The finances of chemistry and physics departments in UK Universities: third review

A report prepared for the Institute of Physics and Royal Society of Chemistry

by

Sean McWhinnie

Oxford Research & Policy

and

Nigel Brown

Nigel Brown Associates

October 2015 (Revised February 2016)

Acknowledgement

We would like to thank all those who gave up their time to help complete questionnaires in the institutions who helped with this study. We would also like to thank those who helped with follow up queries and those who helped answer follow up questions, either in writing or by telephone.

We would also wish to thank the Institute of Physics and the Royal Society of Chemistry for commissioning this study.

Nigel Brown, **Nigel Brown Associates**, and,
Sean McWhinnie, **Oxford Research and Policy**
October 2015

For further information please contact:

Sean McWhinnie
info@oxfordresearchandpolicy.co.uk

Contents

List of Tables

List of Figures

Executive Summary

Background and introduction

This study is the second follow up to separate studies undertaken in 2005 and 2006, respectively, of the finances of chemistry departments in UK universities[1] and of the finances of physics departments in English universities.[2] The first follow up study, carried out in 2009, collected data relating to the academic year 2007/08.[3]

The objective of this study was to re-check the financial position of chemistry and physics departments in the light of recent changes in public funding arrangements and to compare the 2012/13 position to that in 2007/08.

The study relates to the academic year 2012/13 and was carried out against the backdrop of a new funding regime for Home and EU full-time and part-time undergraduates beginning their courses at English universities from September 2012. Under this new regime, English universities can charge maximum fees of £9,000 per annum but different arrangements are in place in respect of the support that students from the different Home nations receive. English-domiciled students pay the fee levied and are eligible for publicly-funded loans repayable after graduation on an income contingent basis through the tax system. Changes were also made to the funding arrangements for Home and EU undergraduates entering universities in Wales and Northern Ireland from September 2012, however, Scottish-domiciled students are not expected to pay any upfront fees.

Corresponding reductions in Funding Council teaching grants in respect of students paying the higher fees were also introduced in 2012/13. For example, in England HEFCE pays a teaching grant to institutions that includes an element for new regime students studying qualifications in "high-cost subjects", which include chemistry and physics.

Methodology

The data for this study were collected through a questionnaire similar to that used in the earlier studies and included:

- Cost drivers (student load [full-time equivalents (FTE)], staff [FTE] and space);
- Teaching and research income by source;
- Budgetary approach and figures;
- Costs derived from the universities' Transparent Approach to Costing (TRAC); and
- The allocation of academic staff time to principal activities.

It was agreed from the outset that there should be the maximum possible overlap between the sample institutions in this follow-up study and those in the 2009 study.

14 universities which had both chemistry and physics departments were identified for inclusion in the sample – ten English universities and four universities in the other three nations of the UK. All 14

1. *Study of the Costs of Chemistry Departments in UK Universities: Summary Report* Nigel Brown, Nigel Brown Associates, Royal Society of Chemistry, London, 2006.
2. Study of the Finances of Physics Departments in English Universities: a summary report Nigel Brown of Nigel Brown Associates, Institute of Physics, London, 2006.
3. *Follow-up Study of the Finances of Chemistry and Physics Departments in UK Universities*, Institute of Physics, London, 2010.

universities were invited to participate; 12 of which were also in the 2009 study. Subsequently, 12 chemistry and physics departments provided data, but not all datasets were complete and in some cases it was not possible to isolate the data specifically for chemistry or physics, respectively.

Ten datasets for both chemistry and physics from 2012/13 and 2007/08 could be used to compare student and staff numbers, as well as space and income data.

For both chemistry and physics, 10 datasets from 2012/13 (both including eight from English universities) were sufficiently complete, including full TRAC information, to use for the full financial analysis. Nine of these datasets could be compared with datasets from 2007/08 for both chemistry and physics.

Cost drivers

Student numbers

Since 2007/08, departments experienced an increase of 30% (from an average of 347 to 451) and 33% (from an average of 329 to 437) in the number of home and EU undergraduate full time equivalents (FTEs) in chemistry and physics, respectively, although the relative growth has not been uniform across the departments. The growth in overseas undergraduate FTEs was 77% in chemistry departments, from an average of 19.1 to 33.9, and 80% in physics departments, from an average of 12.4 to 22.3.

For the chemistry departments in the sample, the increase is in line with proportional increases in the chemistry home and EU undergraduate FTEs nationally across the same period; whereas for the physics departments, the increase is above the proportional increases in physics (and astronomy) home and EU undergraduate FTEs nationally.

Considering the institutions in both the current and earlier studies, all but one of the chemistry departments and all of the physics departments have experienced a growth in undergraduate FTEs, but, the relative growth has not been uniform.

National data show that in England overall chemistry enrolment increased until 2011/12, the last year of old regime fees for new students, while physics and astronomy enrolment in England varied more, increasing until 2009/10 and then falling in 2010/11 before rising again in 2011/12. Both chemistry, and physics and astronomy enrolment in England fell between 2011/12 and 2012/13, reflecting the general reduction in demand as a result of the introduction of the new funding regime incorporating maximum fees of £9,000. In physics and astronomy in particular, enrolment in the rest of the UK increased between 2011/12 and 2012/13.

FTEs for postgraduate taught courses in both physics and chemistry departments are low compared with many other subjects, with a high proportion of these students are from outside the EU. Four year undergraduate integrated Masters courses, leading to MChem or MPhys qualifications, are common in both chemistry and physics so, for most UK students, there is little drive to complete a taught Masters programme on top of an existing undergraduate Masters unless they intend to change disciplines. Increasing the number of taught postgraduate FTEs, in particular from outside the EU, could offer a significant source of potential income for chemistry and physics departments.

In the ten chemistry departments common to both studies there was an increase of 17%, from an average of 99.6 to 116.1, in the home and EU postgraduate research student FTEs between 2007/08 and

2012/13; whilst the ten physics departments experienced an increase of 29% (from an average of 57.1 to 73.6) in home and EU postgraduate research student FTEs. The growth in overseas postgraduate research FTEs was 9% and 34% in the chemistry and physics departments, respectively.

Academic and other staff

Between 2007/08 and 2012/13 the average FTE permanent academic staff (largely funded through departmental budgets) in the ten chemistry departments common to both studies increased by 16%, from 41.7 in 2007/08 to 48.5 in 2012/13, while the average number of FTE research staff (largely supported by external grants and contracts) fell by 8%, from 59.5 to 55.0. For the ten physics departments common to both studies the average number of FTE permanent academic posts increased by 4%, from 40.3 to 41.9, while the average number FTE research staff increased by 8% from 44.7 to 48.1 between 2007/08 and 2012/13.

Between 2007/08 and 2012/13 the average ratio of numbers of students to those of permanent academic staff[4] (SSR) increased from 10.8 to 12.8 for the chemistry departments, and from 9.5 to 13.1 for the physics departments.

The average number of technician posts in the ten common chemistry departments was 22.0 in both 2007/08 and in 2012/13, and in the ten common physics departments was 15.8 in 2007/08 and 16.1 in 2012/13. This indicates that the number of technicians in chemistry departments remains stable, and that in physics departments the number has stabilised following significant reductions in the years leading up to 2007/08 (between 2003/04 and 2007/08 there was a decline of 13% in permanent technician posts in English physics departments common to both of those studies).

Departmental space

For each FTE member of academic staff on departmental budgets, the chemistry departments had an average space per FTE of 189.6 m^2 in 2007/08 and of 181.9 m^2 in 2012/13. Considering all academic and research staff, the respective figures were 81.1 m^2 and 85.8 m^2. The corresponding figures for the ten physics departments were 142.8 m^2 and 164.7 m^2 for the space per permanent academic staff member and 73.9 m^2 and 81.4 m^2 for all academic and research staff in 2007/08 and 2012/13, respectively.

As observed in the earlier studies, chemistry departments have a higher space requirement than physics departments. This difference reflects three factors: the lower requirement for teaching laboratory space in physics than in chemistry; the higher proportion of research in physics than in chemistry not requiring laboratory space (e.g. theoretical physics); and the higher proportion of research in physics than in chemistry that is undertaken in external national and international research facilities (particularly astronomy, particle physics, and nuclear physics). Consequently, chemistry academic staff need to bring in more income than physics academic staff to cover the costs of the additional space

[4] Based on the FTE of all taught students (home, EU and overseas undergraduate and postgraduate) divided by, in 2007/08, total FTE of academic staff on permanent contracts excluding research fellows and post-doctoral fellows or, in 2012/13, divided by permanent academic staff with teaching responsibilities funded through the departmental budget.

Departmental Income

Teaching income

The principal sources of publicly-funded income for teaching are:

- The funding councils' teaching block grant which in England in 2012/13 included money for old regime undergraduate students and new regime undergraduate students studying high-cost subjects;
- Separate additional funding from HEFCE for strategically important and vulnerable subjects (SIVS) in England; and,
- Tuition fee income from home and EU students eligible for public support.

The average public funding per FTE home and EU taught undergraduate and postgraduate student for the eight English chemistry departments was £9,005 in 2012/13 and £8,240 in 2007/08. The corresponding figures for the eight English physics departments were £8,885 for 2012/13 and £8,768 for 2007/08. Although these represent increases in cash terms, in real terms the average funding per FTE has fallen.

The principal source of non-publicly funded teaching income for both chemistry and physics departments is overseas (non-EU) student fees for taught programmes together with fee income from any home or EU students not eligible for public support (usually because they have previously received public support for undergraduate study in England). In 2012/13, income from non-publicly funded undergraduate and postgraduate taught students was around 14.1% of total teaching income for the chemistry departments in the sample and around 9.1% for the physics departments.

The average **total** funding per FTE taught undergraduate and postgraduate student for the eight English chemistry departments was £9,465 in 2012/13 and £8,662 in 2007/08. The corresponding figures for the eight English physics departments were £9,025 for 2012/13 and £9,034 for 2007/08.

Research income

Income that supports research activities in higher education institutions (HEIs) includes:

- The main funding council quality related (QR) grant allocated on the basis of performance in the most recent RAE/REF with a factor to reflect differential costs of disciplines;
- Other funding council subsidiary QR grants – predominantly in England – which include the Research Degree Supervision Fund, Charity Support Funding and Business Research Support;
- Research grant and contract income from public sources, predominantly from the UK research councils;
- Home and EU postgraduate research student fees;
- Other support for postgraduate research supervision and training, including Centres for Doctoral Training (CDTs);
- Research grant and contract income from non-public sources; and,
- Overseas postgraduate research student fees.

Between 2007/08 and 2012/13 six out of ten chemistry departments common to both samples increased their total research income per FTE permanent academic staff member, and eight out of ten physics departments common to both samples increased their research income per FTE permanent academic staff member. On average, physics departments earn less research income per FTE permanent academic staff member than chemistry departments. This in part reflects the higher proportion of theoretical work undertaken in physics departments and the higher proprtion of research activity undertaken by physics departments on national and international facilities, which is through the allocation of time on the facilities rather than in the form of research grants. The data also confirm the heavy dependence of chemistry and physics departments on public sources to support their research activities; overall 84% of the total income in chemistry departments and 90% in physics departments was from public funds.

Total Income

Total income (teaching, research and other income[5]) for the chemistry departments in 2012/13 ranged from £10.2m to £23.8m. Total income for the ten chemistry departments common to the samples for both studies increased overall by 28% between 2007/08 and 2012/13.

Total income in the physics departments in 2012/13 ranged from £6.2m to £28.4m. Total income for those physics departments which were common to the samples for both studies increased overall by 24% between 2007/08 and 2012/13.

Departmental Financial Position

To assess the overall financial position, a comparison was made of the income generated by each department for each activity and TRAC-derived costs.[6] Surpluses and deficits are then calculated as the difference between the income and TRAC-derived costs and are generally reported as the percentage of income.

Division of costs between activities: the allocation of academic staff time

TRAC divides costs between activities (teaching, research, other and support) according to the allocation of academic staff time to those activities (as the principal income generators), based on data collected from individual academic staff.[7]

For chemistry departments in 2012/13 the data show that in all cases the proportion of staff time allocated to teaching activities is greater than the proportion of income which teaching represents with the variance lying in the range of 2 to 15%. For physics departments in 2012/13 similarly the proportion of staff time allocated to teaching activities is greater than the proportion of income which teaching represents with the variance lying in the range of 1 to 17%.

---

5 Details of other departmental income were collected. Departments reported a variety of sources of other income including consultancy income, higher education innovation income, endowments and donations, rental income, etc.

