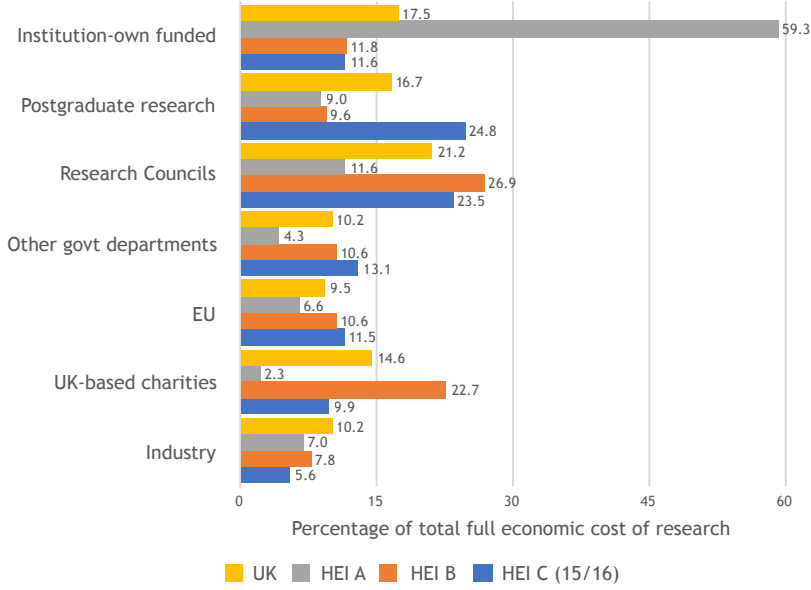
The different HEIs have quite different research income breakdowns as shown in the chart above:

- HEI A is more dependent on recurrent funding from funding

councils and industry funding, and less dependent on Research Council and government department funding than the other institutions;

- HEI B gets a larger proportion of income from charities than the other institutions but less from the EU; and
- HEI C receives more from postgraduate research – almost double the proportion of the other HEIs.

Breakdown of research expenditure by research type 2014/15



Sources: TRAC data 2014/15 and private data

Looking at expenditure on research by funding type at our case study institutions we find that:

- over half of expenditure at HEI A goes on institution-own

funded research compared to only 12 per cent at HEIs B and C;

- almost half of HEI B's expenditure is on Research Council and charity research;
- almost half of HEI C's expenditure is on Research Council and postgraduate research.

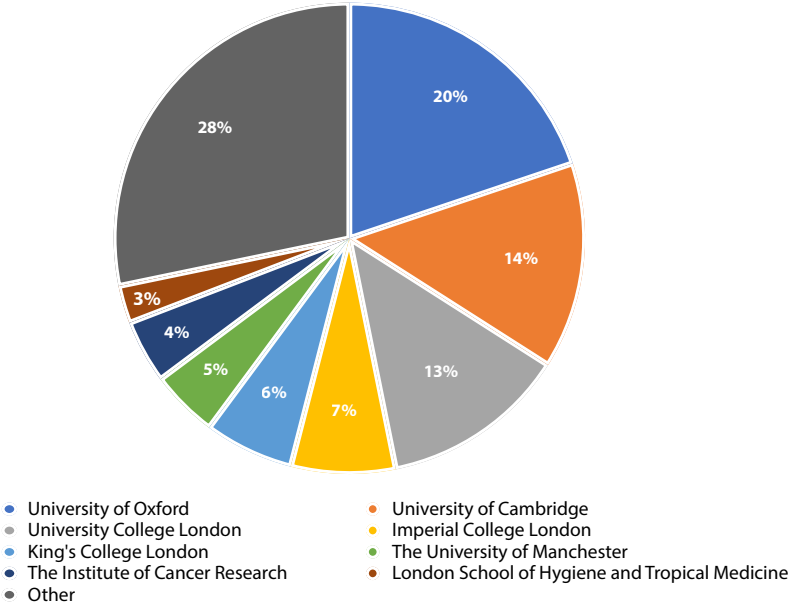
Although these are only three case studies, we believe they are representative of the wider sector or at least research-intensive universities. UK universities face largely similar recovery rates of full economic costs, although the importance of different income streams differs between institutions.

Charity research

Charity income for research projects is a particular cause of concern for a small number of universities, since charities tend to fund at a lower level than others. They generally only cover direct costs and none of the indirect costs of a research project so cover a lesser proportion of the full economic costs than other funding sources. HEFCE provides Quality-Related (QR) research funding to encourage and support universities' research collaborations with charities. In 2015/16, charity QR funding amounted to 20 per cent of institutions' total income from charities for research projects. Yet there is still a large deficit on charity research projects.

Charity research income is highly concentrated in three institutions – the University of Oxford, the University of Cambridge and UCL – which together received 47 per cent of charity research funding. Overall, 18 universities received 91 per cent of the funding.[33]

Charity research income by institution 2012/13 to 2015/16



Source: HEFCE, *2017-18 QR charity support funding and QR business research funding,* http://www.hefce.ac.uk/funding/annallocns/1718/research/

Each new research project a university takes on with charity funding is loss-making, yet universities nevertheless take on these projects to achieve citations, prestige and to improve their rankings, as well as for the public good. Furthermore, in particular disciplines, such as Medicine, charities are one of the key sources of research funding, providing around £1.6 billion a year.[34] The extent to which universities make a loss on charity-funded research could challenge the future sustainability of research in certain disciplines and universities.

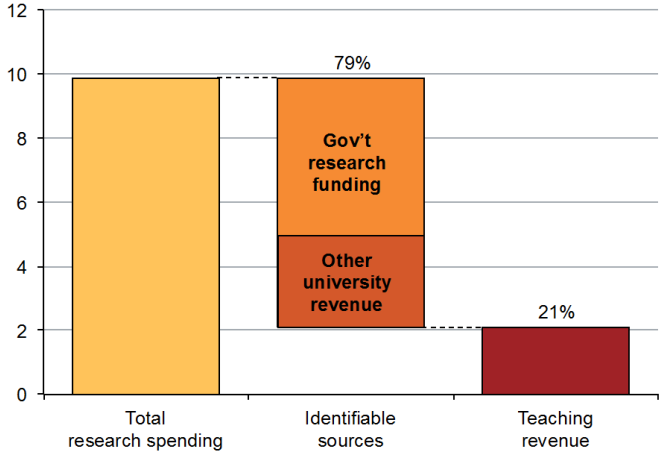
Industry sponsorship

Additionally, across the UK, industry covers less than the full economic cost. Universities frequently compete for industry funding, forcing institutions to take what they can, in the knowledge that if they ask for too much, firms will go elsewhere, including abroad. There is some QR funding to support and encourage collaboration with industry. However, universities could make a more concerted effort to recover a greater proportion of the full economic cost from industry partners, particularly when the research is not directly for the public good. Some universities aim to make a profit on projects funded by commercial sponsors, although the TRAC data suggests few, if any, are successful on a large scale.[35]

Comparison with Australia

Australia is a useful comparator as the UK and Australia have relatively similar research funding systems: both are based on a 'dual-funding' model, with project grants and block grants. There are also many other ways, beyond research, in which the UK and Australian higher education models are similar (as outlined in previous HEPI reports).[36] Furthermore, Australia has undergone similar debates regarding the nature and extent of cross-subsidies from teaching to research.[37]

Australian research funding sources



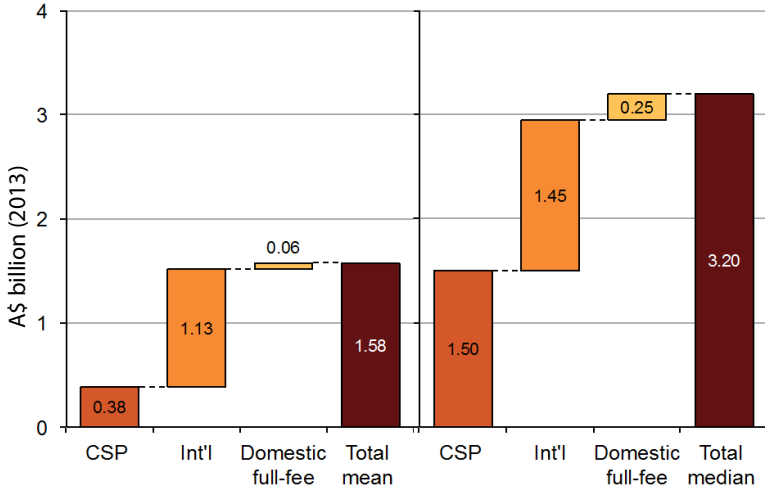
Source: Andrew Norton, *The cash nexus: how teaching funds research in Australian universities*, Grattan Institute, 2015 https://grattan.edu.au/wp-content/uploads/2015/10/831-Cash-nexus-report.pdf. Units: A$ billion