6 TRAC-derived costs are based on full economic costs. The principle behind full economic costs is that the full economic cost of a project should be accounted for, which includes an attribution of the cost of academic staff time and the institution's facilities, estates and indirect costs. The TRAC-derived costs thus include two modifications under full economic costing which are an "infrastructure adjustment" to account for the true capital costs to an institution of maintaining the asset base and the "return for financing and investment" (RFI), which is intended to ensure that institutions take account of the economic cost of capital. (This covers the financing costs of institutions, including the existing costs of borrowing and the opportunity cost of institutional cash used for financing; it also provides funds for the rationalisation and development of institutions' business capability and capacity.) In 2012/13, the infrastructure adjustment accounted for 3.1% of expenditure and the RFI represented 5.0% of expenditure.

7 Despite efforts there remain some questions about the basis of the way that the time allocation data are collected.

Financial position: teaching

In the ten chemistry departments for which reliable TRAC-based costs were available, the cost per FTE taught undergraduate and postgraduate student ranged from £9,215 to £13,922. In the eight departments in English universities, the average cost per FTE was £10,867.

In England using the available data the chemistry departments had deficits on teaching activities that ranged from 4% to almost 60% of total teaching income. Outside England, one department showed a large teaching deficit and one department showed a surplus of 12% on teaching activity. For the eight chemistry departments in English universities for which full and reliable TRAC data were available in 2007/08 and 2012/13 the overall deficit on teaching activities fell slightly from 16.6% of income in 2007/08 to 14.0% of income in 2012/13.

In the 10 physics departments for which reliable TRAC-based costs were available, the cost per FTE taught undergraduate and postgraduate student ranged from £8,374 to £13,411. On average, the cost per FTE was £9,839 in the English departments.

In England in 2012/13 four physics departments had surpluses on teaching activity, ranging between 1% and 11%, and the other four had deficits ranging between 17% and 43%. Outside England, the two departments showed teaching deficits in 2012/13 of 9% to 46%. For the eight physics departments in English universities for which full and reliable TRAC data were available in 2007/08 and 2012/13 the overall deficit on teaching activities increased from 0.3% of income in 2007/08 to 5.8% of income in 2012/13.

Financial position: research

In 2012/13, the ten chemistry departments showed a wide variation in their deficits on research activity, ranging from 3% to 47%. The overall deficit in 2012/13 on research activity was 29.1% of income.

Comparing the nine chemistry departments for which full income and cost data were available in both 2007/08 and 2012/13, the overall deficit on research activity across the departments narrowed from 33.1% of income in 2007/08 to 29.4% in 2012/13. Focussing on the eight English departments alone, the deficit was 34.6% in 2007/08 and 31.4% in 2012/13.

The ten physics departments showed a similarly wide variation in 2012/13 in their financial position with regard to research activity, ranging from a surplus of 2.8% to a deficit of 45.2%. The overall deficit in 2012/13 on research activity was 23.3% of income.

The overall deficit on research activity for the set of nine physics departments for which full income and cost data were available in both 2007/08 and 2012/13 was 20.5% in 2007/08 and 25.6% in 2012/13. Focussing on the eight English departments alone, the deficit was 20.1% in 2007/08 and 28.4% in 2012/13.

Analysis and conclusions

Data show a range of deficits for chemistry departments on the basis of full economic costs in 2012/13 from 10.6% to 37.5%. Research incomes and costs are in general substantially larger than teaching incomes and costs and so the deficits are to a large degree driven by the deficits on departments' research activities. The overall deficit across the ten chemistry departments in the sample was 24.1%.

The overall deficit across the nine chemistry departments in the sample, for which full income and cost data were available in both 2007/08 and 2012/13, was 25.9% in 2007/08 and 24.9% in 2012/13. In the eight English universities, the overall deficit was 24.8% in 2007/08 and 25.2% in 2012/13. The overall financial position appears to be about the same in 2007/08 so on a full economic cost basis deficits in chemistry departments were still substantial in 2012/13.

The overall deficits across all activities for the physics departments in 2012/13 for which full income and cost data are available range between 2% and 34%. The overall deficit for all the physics departments was 20.8%.

The overall deficit for the nine physics departments, for which full income and cost data were available in both 2007/08 and 2012/13, was 13.6% in 2007/08 and 22.5% in 2012/13. In the eight English universities, the overall deficit was 10.6% in 2007/08 and 19.5% in 2012/13. The financial position of the physics departments has therefore deteriorated between 2007/08 and 2012/13, reflecting the increased deficits attributable to both teaching and research activities.

The comparison of these findings on surpluses/deficits with departmental budgetary information is complicated by a number of factors:

- Some departments are within a faculty structure and are required to generate a surplus against total income to provide a contribution to central costs. These contribution targets are set by the faculty based on the overall faculty contribution set by the university;
- Even for many of those departments with fully devolved budgets, the financial requirement is to meet a target contribution to the university's central costs rather than a surplus/deficit target;
- Only one university in the sample operates with anything approaching a full economic cost basis, for its resource allocation and budgetary systems.

Bearing these factors in mind, nearly every department in the sample was either in deficit in 2012/13 or had a shortfall against its target contribution rate to central costs.

It is also worth noting in this context that all the costs used in TRAC do not appear in university accounts. HEFCE is still pushing universities to ensure that they do bear sustainability in mind to avoid the situation found at the time of the Dearing report,[8] which was that universities had a capital deficit. At the time, this situation necessitated initiatives like JIF and SRIF in order to make good the lack of investment in infrastructure.[9]

The overall financial position, as measured by the balance between departmental income and TRAC-based costs of chemistry and physics departments, was about the same in 2012/13 for the chemistry departments and had deteriorated in the physics departments, compared to 2007/08. There had been some modest overall improvement in the position of research and teaching activities in chemistry departments, but the position of both teaching and research activities in physics departments had deteriorated since 2007/08.

---

8 *The Dearing Report: Higher Education in the learning society*, Her Majesty's Stationery Office, London, 1997.

9 JIF is the Joint Infrastructure Fund and was set up in 1998 to address the deterioration in university infrastructure funding identified by the Dearing Committee. SRIF is the Science Research Investment Fund and was a major investment in the physical infrastructure of research which ran over three rounds between 2002/03 and 2007/08.

The signs are that both chemistry and physics are withstanding the perturbations caused by the introduction of the new regime with maximum fees of £9,000 in England. However, the new system was not fully implemented in 2012/13 and there is clearly a need to continue to monitor its effects.

Despite the recent relative stability, the prospects for the future financial position of departments with respect to teaching remain uncertain for a number of reasons:

- Although SIVS funding continues, the value of funding per FTE will continue to be eroded if FTEs continue to increase;
- The increased transparency brought about by the introduction of the new fees regime, alongside increasing pressure for universities to provide 'value for money' for students,[10] will almost certainly make it more difficult for universities to cross-subsidise teaching deficits in laboratory-based subjects like chemistry and physics using surpluses generated elsewhere;
- Any significant increase in the proportion of undergraduates opting to take three year bachelors courses rather than four year integrated masters courses, as a consequence of higher fees, will reduce the overall student load and hence will reduce teaching income if additional students cannot be recruited;
- The cap on student numbers in England is to be lifted from 2015/16 onwards. The effect on numbers in chemistry and physics is unknown, but to ensure that HEIs provide places in the subjects most needed in the economy, the Government will provide extra funding for STEM students of £50m per academic year from 2015/16;
- If changes are made to the loan system (or the funding system more generally) for political or financial reasons, student demand may fall or the amount of funding received for each student might decline;
- Public sector pay restraint has to some extent controlled the staff costs in the last few years but in due course there will be increasing pressure to restore at least some of the real terms reduction in salary levels;
- The debate around how to limit the liabilities of the Universities Superannuation Scheme also continues and it is likely that higher employer contributions will be required;
- The announcement of government-backed student loans of up to £10,000 available to all people under the age of 30 undertaking postgraduate masters degrees from 2016/17 should increase demand.

All but one of the chemistry and all of the physics departments for which full TRAC data were available showed deficits on their research activities in 2012/13. It does appear that research deficits have reached an equilibrium which may reflect some of the following permanent and temporary factors:

- Research councils (and other research sponsors) do not pay the full economic costs of the research they support although the contribution they make to overheads has improved since the earlier studies;

[10] *Student expectations and perceptions of higher education*, Kings Learning Institute, 2013 (https://www.kcl.ac.uk/study/learningteaching/kli/research/student-experience/QAAReport.pdf); *2013 Student Academic Experience Survey*, Higher Education Policy Institute and Which?, 2013 (http://www.hepi.ac.uk/2013/05/15/2013-student-academic-experience-survey/)

- Chemistry and physics are particularly dependent on public sources of research income and hence on the metrics used to distribute that funding. Whilst public funding for research has been protected to some extent, the flat cash settlement for non-capital funding from 2010 equates to a real terms cut of over £1bn,[11] and the future levels of public investment are uncertain.;
- Research costs are equally sensitive as teaching costs to pressures for real increases in salaries and the possibility that increased employers' contributions to the Universities Superannuation scheme may be required;
- Chemistry and physics have particularly high numbers of postgraduate research students and there remains a good deal of uncertainty as to whether the income for research students actually covers the costs.

Despite the restraint on public expenditure, public research spending has to some extent been protected but as the national deficit has taken longer to come down than had been hoped, it is always possible that future rounds of public spending cuts will mean that research, in particular, can no longer be protected.

This study collected limited data from chemistry and physics departments in other countries of the UK outside England. However, the indications are that departments outside England are also in deficit, particularly since they have not benefited from the increased teaching income generated by the introduction of the higher tuition fees charged in England or from the additional SIVS money provided by HEFCE. In Scotland, in particular, the lower fees paid for Scottish-domiciled students by the Student Awards Agency for Scotland means that teaching income is much more dependent on state funding than in the rest of the UK. In Wales too, there is a high dependency on state funding for teaching; in addition, the Welsh Assembly Government pays a significant proportion of the fees for Welsh students attending English universities, which reduces the teaching income available for Welsh HEIs.

In conclusion, most chemistry and physics departments still run at substantial deficits in their main activities of teaching and research. The slight improvements in some departments suggest that some have made efficiency savings since the earlier report; this best practice should be shared throughout the sector. However, these savings have not been enough to significantly reduce the deficit so it is imperative that public investment in research is maintained and teaching income is protected. The additional HEFCE funding streams for SIVS and for high cost subjects are vital for these laboratory-based subjects. UK chemistry and physics departments make an essential contribution to society and the economy and must be sustained.

---

11 http://www.rsc.org/globalassets/04-campaigning-outreach/campaigning/campaign-for-government-science-support/science-funding-briefing.pdf

1. Introduction

This is the report of a study undertaken by Sean McWhinnie of Oxford Research and Policy and Nigel Brown of Nigel Brown Associates of the finances of Chemistry and Physics departments in a sample of UK universities commissioned jointly by the Royal Society of Chemistry (RSC) and the Institute of Physics (IOP). This study is the second follow up to separate studies undertaken by Nigel Brown in 2005 of the finances of chemistry departments in UK universities[12] for the RSC and in 2006 of the finances of physics departments in English universities for the IOP.[13] The first follow up study, also jointly commissioned by the RSC and the IOP, was carried out in 2009 by Nigel Brown.[14] In drawing up the sample of departments for this study, participation in the 2009 study was an important criterion in order to enable comparisons between the current position and that observed in the earlier study.

As with previous studies, it must be borne in mind that this study is a "snapshot" of the situation in 2012/13. 2012/13 was the first year of a new funding regime for full-time and part-time undergraduates beginning their courses from September 2012, with maximum fees of £9000 per annum for home and EU students in England with corresponding reductions in Funding Council teaching grants in respect of these students. Changes were also made to the funding arrangements for home and EU undergraduates entering universities in Wales and Northern Ireland from September 2012.

Teaching income was thus in a state of flux, which will continue for at least another three academic years until all old regime students undertaking four-year undergraduate courses have completed.

The outcome of the 2014 Research Excellence Framework (REF), and subsequently funding decisions, will affect research income from academic year 2015/16 onwards.

Universities also continue to face increasing cost pressures, along with all other publicly-funded bodies. University staff have been subject to low pay rises over the last few years and pressure is increasing on the University Superannuation Scheme (USS) to make changes in order to limit its future liabilities. Furthermore, the £9,000 fee cap is not subject to inflation-related increases unlike the fee cap under the previous fee regime.

As with the earlier studies, it must be borne in mind that the sample of departments was drawn up on pragmatic rather than statistical criteria. Nevertheless, the departments included are broadly typical of the sector as a whole in terms of the range of undergraduate student numbers and research income.

---

12. *Study of the Costs of Chemistry Departments in UK Universities: Summary Report*, Nigel Brown, Nigel Brown Associates, Royal Society of Chemistry, London, 2006.
13. *Study of the Finances of Physics Departments in English Universities: a summary report*, Nigel Brown of Nigel Brown Associates, Institute of Physics, London, 2006.
14. *Follow-up Study of the Finances of Chemistry and Physics Departments in UK Universities*, Nigel Brown of Nigel Brown Associates, Institute of Physics, London, 2010.