In Australia, approximately A$1 in A$5 spent on research comes from surpluses on teaching, of which a substantial proportion comes from teaching international students. The cross-subsidy has increased over recent years from 15 per

cent in 2008 to 21 per cent in 2012. Universities earn up to A$3.2 billion (£2 billion) more from students than they spend on teaching and have powerful incentives to spend the extra money on research. [38]

In Australia, the surplus on teaching is not only derived from teaching international students. The Grattan Institute estimate that the surplus on Commonwealth-supported students (home students who can receive a loan for their fees from the Australian Government) could be A$1.5 billion. They have produced two estimates, the first calculating the average surplus using the mean cost (left-hand side of the next figure), giving a surplus of A$380 million and a second using the median cost (right-hand side) giving a surplus of A$1.5 billion. The true cost to most institutions is likely to be somewhere in between, as the data is skewed so the mean cost overestimates the cost to most institutions although it is perhaps more accurate for the most research-intensive Group of Eight institutions.[39]

Surplus from teaching by fee status using mean and median costs



Source: Grattan Institute, *The cash nexus: how teaching funds research in Australian universities*, 2015 https://grattan.edu.au/wp-content/uploads/2015/10/831-Cash-nexus-report.pdf. Units: A$ billion

In Australia's dual-funding system, project funding has increased more quickly than block grants, intensifying the problem over time. This particularly affects the Group of Eight universities, which receive the majority of research funding (73 per cent of Australian Competitive Grant funding).[40] The Group of Eight spend A$6 billion on research each year but receive only A$2.5 billion from the Government.[41]

Australia has faced similar challenges to the UK over how to distribute research funding across a diverse set of universities. The Group of Eight have pushed for greater concentration of research funding. The Chief Executive, Vicki Thomson, has argued:

> *Australia's research funding system is broken: it is over-complicated and rewards research that is below world standard ... We are using scarce taxpayer dollars on research that is frankly mediocre ... Instead of an egalitarian, 'every child gets a prize' approach we should be funding excellence.*[42]

However, concentrating research funding among too few institutions could limit diversity and the ability of the sector to respond to the challenges of the future.

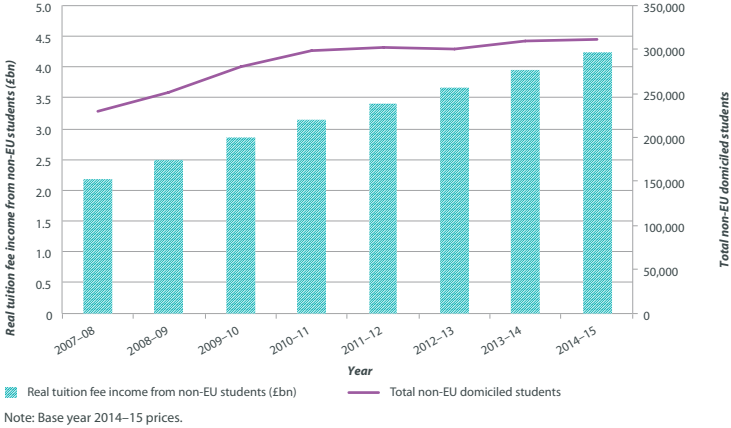
Challenges faced by the higher education sector

Non-publicly-funded teaching surpluses

International students provide a vital source of research funding at present that is not guaranteed to continue in the future at the same level.

In 2014/15, there were 437,000 international students in the UK: 125,000 EU students and 312,000 non-EU students. UK universities received £4.2 billion from non-EU students' tuition fees (undergraduate and postgraduate), generating a surplus of approximately £1.2 billion.[43] This contributed towards subsidising research and other activities. This surplus paid for about 14 per cent of research income.

Non-EU student numbers and the income from their tuition fees 2007/8 – 2014/15



Note: Base year 2014–15 prices.