2. Background

The original studies undertaken between 2004 and 2006 compared costs, derived using the methodology of the Transparent Approach to Costing (TRAC),[15] and income from all sources. They showed that all chemistry and physics departments in the samples were at that time operating with significant deficits overall and in most cases deficits on both teaching and research activity. The follow-up study showed that both chemistry and physics departments in the sample were by and large continuing to operate in deficit overall in 2007/08. The overall deficit on all activities for the chemistry departments in the sample in 2007/08 was 29.1% of total income, while for the physics departments it was 16.7%. However, the financial position of teaching in both chemistry and physics departments in England appeared to have improved substantially since the earlier studies. Those improvements were thought to reflect two main factors: the improved income per FTE student in departments in English universities reflecting increased tuition fees for home and EU undergraduates and the additional funding provided by HEFCE for strategically important and vulnerable subjects (SIVS) provided from 2007/08.

Nearly all of the chemistry and physics departments in the sample were in deficit in 2007/08 on research activity due to a number of factors, including the overhead element of grants being still short of full economic costing. Research spend in 2007/08 almost certainly reflected the effort put into research activity in the build up to submissions to the RAE 2008 by institutions to secure the best possible rating. The proportion of academic staff time spent on research may well have increased, shifting costs from teaching to research.

Since 2007/08 there have been a number of further changes to the public funding of higher education including:

- Following the introduction in England and Northern Ireland from 2006/07 of a variable tuition fee regime for full-time undergraduate teaching with a maximum fee of £3,000 per student,[16] a variable fee with a maximum of £9,000 was introduced for academic year 2012/13. As under the £3,000 fee regime, English students paying the £9,000 fees were eligible for publicly-funded loans repayable after graduation on an income contingent basis through the tax system on earnings over £21,000 per annum. Welsh students were eligible for a grant up to £5,315 and could apply for a loan of up to £3,685. Scottish students were eligible for a means tested bursary of up to £1,750 as well as fee loans.
- In Wales from 2012/13 universities also can charge fees up to a maximum of £9,000. Welsh-domiciled students are required to pay £3,685 and are eligible for publicly-funded loans repayable after graduation on an income contingent basis through the tax system on earnings above £21,000 per annum. A Fee Grant pays the balance of the tuition fee up to a maximum grant of £5,315 if a tuition fee of £9,000 is charged. Students from the rest of the UK are charged variable fees up to a maximum of £9,000 like England.
- In Scotland the standard tuition fee for an undergraduate degree course in Scotland in 2014 is £1,820. The Student Awards Agency for Scotland (SAAS) pays these fees if students meet eligibility conditions; for example, Scottish residents and/or qualifying non-UK EC students.

---

15. TRAC was developed for the Joint Pricing and Costing Steering Group of HEIs by JM Consulting to deliver an approach to deriving the full economic costs (fecs) of publicly funded research as a basis for costing and pricing research projects, especially those funded by UK Research Councils.
16. The so-called "old-regime" fee was subject to annual rises reflecting the GDP deflator and was £3,450 in 2012/13.

Students from the rest of the UK are charged variable fees up to a maximum of £9,000 like England and Wales. In addition to publicly funded loans, eligible students from England, Northern Ireland and Wales have access to Undergraduate Scholarships and Bursaries to help offset these higher fees.

- In Northern Ireland, Queen's University Belfast charges £9,000 fees. Northern Irish-domiciled students pay £3,685 and students from the rest of the UK pay the full £9,000. Different arrangements are in place to provide funding for students dependent on where students are domiciled.
- In England any university or college that wants to charge fees above £6,000 for home/EU undergraduates, and/or postgraduates on PGCE or initial teacher training courses, must have an access agreement approved by the Director of Fair Access. Access agreements cover full-time students and (from 2012/13) part-time students studying at an intensity of at least 25 per cent of a full-time course. An access agreement sets out a university's or college's fee limits and the access measures it intends to put in place e.g. outreach work and financial support for students. As part of their access agreements, universities provide bursaries for less well-off students.
- Full implementation of specific R grants by HEFCE towards the overhead costs of research projects funded by UK research charities and UK business.
- The contribution towards overheads within Research Council grants has increased to 80% but continues to fall short of meeting the full economic costs of research projects.

From 2007/08 HEFCE allocated £75 million per annum in time-limited core funding to secure the provision of strategically important and vulnerable subjects (SIVS)[17] – Chemistry, Physics, Chemical Engineering and Mineral, Metallurgy and Materials Engineering – targeted at those institutions which clearly offered significant and focussed taught activity in the high cost subject areas concerned. The funding was provided for project work to increase participation in these subjects and also as additional teaching funding to institutions with teaching provision in the subjects. Although the funding was initially for three years, HEFCE announced in January 2009 that this additional funding would continue on a recurrent basis from 2010. Following a review of this specific funding, HEFCE decided to continue it from 2013/14 onwards,[18] albeit in a more flexible way which allows for subjects to be added and removed from the list of those funded. From 2013/14 Earth, Marine & Environmental Sciences was added to the list of subjects funded.

Furthermore, the basis of calculation of individual funding allocations was revised for 2013/14 onwards with departmental allocations being based on the student FTEs taken from 2010/11 HESA data instead of being based on HESA data for 2005/06. The total amount distributed to departments has varied between £24.8M in 2007/08 to £22.7M in 2012/13.

Since the introduction of additional funds for strategically important and vulnerable subjects the FTEs of chemistry and physics students has increased, leading to a fall in the amount of money per FTE. Figure 1 illustrates how between 2007/08 and 2012/13 the amount of additional funding per taught student FTE fell by around £300 in chemistry and £370 in physics.

17. HEFCE Circular Letter 13/2007, 30 March 2007.
18. HEFCE Circular Letter 02/2013, January 2013.

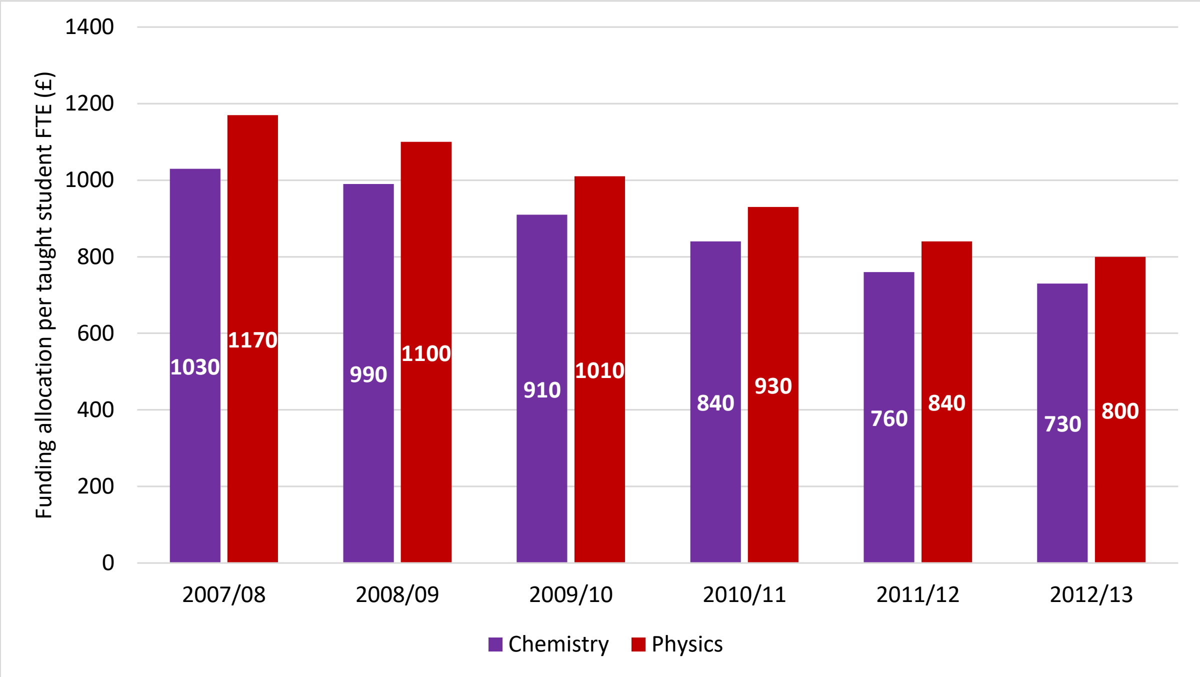


Figure 1: Additional funding for strategically important and vulnerable science subjects per taught student FTE

Sources: HEFCE SIVS Funding Data and HESA Student Data

Note: FTEs from HESA student data. FTEs have been restricted to just those institutions in receipt of SIVS funding for chemistry and physics, respectively. Funding and FTE data for the Open University have been excluded.

It should be noted that the SIVS funding remains distinct from additional per capita funding for high-cost subjects that HEFCE provides under new regime funding.

Given the continually changing nature of university funding, and a desire to continue to monitor the financial health of chemistry and physics departments, the RSC and the IOP jointly commissioned this study of the finances of chemistry and physics departments in UK universities.

3. Approach

The approach adopted for the present study was as far as possible the same as that taken for the first follow-up study to allow comparisons to be drawn between the two sets of data for chemistry and physics departments.

It was agreed that there should be the maximum possible overlap between the sample institutions in this follow-up study and in the 2009 study.

14 universities which had both chemistry and physics departments were identified for inclusion in the sample – ten English universities and four universities in the other three nations of the UK. All 14 universities were invited to participate; 12 of which were also in the 2009 study.

The present study was based around a questionnaire updated from the one used in the 2009 study. The study used a common questionnaire for all English departments, but the questionnaire was adapted for universities in Scotland, Wales and Northern Ireland. The data requested included:

- Cost drivers (student load [full-time equivalents (FTE)], staff [FTE] and space);
- Income for teaching, research and other activities, distinguishing publicly funded income from income from private sources;
- Budgetary approach and data;
- TRAC cost data split between publicly and non-publicly funded teaching, publicly and non-publicly funded research, and other activities; and in turn split between types of expenditure – departmental direct and indirect costs, premises costs, other central charges and full economic cost adjustments; and
- The allocation of academic staff time between teaching, research, other activities and support.

Unlike earlier studies, guidance notes were provided in order to seek to improve the quality of the returned data. When data were returned they were checked and any inconsistencies were followed-up with university and departmental contacts. In addition, further queries on individual data were raised where indicators appeared out of line having compiled data into tables and charts.

Once questionnaires were returned English universities were invited to respond to a series of additional questions. The answers to the questions were collected either by interviewing contacts over the telephone and/or through written returns. The questions were based in particular around the operation of resource allocation models within universities.

It has not proved possible to obtain complete datasets for every institution in the sample. 12 chemistry departments provided data and of these ten of the datasets were sufficiently complete with full TRAC information to use for the full analysis of income and costs. However, where data are available for the other departments without full TRAC information these are presented in relevant tables and figures. 12 physics departments returned data and of these ten of the datasets were sufficiently complete to use in the full TRAC analysis.

For both chemistry and physics nine datasets were sufficiently complete with full TRAC data in both 2007/08 and 2012/13 enabling comparisons to be made.

As was noted in earlier studies, a very high proportion of both teaching and research in chemistry and physics departments is supported by public funding. Consequently the division of teaching and research into that funded from public and private sources is somewhat arbitrary. As in the2009 report, much of the data presented does not therefore differentiate public and privately funded activity.

The report of the study first presents the data for chemistry and physics departments separately in a series of tables and figures. In the discussion and conclusion section of the report some data for both chemistry and physics departments are presented together. Findings from the present study are presented alongside data from the 2009 study where the data allow.

Terminology

Throughout this report the term “average” is used to denote the arithmetic mean of the data for individual departments. When the term “overall deficit” is used it denotes the deficit for the group of departments under discussion. That is, the overall deficit is calculated by summing the individual departments’ incomes and costs separately and comparing those two overall figures.

4. Findings: Cost Drivers

The sections below present data on the principal cost drivers – students, academic staff, technicians and departmental space – for the chemistry and physics departments from the present study and seek to identify significant changes since the 2009 study by comparing relevant findings for the departments common to this study and the earlier study.

4.1 Student numbers

Table 1 and table 2 compare undergraduate student FTEs in 2012/13 with those in the 2007/08 for chemistry and physics respectively for the whole sample and for the departments common to both studies.

The data show that in the ten chemistry departments common to both studies there was an increase of 30% in the home and UK undergraduate FTEs between 2007/08 and 2012/13. In the ten physics departments common to both studies there was an increase of 33% in home and EU undergraduate FTEs. The growth in overseas undergraduate FTEs was 77% and 80% in the common chemistry and physics departments, respectively.

Table 1: Undergraduate student FTEs in the sample Chemistry Departments in 2007/08 and 2012/13

Institutions		2007/08		2012/13	
		Home and EU	Overseas	Home and EU	Overseas
Whole sample	Range	177–558	0–102	330–638	13–75
	Average	343.4	23.1	446.1	36.2
Common institutions (10)	Range	237–487	2–40	330–638	13–75
	Average	346.8	19.1	450.7	33.9

Source: *Institutional data*

Table 2: Undergraduate student FTEs in the sample Physics Departments in 2007/08 and 2012/13

Institutions		2007/08		2012/13	
		Home and EU	Overseas	Home and EU	Overseas
Whole sample	Range	184–541	0–37	338–524	10–81
	Average	309.9	11.2	426.8	22.3
Common institutions (10)	Range	224–541	4–37	338–524	10–81
	Average	328.9	12.4	437.2	22.3

Source: *Institutional data*

Increases in national figures for chemistry shown in table 3 below are in line with the increases in departments common to both studies. The numbers of home and EU FTEs in the physics departments common to both studies has increased more than numbers across the whole sector, as shown in table 4.

Table 3: Home and EU undergraduate student FTEs with principal subject Chemistry from 2007/08 to 2012/13

Year	Institution Location				Overall
	England	Northern Ireland	Scotland	Wales	
2007/08	10,730	170	1,945	475	13,320
2008/09	11,295	165	2,065	695	14,225
2009/10	11,870	150	2,170	530	14,720
2010/11	12,485	170	2,220	745	15,625
2011/12	12,880	170	2,145	905	16,100
2012/13	13,315	195	1,995	710	16,215
% Change	24%	15%	3%	49%	22%

Source: *HESA Student Data (values rounded to the nearest 5)*

Table 4: Home and EU undergraduate student FTEs with principal subjects Physics or Astronomy from 2007/08 to 2012/13

Year	Institution Location				Overall
	England	Northern Ireland	Scotland	Wales	
2007/08	11,135	160	1,460	560	13,315
2008/09	11,985	165	1,560	585	14,290
2009/10	12,635	165	1,645	620	15,060
2010/11	12,530	190	1,770	675	15,160
2011/12	12,530	200	1,750	835	15,315
2012/13	12,585	250	1,940	990	15,765
% Change	13%	57%	33%	77%	18%

Source: *HESA Student Data (values rounded to the nearest 5)*

Figure 2 and figure 3 show the change in home and EU undergraduate numbers for the institutions in both the current and earlier studies for chemistry and physics, respectively. All but one of the chemistry departments and all of the physics departments have experienced a growth in undergraduate FTEs since 2007/08, but, the relative growth has not been uniform. A similar pattern of non-uniform growth was observed in the 2009 study comparing 2007/08 student numbers' data with earlier years.

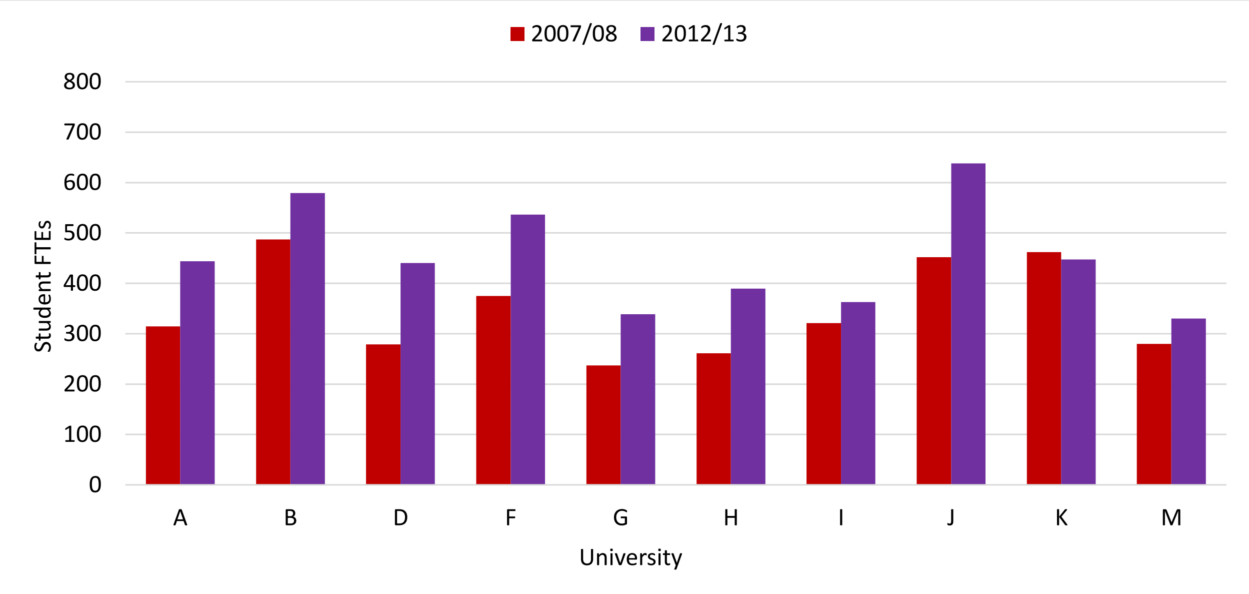


Figure 2: Home and EU Undergraduate Chemistry Students (FTE) for Comparator Universities 2007/08 and 2012/13
Source: *Institutional Data*

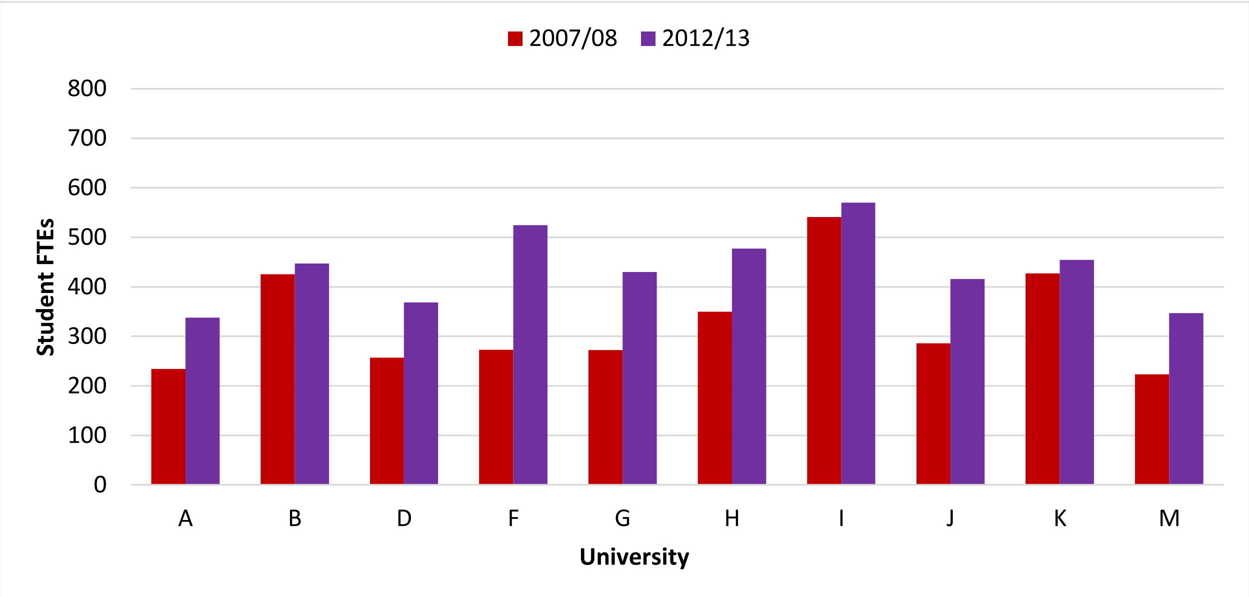


Figure 3: Home and EU Undergraduate Physics Students (FTE) for Comparator Universities 2007/08 and 2012/13
Source: *Institutional Data*

Table 5: First Year Chemistry and Physics Undergraduate Enrolment (including overseas) in 2010/11 to 2013/14

Institutions		Chemistry (11 Departments)					Physics (12 Departments)				
		2010/11	2011/12	2012/13	2013/14	% change	2010/11	2011/12	2012/13	2013/14	% change
English Universities	Total	1,107	1,144	1,056	1,152	4.1	1,190	1,260	1,248	1,353	13.7
	Average	138	143	132	144		132	140	139	150	
Universities in other countries of the UK	Total	306	301	373	410	34.0	262	267	343	357	36.3
	Average	102	100	124	137		87	89	114	119	
Overall Total		1,413	1,445	1,429	1,562	10.5	1,452	1,527	1,591	1,710	17.8

Source*: Institutional Data*

Table 5, figure 4 and figure 5 show the number of first year undergraduate enrolments for chemistry and physics for the English Universities and other UK universities in the sample for each year from 2010/11 to 2013/14. These figures show an overall increase of 10.5% in first year enrolments between 2010/11 and 2013/14 to chemistry departments in the sample and an increase of 17.8% in first year enrolments to physics departments in the sample over the same period.

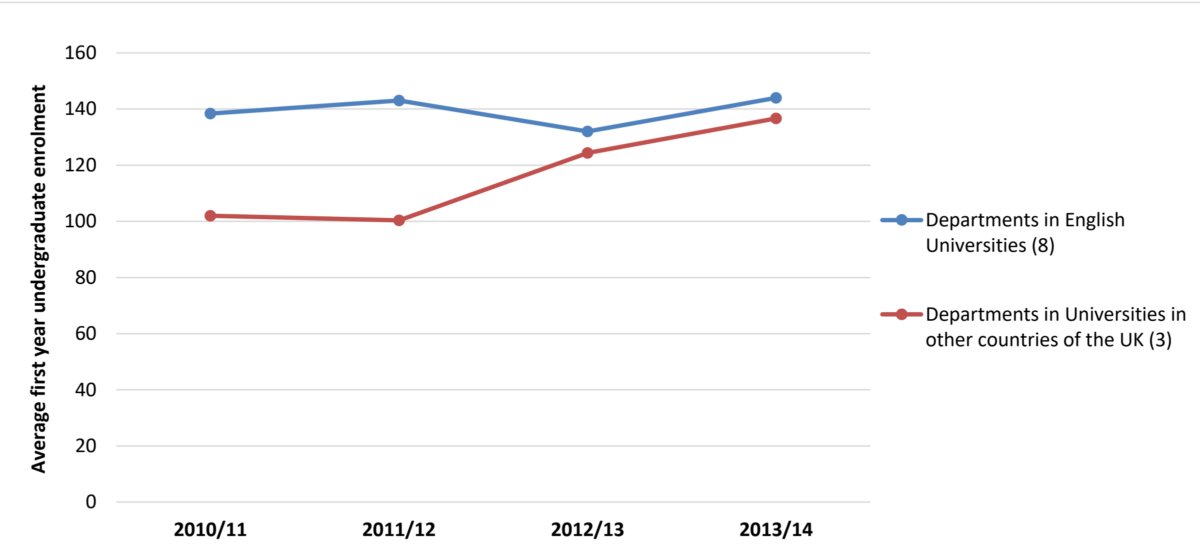


Figure 4: Average first year undergraduate enrolment 2010/11 to 2013/14 for Chemistry Departments in the sample
Source*: Institutional Data*

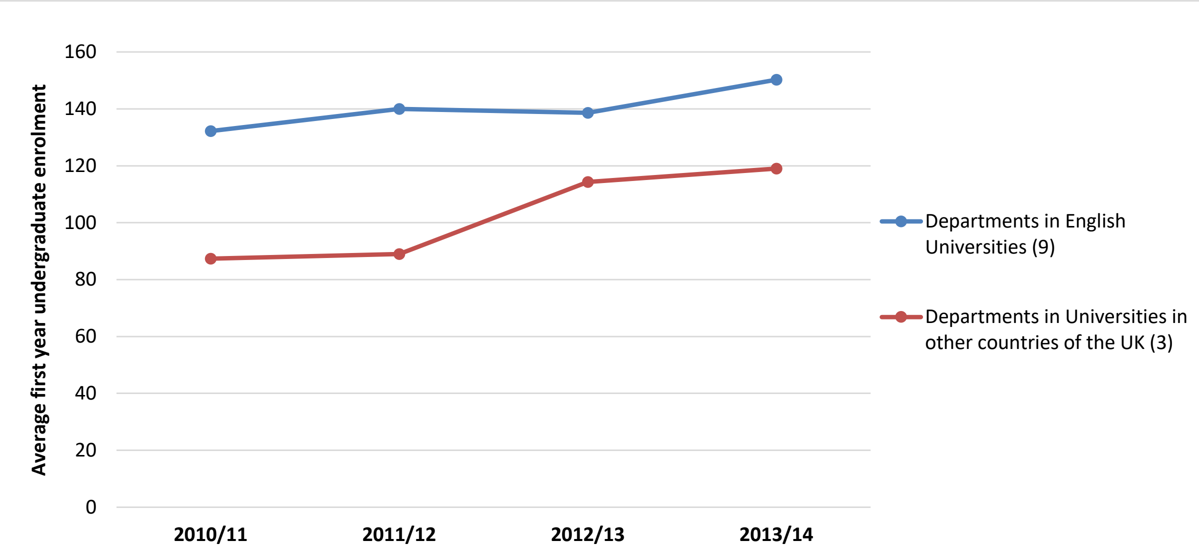


Figure 5: Average first year undergraduate enrolment 2010/11 to 2013/14 for Physics Departments in the sample
Source*: Institutional Data*

These figures show differences in the pattern of the average first year enrolments in both chemistry and physics between departments in English universities and universities in the other parts of the UK in the sample. The difference in the pattern of first year enrolments between 2011/12 and 2013/14 reflects the major changes in the student fee regime introduced in 2012/13 in England and their impact on student demand. This is considered further below.