Source: Universities UK, *Facts and Figures 2016*, 2016, p.14 http://www.universitiesuk.ac.uk/facts-and-stats/data-and-analysis/Documents/facts-and-figures-2016.pdf

Most estimates suggest the UK will see a decline in numbers of EU students following Brexit, due to the loss of student support that will see the cost of higher education increase substantially for EU students. The scale of the decline is difficult to forecast although London Economics estimated for HEPI and Kaplan that the UK could see a 31,000 reduction (57 per cent) in new EU students each year. However, those EU students who still choose to study in the UK could pay the higher rate of tuition fees and the loss in value of the £ could lead to more non-EU students, bringing in additional revenue.[44]

There are signs that international student numbers are falling. UCAS data show that in 2016, the number of acceptances from non-EU countries fell by 2.3 per cent, the first time acceptances from non-EU countries have fallen since 2011.[45]

Government policy clearly impacts on the future for international student numbers, and institutions cannot be complacent in assuming their numbers are bound to continue at current or higher levels. Universities must assess how they can maintain their international student numbers if possible, or how to fill the financial deficit they leave behind if not.

HEFCE have noted:

> *it is anticipated that Britain's forthcoming exit from the European Union, increasing global competition in the higher education market, changes to funding arrangements and a volatile economy both in the UK and internationally will continue to impact the financial stability of HEIs across the sector.*[46]

Publicly-funded teaching surpluses

It is uncertain what the future holds for home students' tuition fees. The Government are freezing tuition fees at £9,250 so they will not rise in line with inflation, potentially putting pressure on institutions' abilities to cover the costs of teaching across the board. In particular, any publicly-funded cross-subsidies which typically occur between different subjects will come under threat as university budgets tighten, especially with Labour committed to scrapping tuition fees if they win the next election and the Conservatives expecting institutions to give their students more information on where fees go.

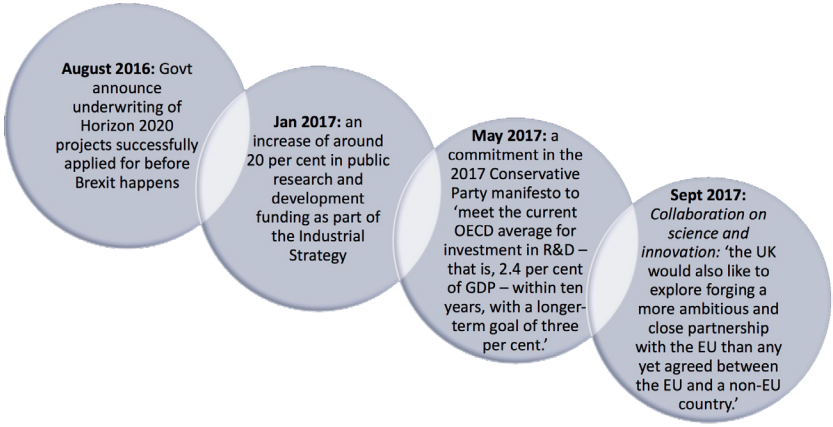
The introduction of the TEF alongside the REF has put pressure on universities to excel in teaching as well as research. Universities may need to perform well on the TEF in the future if they wish to continue to attract students in their current numbers. It will not be possible for academics to devote ever more time to research if the pressure for high-quality teaching demands more of their time too. It is likely that universities will have to invest more income in teaching rather than using it as a source to cross-subsidise research.

Furthermore, the separation of HEFCE's teaching and research roles through the formation of the new Office for Students and UK Research and Innovation could lead to further questions over the validity of cross-subsidies from teaching to research, particularly from public funds. The OfS is unlikely to want the money they give to institutions for teaching to be spent on research unless it can be proven that it benefits teaching.

Loss of research funding and collaborative partners

More directly, the EU is an important source of research funding. In 2014/15, 14 per cent of all research income came from the EU (over £836 million). Universities UK found that EU research funding generated over 19,000 full-time-equivalent jobs across the UK, £1.86 billion of output and £1 billion of GDP.[47]

At present, no one knows what the future holds for the UK's involvement in EU research and whether it will continue to receive EU funding. Universities hope their researchers will be able to apply for the 9th Framework Programme (the successor to Horizon 2020, the EU's current research and innovation programme), while the Government has shown its commitment to future collaboration with Europe, including on future Framework Programmes.[48]



Furthermore, the UK is a world leader in internationally collaborative research. Universities UK have argued that:

> *This is a great advantage to our research base: UK*

> *international co-authorship is associated with 61% greater field-weighted citation impact compared to UK institutional co-authorship.*[49]

In 2015, 60 per cent of the UK's internationally co-authored papers were with EU partners.[50] Collaboration between UK and EU universities has been strong due to programmes such as Horizon 2020 that offer funding for collaboration. This international research accounts for a major share of UK universities' most highly-cited papers. Dr Jonathan Adams has argued that new partnerships elsewhere in the world and with Europe outside the EU Framework Programme will be difficult to negotiate, as they will all need a new funding mechanism.[51]

Without collaborative research partnerships, the UK risks not just losing a valuable source of research funding, but also valuable research that brings many benefits to the UK.

Solutions

At present, there is a £3.3 billion deficit in research funding across the UK.

There are three main ways this gap could be addressed:

(i) by increasing the research budget (without increasing the volume of research) to move towards 100 per cent fEC;

(ii) by keeping the budget but funding at full fEC rates by reducing the volume of research that receives funding; or

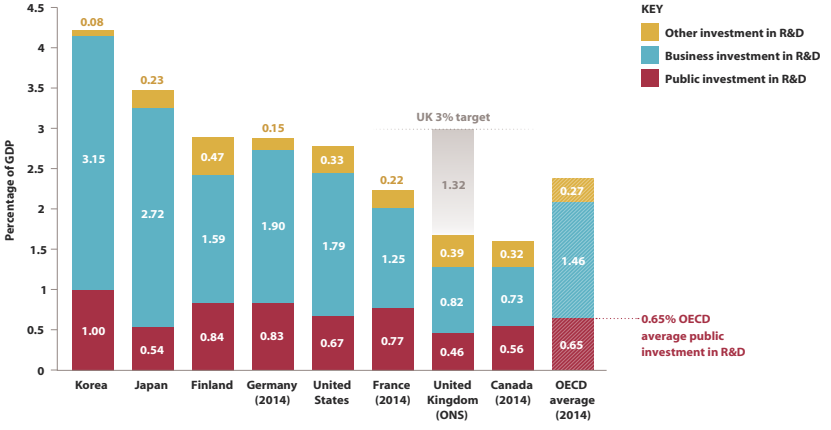
(iii) by accepting cross-subsidies and shortfalls.

We consider the three potential solutions above, but conclude that the UK Government should boost research funding, particularly QR funding and – within that – to start by boosting charity QR funding to fill some of the research gap and guarantee the long-term sustainability of research in UK universities.

(i) increase the research budget

This is a clear solution to the current underfunding of research. If the research budget were to be increased to the point where the current volume of research projects can be funded at (or close to) 100 per cent of fEC, without increasing the volume further, UK research would be in a more sustainable long-term position.

Investment in R&D by country and investment type 2015



Note – figures are rounded.

Sources: The Royal Society, British Academy, Royal Academy of Engineering and the Academy of Medical Sciences, *Investing in UK R&D*, 2017, p3; OECD Main Science and Technology Indicators 2015; ONS 2015

The Conservative manifesto for the 2017 General Election set a long-term goal of 3 per cent of UK GDP to be spent on research and development (R&D). At present, the figure is only 1.7 per cent. **Achieving the Conservatives' 3 per cent target would therefore require an increase in R&D expenditure (public and private) of £24.8 billion**. An increase in public expenditure on research would be a move towards achieving this target and would likely encourage greater investment in R&D from other sectors, particularly industry, since public funding of research is thought to 'crowd-in' rather than 'crowd-out' other funding.[52] Currently, every £1 of government spending on research leverages an estimated additional £1.36 of private funding.[53] However, at least in the short- to medium-term, the budget for research and development is unlikely to be increased by the

£2.8 billion that is necessary to fill the research deficit let alone the larger sums necessary to meet the spending commitments of the UK's main competitors or the 3 per cent target. Moreover, in the context of a more interventionist industrial strategy, it is unlikely extra funding would come without new strings attached.

One challenge is whether it is feasible or desirable to increase the research budget without increasing the volume of research. Universities have strong incentives to increase research output as universities across the world are chasing the same league-table places. To move up, or at least maintain their rankings, institutions must continue to invest in improving the quality and quantity of their research more than their competitors.

Although the UK higher education sector had a sustainability gap of over £1 billion in 2014/15, institutions are generally covering their immediate costs through the cross-subsidies, at least in the short-term.[54] It seems plausible therefore, given the incentives, that universities might use any extra funds to increase their volume of research, thereby not improving their long-term sustainability or addressing the question of the sustainability of UK research. This could be of short-term benefit to the UK while not actually addressing the funding councils' underlying concerns.