Figure 6 shows the enrolment of students into first-degree and other undergraduate principal subject chemistry courses in the whole of England and in the rest of the UK and figure 7 presents equivalent data for principal subjects physics and astronomy.

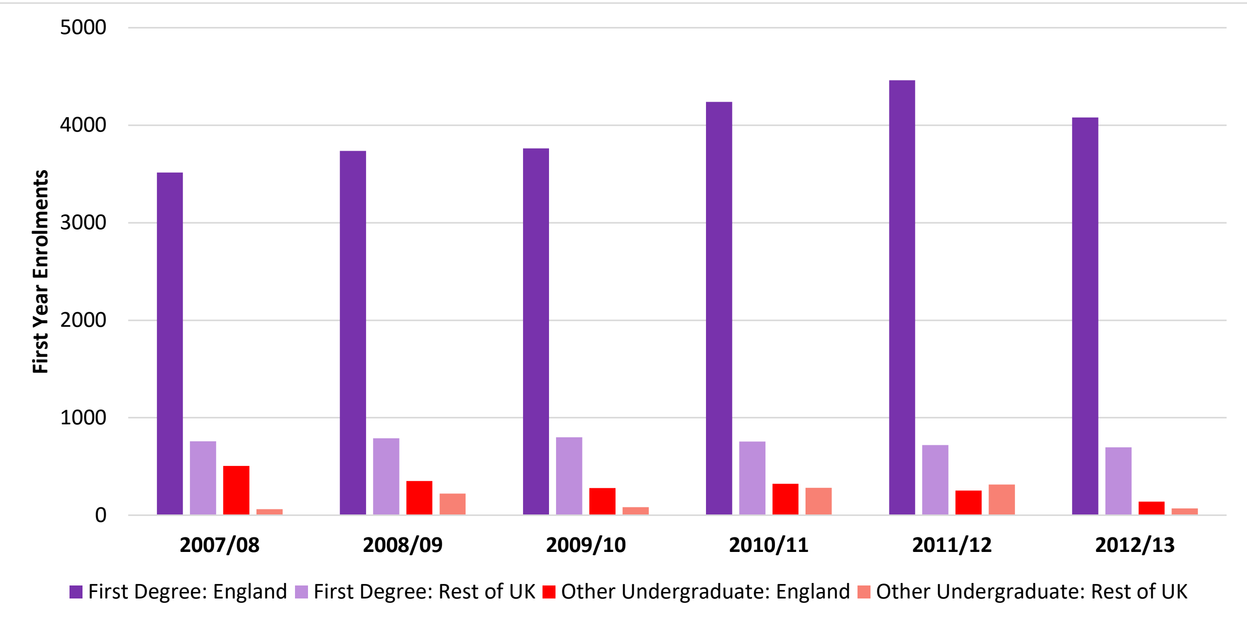


Figure 6: First-year enrolment* 2007/08 to 2013/14 into principal subject Chemistry undergraduate courses in England and the rest of the UK.
Source*: HESA Student Data*

* *First year enrolment is estimated by using a headcount of students registered in principal subject chemistry for 0.5 or more FTE.*

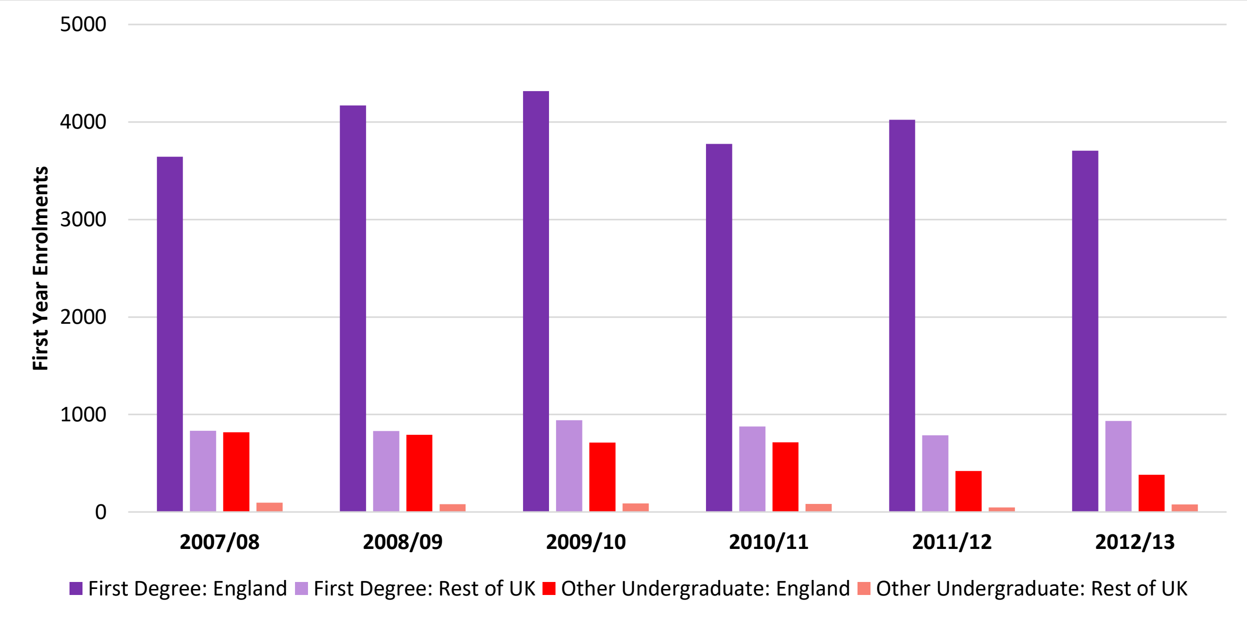


Figure 7: First-year enrolment* 2007/08 to 2013/14 into principal subjects Physics and Astronomy undergraduate courses in England and the rest of the UK.
Source*: HESA Student Data*

* *First year enrolment is estimated by using a headcount of students registered in principal subjects physics and astronomy for 0.5 or more FTE. There will be some double counting of students who are registered 0.5 FTE physics and 0.5 FTE astronomy.*

The data show that in England chemistry enrolment increased up to 2011/12, the last year of old regime fees, while physics and astronomy enrolment in England increased until 2009/10 before falling in 2010/11 and increasing again in 2011/12. Both chemistry, and physics and astronomy enrolment in England fell between 2011/12 and 2012/13, reflecting the general reduction in demand as a result of the introduction of the new funding regime incorporating maximum fees of £9,000. In physics and astronomy in particular, enrolment in the rest of the UK increased between 2011/12 and 2012/13. These differences in enrolment patterns between England and the other countries of the UK relate to the much more modest changes to the fee regime for first year students domiciled in the other countries of the UK attending universities in their home country than was the case for English students attending English universities.

Initial indications, including data for this study, are that recruitment has risen again in England and has continued to rise in the rest of the UK in 2013/14. The most likely cause is that students facing the choice of entering under the old fee regime in 2011 or deferring entry until 2012 were less likely to defer entry than usual leading to increases in enrolment in 2011/12. In 2012/13 enrolment fell reflecting the reduction in students completing a gap year. Now with new regime fees in place, it is likely that the normal pattern of student enrolment will resume. Chemistry and physics have a relatively young student entrant profile and consequently are likely to be more affected by the supply and choices of 18 and 19 year entrants than some other subjects.

Nonetheless, as was illustrated in table 3 and table 4, overall there has been continuous increase in the total student FTEs taking chemistry and physics/astronomy. It should be noted that this FTE figure includes all teaching, including service teaching, whereas the enrolment figures aim to represent those students registering for chemistry or physics/astronomy courses.

In the sample chemistry departments the average number of taught postgraduate student FTEs in 2012/13 was 12 with 48% of these from outside the EU. In the sample physics departments the average number of taught postgraduate student FTEs in 2012/13 was also 12 with 22% of these from outside the EU.

These data are consistent with the findings from the earlier studies that postgraduate taught programmes in both chemistry and physics are unusual with only one or two departments having more than ten such students in 2007/08. However, it continues to be the case that a high proportion of these students are from outside the EU and hence taught postgraduate courses are potentially a significant source of income.

Table 6 and table 7 compare postgraduate research student FTEs in 2012/13 with those in the 2007/08 for chemistry and physics respectively for the whole sample and for the departments common to both studies.

The data show that in the ten chemistry departments common to both studies there was an increase of 17% in the home and UK postgraduate research FTEs between 2007/08 and 2012/13. In the ten physics departments common to both studies there was an increase on 29% in home and EU postgraduate research FTEs. The growth in overseas postgraduate research FTEs was 9% and 34% in the chemistry and physics departments common to both studies, respectively.

Table 6: Postgraduate research student FTEs in the sample Chemistry Departments in 2007/08 and 2012/13

Institutions		2007/08		2012/13	
		Home and EU	Overseas	Home and EU	Overseas
Whole sample	Range	38–161	6–61	58–186	12–43
	Average	94.6	23.1	110.8	25.4
Common institutions (10)	Range	58–161	6–61	65–186	12–33
	Average	99.6	21.8	116.1	23.7

Source: *Institutional data*

Table 7: Postgraduate research student FTEs in the sample Physics Departments in 2007/08 and 2012/13

Institutions		2007/08		2012/13	
		Home and EU	Overseas	Home and EU	Overseas
Whole sample	Range	12–84	4–25	25–138	5–27
	Average	48.8	8.7	73.1	13.4
Common institutions (10)	Range	28–84	4–25	25–138	5–27
	Average	57.1	10.2	73.6	13.7

Source: *Institutional data*

4.2 Academic Staffing

Academic staff include all teaching and research, research-only and teaching-only staff on permanent contracts funded out of general university income and those staff, mainly research-only, funded by external grants and contracts. In taking forward this analysis it is important to distinguish the numbers in these two groups since they are driven by different factors.

In 2012/13 total academic staffing in the chemistry departments in the sample ranged from 70 to 145 and in the physics departments from 44 to 153. The proportion of posts funded from departmental budgets (as opposed to those funded by external research grants and contracts) was 48.0% of the total for the chemistry departments and 48.1% for the physics departments in the sample. In 2007/08 total academic staffing in the chemistry departments in the sample ranged from 30 to 173 and in the physics departments from 23 to 175 with the overall proportion of posts funded from departmental budgets 42.8% for chemistry departments and 48.8% for physics departments in the whole sample.

For the chemistry departments common to the 2007/08 and 2012/13 studies the proportion of posts funded from departmental budgets increased from 41.6% in 2007/08 to 48.0% in 2012/13. For the physics departments common to both studies the proportion of posts funded from departmental budgets was similar being 46.4% in 2007/08 and 46.9% in 2012/13.

The detailed picture for individual departments in 2007/08 and 2012/13 is shown in figure 8 and figure 9.

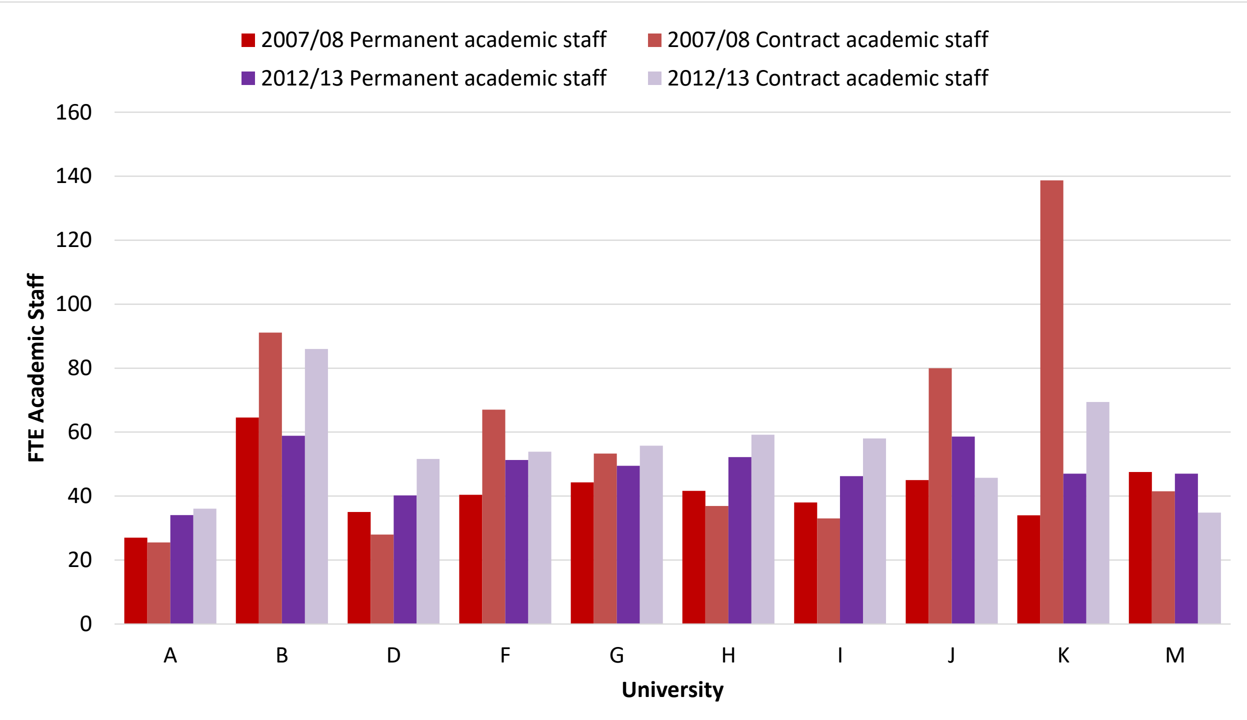


Figure 8: Permanent and Contract Academic Staff (FTEs) in Chemistry Departments in 2007/08 and 2012/13
Source: *Institutional data*

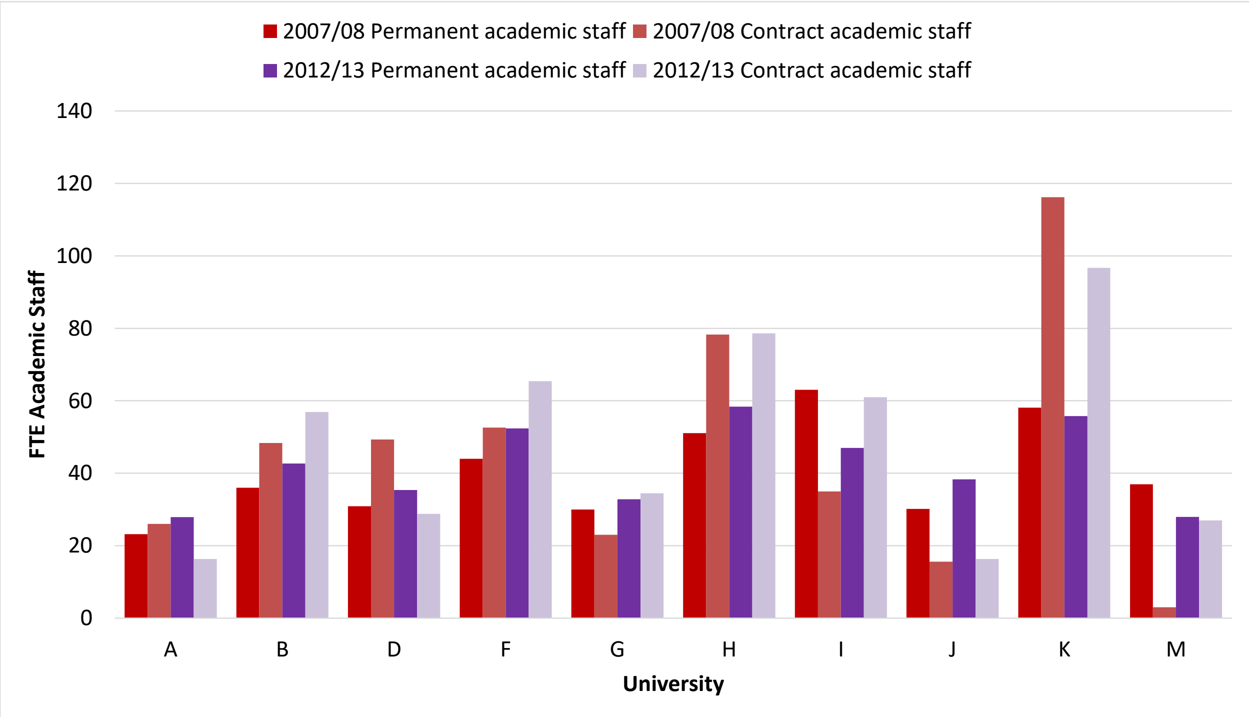


Figure 9: Permanent and Contract Academic Staff (FTEs) in Physics Departments in 2007/08 and 2012/13
Source: *Institutional data*

These two figures show a complex pattern of changes in the numbers of academic staff on permanent contracts and those funded through research grants and contracts between the two years. For those chemistry departments in both samples the average number of FTE permanent academic staff increased from 41.7 in 2007/08 to 48.5 in 2012/13 (16%) while the average number of FTE academic staff supported by external grants and contracts fell from 59.5 to 55.0 (8%). For physics departments in both samples the average number of permanent academic posts increased from 40.3 to 41.9 (4%) while the average number of posts supported by external grants and contracts increased from 44.7 to 48.1 (8%) between 2007/08 and 2012/13.

Between 2007/08 and 2012/13 the average student to permanent academic staff ratio[19] (SSR) has increased from 10.8 to 12.8 for the ten chemistry departments common to both samples. For the ten physics departments in both samples the increase in the average SSRs between 2007/08 and 2012/13 was from 9.5 to 13.1.

---

19. Based on the FTE of all taught students (home, EU and overseas undergraduate and postgraduate) divided by, in 2007/08, total FTE of academic staff on permanent contracts excluding research fellows and post-doctoral fellows or, in 2012/13, divided by permanent academic staff with teaching responsibilities funded through the departmental budget.

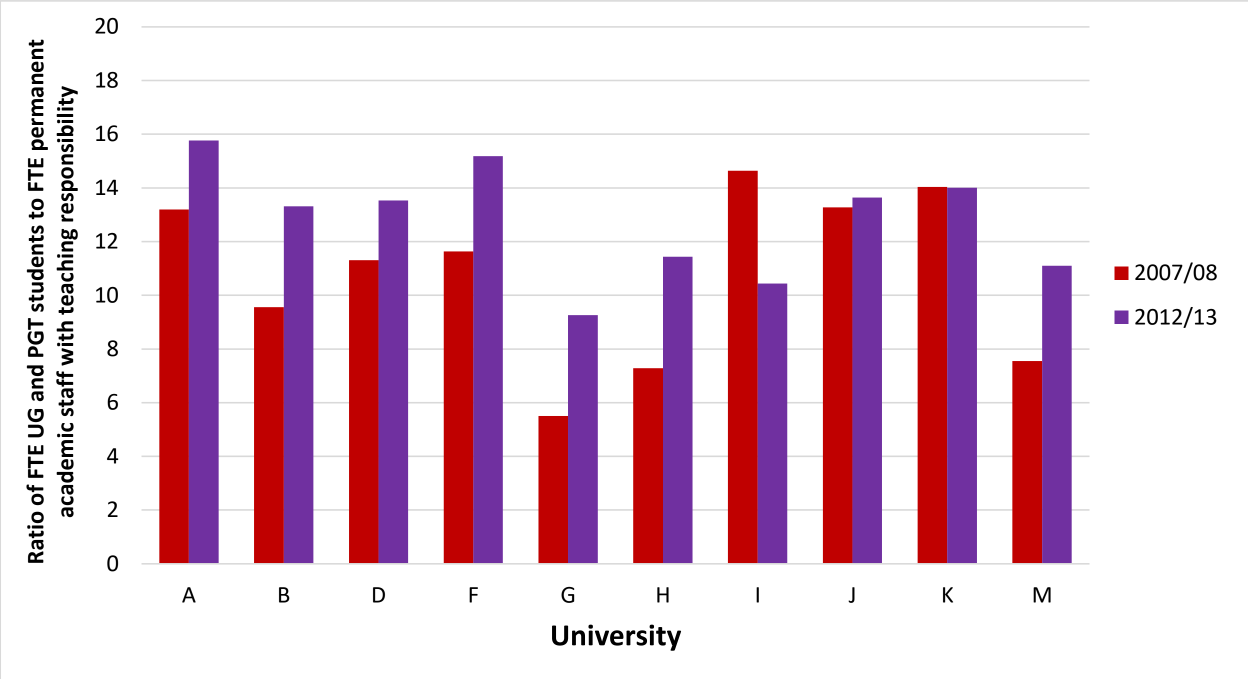


Figure **10** and figure 11 show the change in SSRs for the ten chemistry and physics departments that were common to the 2007/08 and 2012/13 studies.

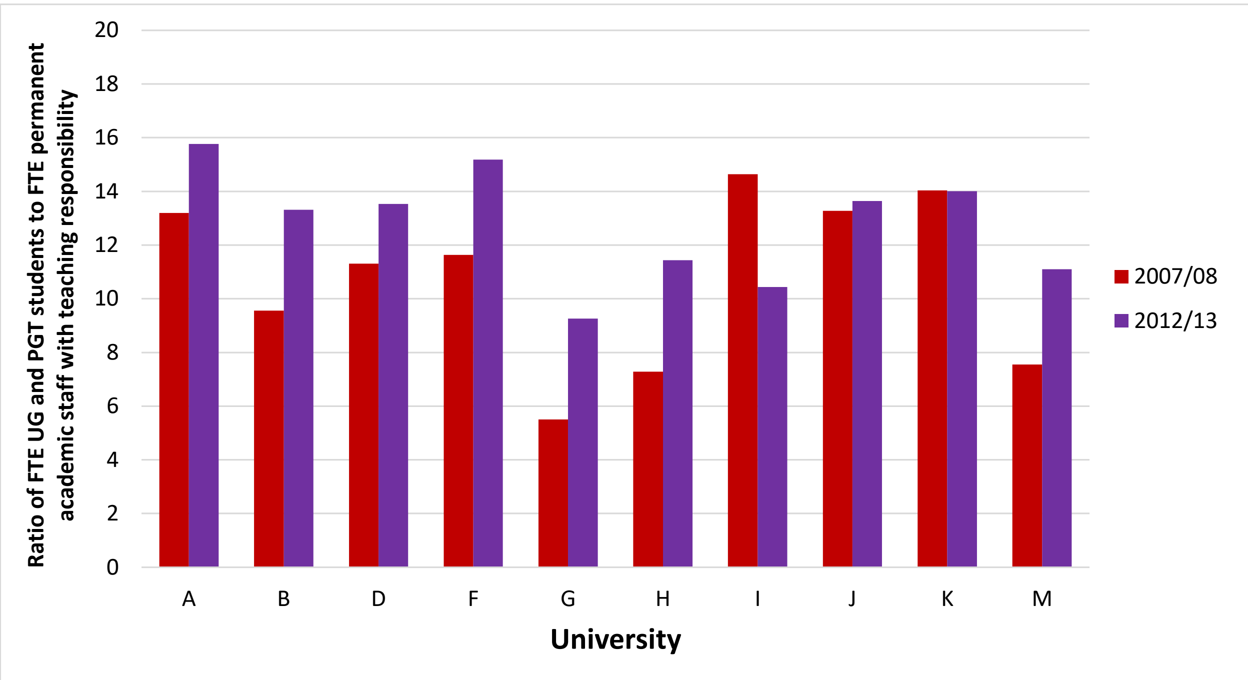


Figure 10: Ratio of FTE UG and PGT Students to FTE Permanent Academic Staff with teaching responsibilities paid from departmental budgets for Chemistry Departments in 2007/08 and 2012/13
Source: *Institutional data*