(ii) keep the budget but reduce the volume of research to fund at full fEC rates

In 2009, Professor Alan Alexander recommended:

> *The principle of providing additional investment in support of fEC while not building volume is a sound one, which is having a positive impact on the sustainability of the HE research base.*[55]

However, this has not occurred. Although research income has grown by 16 per cent between 2010 and 2015, research costs have grown by almost 26 per cent, likely due to an increase in the volume of research. Research funding has not kept up with costs, so universities have not recovered the full economic costs of their research.

Reducing the volume of research carried out in the UK would require making important strategic decisions about the UK's research priorities. To reduce the volume, the UK must either:

(a) reduce the number of universities conducting research; or
(b) reduce the range of research areas.

(a) reduce the number of institutions conducting research

Reducing the number of universities conducting research could bring efficiency benefits through economies of scale and shared good practice. Professor Michael Arthur, then head of the Russell Group of Universities and Vice-Chancellor of Leeds University, argued in 2009 that research funding should be concentrated in Britain's top 30 universities to halt a 'progression to mediocrity' in higher education. He argued that, 'without a clear policy in favour of focused funding, Britain's 'international standing, profile and performance will drop away".[56]

The UK aims to 'fund research of the highest quality wherever (and in whichever discipline) it is found' through Quality-Related (QR) funding.[57] A wide range of universities currently receive some QR funding, which supports other sources of research income. Yet UK research funding is highly concentrated already: the 24 Russell Group universities account for just under 20 per cent of UK universities but three-quarters of research grant and contract income.[58]

Reducing the number of universities where research is substantively funded to concentrate it further risks missing out on world-class research of the highest quality. MillionPlus, the Association for Modern Universities, have argued:

> *A diverse array of subject groups at a diverse array of universities produce research that has been recognised as world-leading and internationally excellent and there is no case to further increase the concentration of research funding in the UK.*[59]

Diversity is likely to be important in addressing the challenges of the future. A wide range of universities undertaking research allows more opportunities for research in new and emerging disciplines and markets. University Alliance have recommended that:

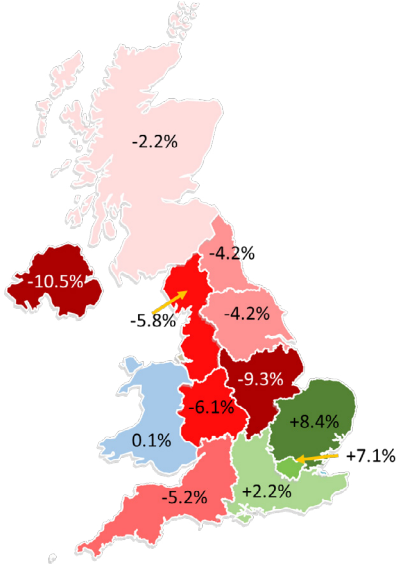
> *The government should develop a 'balanced portfolio' approach to funding excellence in research and innovation, capturing a broad scope and spread of activities – from big science through to small-scale interactions between universities and local businesses, driving job creation and productivity across the whole of the UK.*[60]

Restricting which universities conduct research risks creating regional gaps, leaving certain sizeable areas of the country without a research hub. Universities bring many benefits to the local community, including employment, income and investment in the local area. Universities generate more than £73 billion a year in output, contribute nearly 3 per cent of UK GDP and generate more than 750,000 jobs.[61] Local businesses need a local university to provide expertise and skilled new recruits that can be difficult to find otherwise.

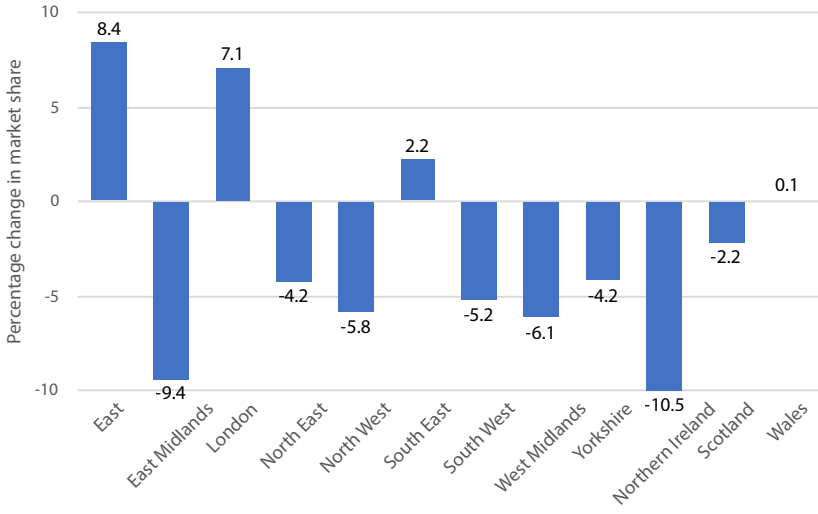
Research is ranked based on 'originality, significance and