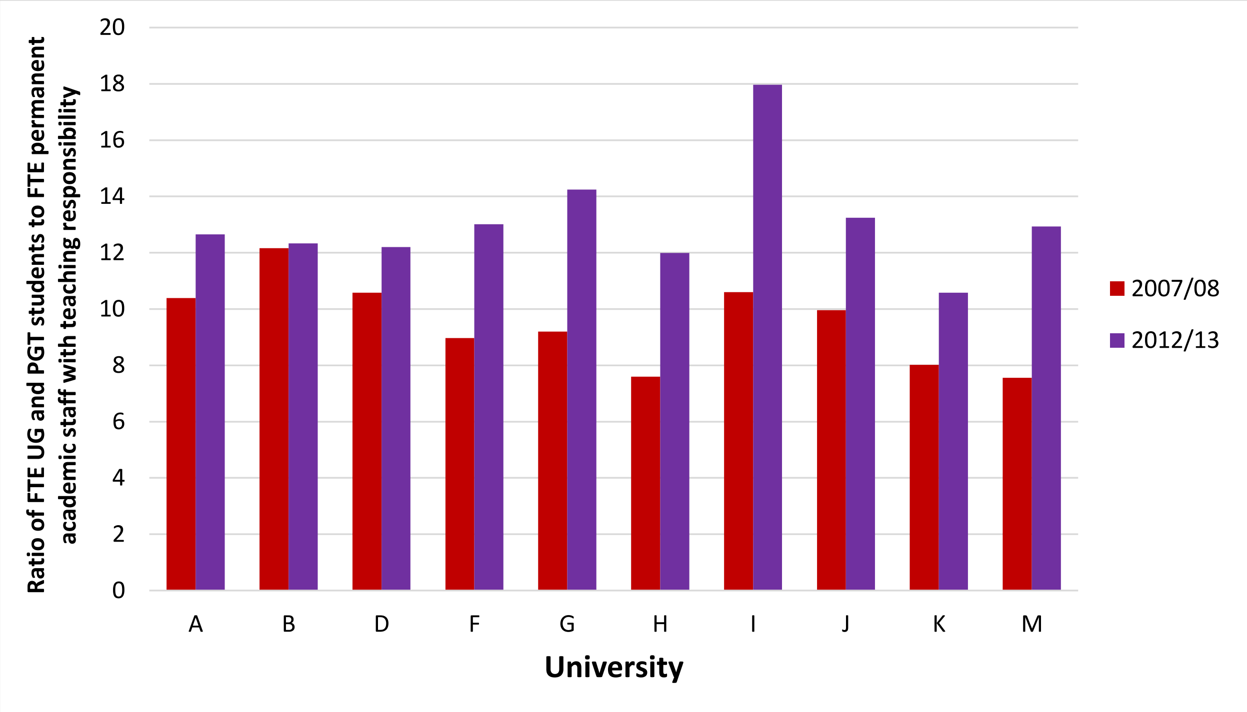


Figure 11: Ratio of FTE Students to FTE Permanent Academic Staff with teaching responsibilities paid from departmental budgets for Physics Departments in 2007/08 and 2012/13
Source: *Institutional data*

These figures show that SSRs increased in all but two of the chemistry and physics departments between 2007/08 and 2012/13.

As has been noted in earlier reports, the number of staff funded by external grants and contract income is related to the level of that income and this is considered further later. It was also noted in the 2009 report that the requirements of European employment law might result in a shift towards employing research staff on permanent contracts. Although information on this aspect was not explicitly requested in the questionnaires, there has been an increase in the proportion of research staff employed from within the department budgets. In chemistry 9% of research staff were employed on department budgets in 2007/08 while by 2012/13 the figures had increased to 15%. In physics 8% of research staff were employed on department budgets in 2007/08 while by 2012/13 the figures had increased to 11%.

4.3 Technicians

In chemistry departments in the sample the average number of technicians was 20.9 with a ratio of one technician post for every 2.1 academic posts. For physics the corresponding figures were 14.7 and 2.9, respectively.

Considering only those departments common to both studies, in 2007/08 the average number of technicians per chemistry department in the sample was 22.0 with a ratio of one permanent technician post for every 1.9 permanent academic posts, and in 2012/13 the figures were 22.0 and 2.4. For physics departments in 2007/08 there was an average of 15.8 technician posts with a ratio one permanent technician post for every 2.6 permanent academic posts, and in 2012/13 the figures were 16.1 and 2.6, respectively. In chemistry departments common to both studies the number of technicians remained about the same while the number of academic staff increased by 14%. In physics departments the numbers of staff and technicians were little changed (between 2003/04 and 2007/08 there was a decline of 13% in permanent technician posts in physics departments common to both of those studies).

This suggests that the number of technicians in chemistry departments continues to remains stable while that in physics departments has stabilised, following significant reductions in the years leading up to 2007/08.

4.4 Space

Laboratory-based subjects like chemistry and physics have a higher need for dedicated space and in particular highly serviced specialist space than most other subjects. The costs of space are therefore a significant element within total costs. For the chemistry departments in the sample around 40% of the total space in 2012/13 was research laboratories and 16% was teaching laboratories. For the physics departments in the sample research laboratories accounted for around 28% and teaching laboratories accounted for around 14%. These figures show that in general chemistry departments require more research laboratory space. This in part reflects the higher proportion of chemistry research undertaken in-house as opposed to in national or international research facilities than for physics research.

The simplest drivers for comparative purposes are the FTE of academic staff, both permanent academic staff and those funded by external research grants and contracts.

Comparative data for chemistry departments common to both the 2009 and the 2014 studies are shown in table **8** and figure 12, and data for physics departments are shown in table 9 and figure 13.

Table 8: Space per FTE Academic Staff for Comparator Chemistry Departments 2007/08 and 2012/13

University	2007/08					2012/13				
	Total space (sq. metres)	Permanent Academic Staff (FTE)	Contract Academic Staff (FTE)	Space per FTE permanent academic staff (sq. metres)	Space per FTE permanent and contract academic staff (sq. metres)	Total space (sq. metres)	Permanent Academic Staff (FTE)	Contract Academic Staff (FTE)	Space per FTE permanent academic staff (sq. metres)	Space per FTE permanent and contract academic staff (sq. metres)
A	3714	27.0	25.5	137.6	70.7	5830	34.1	36.1	171.1	83.1
B	12073	64.5	91.1	187.1	77.6	12671	58.9	86.0	215.3	87.5
D	7658	35.0	27.9	218.8	121.7	8274	40.2	51.6	205.9	90.2
F	9360	40.4	67.0	231.6	87.1	9485	51.3	53.9	184.9	90.2
G	7128	44.3	53.3	160.9	73.0	7221	49.5	55.8	146.0	68.6
H	7909	41.6	36.9	190.1	100.8	7909	52.2	59.2	151.5	71.0
I	5000	38.0	33.0	131.6	70.4	7696	46.2	58.0	166.6	73.9
J	9651	45.0	80.0	214.5	77.2	13074	58.6	45.7	223.1	125.3
K	9514	34.0	138.7	280.2	55.1	9798	47.0	69.4	208.5	84.2
M	6846	47.5	41.5	144.1	76.9	6848	47.0	34.8	145.7	83.7
Overall	**78,853**	**417.3**	**594.92**	**189.0**	**77.9**	**88,806**	**484.9**	**550.4**	**183.2**	**85.8**

Source: *Institutional data*

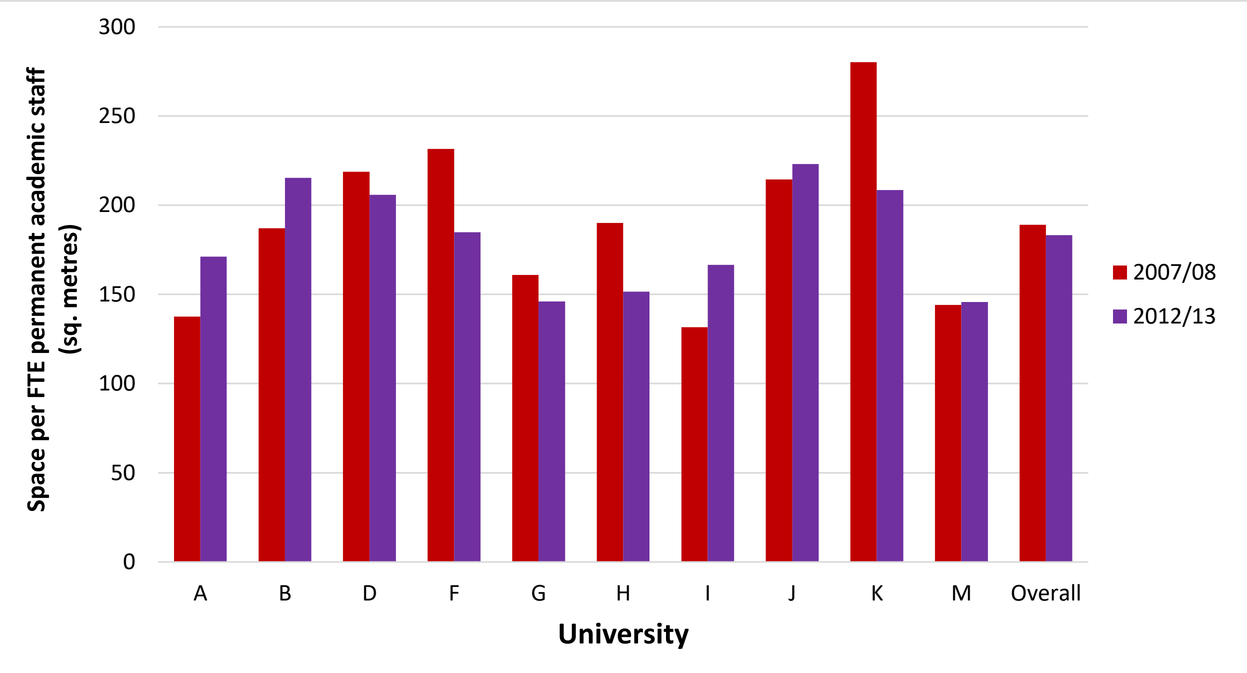


Figure 12: Space per FTE Permanent Academic Staff for Comparator Chemistry Departments 2007/08 and 2012/13

Source: *Institutional data*

Table 9: Space per FTE Academic Staff for Comparator Physics Departments 2007/08 and 2012/13

University	2007/08					2012/13				
	Total space (sq. metres)	Permanent Academic Staff (FTE)	Contract Academic Staff (FTE)	Space per FTE permanent academic staff (sq. metres)	Space per FTE permanent and contract academic staff (sq. metres)	Total space (sq. metres)	Permanent Academic Staff (FTE)	Contract Academic Staff (FTE)	Space per FTE permanent academic staff (sq. metres)	Space per FTE permanent and contract academic staff (sq. metres)
A	3,204	23.2	26.0	138.1	65.1	4,242	27.9	16.3	152.0	96.0
B	6,169	36.0	48.3	171.4	73.2	8,317	42.7	56.9	194.9	83.5
D	5,591	30.9	49.3	180.9	69.7	4,930	35.4	28.8	139.5	76.9
F	7,903	44.0	52.6	179.6	81.8	8,122	52.4	65.4	155.0	68.9
G	3,419	30.0	23.0	114.0	64.5	3,439	32.8	34.4	104.8	51.1
H	5,535	51.1	78.3	108.4	42.8	5,536	58.4	78.6	94.8	40.4
I	6,400	63.0	35.0	101.6	65.3	8,945	47.0	61.0	190.3	82.8
J	4,596	30.1	15.6	152.5	100.5	7,190	38.3	16.3	187.7	131.7
K	8,300	58.1	116.2	142.9	47.6	13,548	55.8	96.7	242.9	88.8
M	5117	36.9	3.0	138.6	128.1	5,173	28.0	27.0	185.1	94.1
Overall	**56,234**	**403.0**	**447**	**139.4**	**66.1**	69442	**418.7**	**481.4**	**165.9**	**77.1**

Source: *Institutional data*

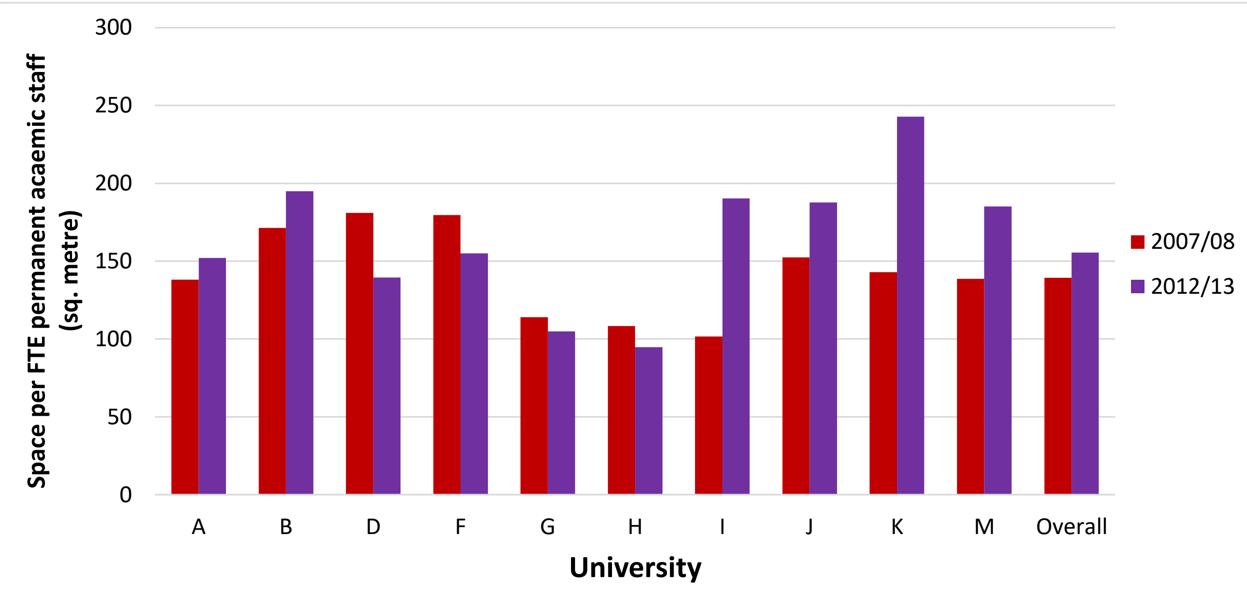


Figure 13: Space per FTE Permanent Academic Staff for Comparator Physics Departments 2007/08 and 2012/13

Source: *Institutional data*

The chemistry departments common to both samples had an average space per FTE academic staff on departmental budget of 189.6m^2 and an overall figure of 189.0 m^2 for 2007/08 and in 2012/13 the corresponding figures were and average of 181.9 m^2 and an overall figure of 183.2 m^2. Considering all academic staff, both those funded from departmental budgets and from grants and contracts, the respective average figures were 81.1 m^2 and 85.8 m^2, respectively, and the overall figures were 77.9 m^2 and 85.8 m^2, respectively. The corresponding average figures for the physics departments in both samples were an average space of 142.8 m^2 and 164.7 m^2 and the corresponding overall figures were 139.4 m^2 and 165.9 m^2 for the space per permanent academic staff member in 2007/08 and 2012/13, respectively. For all academic the average figures were 73.9 m^2 and 81.4 m^2 and the overall figures 66.1 m^2 and 77.1 m^2 in 2007/08 and 2012/13, respectively.