rigour' by a starring system, where 4* research is deemed to be 'world-leading' and 3* research is 'internationally excellent'.[62] At present, mainstream Quality-Related (QR) funded is awarded to 4* and 3* research, at a ratio of 4:1. If QR funding were restricted to only 4* research, it would serve to further concentrate resources among the Golden Triangle: Oxford, Cambridge and London. The market share of QR funding would increase as a result of the change in the East of England, London and the South-East. All other regions, except Wales which would see no change, would see their market share of funding fall as a result. This would be an unwelcome policy change that could harm the UK research base.

The potential change in market share of QR funding in changing from funding 4 and 3* research to only 4* research, by UK regions*



Source: https://www.theguardian.com/news/datablog/ng-interactive/2014/dec/18/university-research-excellence-framework-2014-full-rankings, analysis by HEPI



Source: https://www.theguardian.com/news/datablog/ng-interactive/2014/dec/18/university-research-excellence-framework-2014-full-rankings, analysis by HEPI

Additionally, concentrating research funding in too small a group of universities could hit younger researchers hard, reducing the number of world-class researchers coming through the UK system. Jonathan Adams, chief scientist at Digital Science, has argued, 'you can't just restrict your focus on the elite institutions, … you don't have the feed through of younger researchers' without investing in other universities.[63]

b) reduce the number of research areas

A study by Elsevier for the Department of Business, Energy and Industrial Strategy published in 2017 found that, 'The UK research base is well-rounded and demonstrates excellence in diverse research fields'.[64] Strength across a range of disciplines and inter-disciplinary work is likely to be vital in addressing the

future challenges the UK will face. The British Academy argue that:

> *Most of the major challenges which society faces – climate change, the rise of populism, growing inequalities, secular stagnation, computerisation of occupations, as obvious examples – require IDR [inter-disciplinary research] and cooperation.*[65]

Furthermore, the UK Government has identified interdisciplinary working as a priority and it is one of the key reasons for bringing the Research Councils together in a new, single, overarching body – UK Research and Innovation. This offers:

> *A greater focus on cross-cutting issues that are outside the core remits of the current funding bodies, such as multi- and inter-disciplinary research, enabling the system to respond rapidly and effectively to current and future challenges.*[66]

There is some evidence that interdisciplinary papers are cited more, with the top 1 per cent of the most highly-cited papers exhibiting higher levels of interdisciplinarity than papers in other citation rank classes.[67] World-class interdisciplinary research must be based on strong, vigorous disciplines and so the UK requires a broad foundation across a range of disciplines, as well as structures in place to enable world-class inter-disciplinary research to address the most important global challenges.

The current dual support funding system for research through Quality-Related (QR) funding as a block grant to universities, combined with specific project funding allocated on the basis of bids, allows for a wide variety of research to be funded. The British

Academy has argued that, 'the UK's varied and diverse portfolio of research funding opportunities is a recognised strength, nationally and internationally'.[68] In particular, QR funding:

> *allows for excellence to be funded wherever it is found, for curiosity–driven, bottom–up research, giving universities the flexibility to make their own decisions about fostering and developing their research environment.* [69]

We should be cautious about restricting the breadth of UK research or limiting QR funding so that we do not harm the strength of the UK economy and research, now and in the future. Digital Science have argued that a 'loss of structural diversity is a loss of capacity to respond flexibly when priorities change or when opportunities appear'.[70]

(iii) accept cross-subsidies and shortfalls

There is little incentive for policymakers to increase public funding to cover a higher proportion of research costs while universities can find other income sources to fill the deficit.

International student fees are a useful source of income for this purpose, particularly as UK universities are highly successful in attracting international students. The UK is the second most popular destination for international students in the world, attracting over 10 per cent of all international students in 2013.[71] Furthermore, numbers increased by 63 per cent between 2003 and 2013. However, the UK is in danger of stagnation while others forge ahead. It is likely Australia will soon overtake the UK as the second most popular destination. Fears around anti-migrant sentiment, Brexit and growing global competition threaten the size of the UK's share of the international student market.

Most international students in the UK choose to study at research-intensive universities, even though they will be paying above cost-price. They benefit from the strong reputation of UK universities, largely derived from the UK's success in research. Although international students may be able to get better value for money elsewhere, they come knowing the fees they will have to face and choose to study in the UK anyway. If universities want to continue using tuition fees from international students to subsidise research, the challenge is to ensure the UK continues to be at least as an attractive a destination for international students as it has been in the past.

In fact, one solution to the problem of the underfunding of research would be to increase the number of international students in the UK. On average, each non-EU, full-fee paying student subsidises research by over £8,000 over the duration of their study. Universities could invest more in recruiting international students, since each student helps to fill the research deficit. However, some commentators, such as Lord Adonis, have argued the UK should recruit more international students to cover other potential costs, such as the reduction or abolition of tuition fees for UK students.[72] Universities face many competing pressures on their income and there is no guarantee that any additional income from other sources would be spent on research.

Students are increasingly demanding better value for money from their tuition fees. The *HEPI / HEA 2017 Student Academic Experience Survey* found that there are now almost as many students (34 per cent) who feel they receive poor value for money as there are who believe they receive good value (35 per cent).[73]

Furthermore, students want to know more about how their tuition fees are spent. Almost three-quarters of students feel they have not received enough information about how their tuition fees have been spent, including 60 per cent of students paying overseas fees. Only 20 per cent of students feel they have received sufficient information.[74]

The *Student Academic Experience Survey* found that teaching quality seemed to be a major driver of value which 'consolidates the importance of teaching and provides a consistent view for the sector that a focus on teaching is likely to pay dividends in terms of student views of their experience'.[75] Universities are committed to the idea of research-informed teaching: the idea that teachers who are also researchers make better teachers and it was an important theme in the Teaching Excellence Framework provider submissions.[76] Yet there is little robust evidence on this. A meta-analysis conducted by Hattie and Marsh endorsed Kennetz Feldman's earlier conclusion: 'the likelihood that research productivity actually benefits teaching is extremely small or that the two, for all practical purposes, are essentially unrelated'.[77] So it is not enough to invest in research in the hope that it indirectly improves teaching, if the aim is to improve the quality of teaching.

On balance, we recommend that as part of the wider commitments to increase the UK's research and development spending, the Government should:

1) increase QR funding by £1 billion a year, in addition to current spending commitments, to fill the sustainability gap and to keep up strong regional capacity;

2) increase charity QR funding as a part of this to fix one of the biggest problems and incentivise more university-charity collaboration; and

3) set out clear roadmaps for how they intend to reach the targets of spending 2.4 per cent and 3 per cent of GDP on research and development, and the role they expect each sector to play.

Conclusion

The UK research base is under threat. The UK is a strong performer in research globally, with UK productivity 3.6 times the world average – in stark contrast to productivity in other sectors. However, there is a consistent and large research deficit that can only be filled by cross-subsidies from other income sources. While some cross-subsidies are inevitable and even desirable in institutions as large as universities, they cannot be pushed too far. The UK's expenditure on research and development is well below that of its competitors and data suggest the current level of research is not sustainable in the long-term without improvements funding.

The key threats to the UK research base are as follows:

- students demanding more for their money, while international students can vote with their feet by choosing to study elsewhere if they do not feel the UK offers sufficiently good value for money or is less welcoming than in the past;
- the uncertainty of Brexit in terms of EU research funding and collaboration; and
- the long-term effects of austerity – from 2010 to 2015 there was no real rise in the science and research budget, putting university research under increasing pressure.

The responsibility for ensuring that UK research is sustainable in the long-term lies with universities and Government, which need to make long-term plans as to how they can fill the research deficit. **For the Conservative Government to meet their target of spending 3 per cent of GDP on research and**

development, assuming contributors continue to pay in their current proportions, all sectors must contribute by increasing their investment in the UK research base by almost 80 per cent or about £6.3 billion per year.

This includes:

- an additional 250,000 full fee-paying international students, each contributing £8,000 to UK research each year through their fees;
- Research Councils and Funding Councils spending an additional £3 billion on funding research;
- industry contributing an additional £700 million;
- charities contributing an additional £830 million;
- government departments contributing £760 million extra each year.

The Government have committed an additional £4.7 billion by 2020/21 for research and development, which will go some way towards achieving the target but is not nearly enough: all sectors must increase their spending if the 3 per cent target is to be hit.

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