The space per permanent academic staff member is an important figure as it is the permanent academic staff who ostensibly generate income through recruiting and teaching students and raising research income. As observed in the earlier studies, chemistry departments have a higher space requirement than physics departments and consequently chemistry academic staff have to bring in more income to pay for that space.

For the sample as a whole in 2012/13 the teaching laboratory space per FTE permanent academic staff member was 28.6 m^2 for the chemistry departments and 21.9 m^2 for the physics departments. The research laboratory space per FTE permanent academic staff was 77.6 m^2 in the chemistry departments and 43.6 m^2 in the physics departments. On the other hand, office space for chemistry departments was lower at 14.8 m^2 per FTE all academic staff than for physics departments for which it was 22.8 m^2. It is possible that in physics departments the office space is actually where some researchers spend their time undertaking workstation-based work. Research laboratory space tends to be some of the most expensive space to maintain and consequently, as the data show, chemistry departments have higher space costs than physics departments.

5. Findings: Income and Costs

5.1 Teaching Income

The principal sources of income for teaching are public funding from funding councils, including funding from HEFCE for SIVS, and tuition fee income in support of home and EU students eligible for public support; and non-public funding which mainly comprises tuition fees paid by overseas (non-EU) students together with fee income from any home or EU students not eligible for public support usually because they have previously received public support for undergraduate study in England (Equivalent or Lower Qualification (EQL) students). These include both undergraduate students and taught postgraduate students. It should be emphasised that tuition fee income in support of home and EU students is regarded as publicly-funded income for TRAC purposes.

Table 10 and table 11 below present the publicly funded teaching income for chemistry and physics departments in the sample split between undergraduate income and postgraduate income. Data for the English departments are shown separately from the departments in other countries of the UK.

Table 10: Publicly Funded Teaching Income for the Sample Chemistry Departments in 2012/13 for which full data were available (11 departments)

University		Publicly funded Home and EU Undergraduate Income (£000s)*	Publicly funded Home and EU Postgraduate Taught Income (£000s)	Total Publicly funded teaching Income (£000s)	Publicly funded Home and EU students (FTE)	Publicly funded Teaching Income (£) per FTE student
English Universities	**A**	3,266	1	3,267	444	7,361
	B	5,484	0	5,484	579	9,465
	D	3,657	69	3,725	447	8,327
	F	5,002	2	5,004	534	9,373
	G	3,625	0	3,625	339	10,698
	H	3,673	130	3,803	399	9,526
	I	3,162	176	3,338	384	8,704
	J	5,424	61	5,485	639	8,588
Universities in other Countries of the UK	**K**	3,869	6	3,875	448	8,649
	M	2,005	181	2,186	341	6,411
	N	3,583	47	3,630	395	9,188

Source: *Institutional Data*

* *Includes additional funding for very high cost and vulnerable laboratory-based subjects (SIVS).*

Table 11: Publicly Funded Teaching Income for the Sample Physics Departments in 2012/13 for which full data were available (12 departments)

University		Publicly funded Home and EU Undergraduate Income (£000s)*	Publicly funded Home and EU Postgraduate Taught Income (£000s)	Total Publicly funded teaching Income (£000s)	Publicly funded Home and EU students (FTE)	Publicly funded Teaching Income (£) per FTE student
English Universities	A	2,501	0	2,501	336	7,435
	B	4,498	99	4,597	454	10,122
	D	3,022	41	3,063	373	8,218
	F	4,948	7	4,955	522	9,500
	G	3,852	0	3,852	430	8,960
	H	4,095	134	4,229	491	8,620
	I	5,194	41	5,235	570	9,184
	J	3,712	68	3,780	418	9,041
	P	2,868	258	3,126	370	8,449
Universities in other Countries of the UK	K	3,886	173	4,059	477	8,504
	M	2,150	9	2,159	347	6,222
	N	3,716	4	3,720	420	8,857

Source: *Institutional Data*

* *Includes additional funding for very high cost and vulnerable laboratory-based subjects (SIVS).*

The principal findings from these data for the 2012/13 sample departments in English universities and from comparisons with 2007/08 for the universities common to both samples are:

- The average public funding per FTE home and EU taught student in the sample of 8 English chemistry departments for which full data were available in 2012/13 was £9,005;
- For those 8 English chemistry departments common to both samples for which full data were available the mean public funding per FTE home and EU taught student in 2007/08 was £8,240, giving an increase of 9.3% from 2007/08 to 2012/13;
- The average public funding per FTE home and EU taught students in the sample of 9 English physics departments for which full data were available in 2012/13 was £8,801;
- For those 8 English physics departments common to both samples for which full data were available the corresponding figures for 2012/13 and 2007/08 were £8,885 and £8,768, an increase of 1.3%.

The observed increases in funding per FTE home and EU students are much smaller than the significant increases observed in funding in the period up to 2007/08. In England those increases were in part due to the introduction of the additional funding for very high cost and vulnerable laboratory-based subjects and of higher loan-backed fees.

Without any other changes, the expected increase in income per FTE home and EU undergraduate student from the full implementation of the £3,000 fee would have been expected by 2011/12 to be about 17%.[20] However, as noted earlier, the value of the additional funding for very high cost and vulnerable subjects has been eroded since it was first introduced, falling by some £300 per FTE for chemistry and £370 per FTE for physics. In addition HEFCE funding has been squeezed in the face of required economies and increased student numbers.

With the exception of the fees from a very small number of home and EU students ineligible for public funding support, the major source of non-publicly funded teaching income recorded by institutions is fees paid by overseas (non-EU) students. Universities are free to set their own tuition fees for overseas students and for postgraduate taught courses (and for home and EU students ineligible for public funding support) and are often able to charge substantial fee premiums compared to the fees charged to publicly supported home and EU students.

Considering the non-publicly funded fee income:

- For chemistry departments the median fee income per FTE non-publicly funded undergraduate and postgraduate taught student was just over £15,100 in 2012/13 and just under £14,000 in 2007/08;
- In chemistry departments the range of fee income per FTE non-publicly funded undergraduate and postgraduate taught student was from £5,391 to £18,803 in 2012/13;
- For physics department the median fee income per FTE non-publicly funded undergraduate and postgraduate taught student was £13,440 in 2012/13 and just under £11,800 in 2007/08;
- In physics departments the range of fee income per FTE non-publicly funded undergraduate and postgraduate taught student was from £3,250 to £18,662 in 2012/13.

As also observed in 2007/08, there are significant outliers in the distribution of non-publicly funded fee for both chemistry and physics departments in the sample. The low figures calculated for two chemistry departments and one physics department may reflect specific arrangements with overseas universities.

Table 12 and table 13 present the split of total teaching income between publicly funded and non-publicly funded teaching income for chemistry and physics departments in the sample for which full data were available.

---

20. In 2007/08 the average HEFCE grant, including, SIVS, was £6500 per FTE for Group B subjects like chemistry and physics and the average home and EU full-time undergraduate fee was £2,290 (two years at £3,070 and two years at £1,250 but year 4 FTE students only 50% of year 3 students). This gives total funding per publicly funded FTE of £8,770. Assuming the same level of HEFCE funding per FTE in 2011/12 and a fee for all home and EU full-time undergraduates of £3,370 gives total funding per FTE of £10,270, an increase of 17%.

Table 12: Publicly and Non-Publicly Funded Teaching Income for Undergraduate and Postgraduate Taught Students for the Sample Chemistry Departments in 2012/13 for which data were available (11 departments)

University		Publicly Funded Teaching Income (£000s)	Non-Publicly Funded Teaching Income (£000s)	Total Teaching Income (£000s)	Non-Publicly Funded Student Fee Income as % of Total Teaching Income
English Universities	**A**	3,267	273	3,540	7.7
	B	5,484	599	6,083	9.8
	D	3,725	394	4,119	9.6
	F	5,004	197	5,201	3.8
	G	3,625	305	3,930	7.8
	H	3,803	1,671	5,474	30.5
	I	3,338	694	4,032	17.2
	J	5,485	717	6,202	11.6
Universities in other Countries of the UK	**K**	3,875	1,143	5,018	22.8
	M	2,186	124	2,310	5.4
	N	3,630	1,031	4,661	22.1

Source*: Institutional data*

Table 13: Publicly and Non-Publicly Funded Teaching Income for Undergraduate and Postgraduate Taught Students for the Sample Physics Departments in 2012/13 for which data were available (12 departments)

University		Publicly Funded Teaching Income (£000s)	Non-Publicly Funded Teaching Income (£000s)	Total Teaching Income (£000s)	Non-Publicly Funded Student Fee Income as % of Total Teaching Income
English Universities	**A**	2,501	108	2,609	4.1
	B	4,597	250	4,847	5.2
	D	3,063	315	3,378	9.3
	F	4,955	318	5,273	6.0
	G	3,852	173	4,025	4.3
	H	4,229	1527	5,756	26.5
	I	5,235	322	5,557	5.8
	J	3,780	259	4,039	6.4
	P	3,126	218	3,344	6.5
Universities in other Countries of the UK	**K**	4,059	734	4,793	15.3
	M	2,159	26	2,185	1.2
	N	3,720	279	3,999	7.0

Source: *Institutional data*

In 2012/13 overall income from non-publicly funded undergraduate and postgraduate taught students was around 14.1% of overall total teaching income for the chemistry departments in the sample for which full data were available and around 9.1% for the physics departments in the sample for which full data were available.

Table 14 and table 15 compare total teaching income per FTE undergraduate and taught postgraduate students with data from the 2009 study for the chemistry and physics departments common to the two studies.

Table 14: Total Teaching Income per FTE Undergraduate and Taught Postgraduate Student in Chemistry Departments 2007/08 and 2012/13 (10 Departments)

University		2007/08			2012/13			Percentage Change: Income per FTE student 2007/08 to 2012/13
		Teaching Income (£000s)	FTE taught students	Income per FTE student (£)	Teaching Income (£000s)	FTE taught students	Income per FTE student (£)	
English Universities	**A**	3,137	343	9,146	3,540	467	7,588	-17.0
	B	5,032	516	9,748	6,083	617	9,864	1.2
	D	2,284	294	7,770	4,119	472	8,733	12.4
	F	3,496	407	8,589	5,201	550	9,462	10.2
	G	1,880	243	7,737	3,930	380	10,343	33.7
	H	2,847	303	9,412	5,474	488	11,215	19.2
	I	3,182	366	8,694	4,032	430	9,379	7.9
	J	4,029	491	8,202	6,202	679	9,133	11.3
Universities in other Countries of the UK	**K**	3,590	477	7,529	5,018	518	9,682	28.6
	M	2,000	292	6,858	2,310	364	6,346	-7.5

Source: *Institutional Data*

Table 15: Total Teaching Income per FTE Undergraduate and Taught Postgraduate Student in Physics Departments 2007/08 and 2012/13 (10 Departments)

University		2007/08			2012/13			Percentage Change: Income per FTE student 2007/08 to 2012/13
		Teaching Income (£000s)	FTE taught students	Income per FTE student (£)	Teaching Income (£000s)	FTE taught students	Income per FTE student (£)	
English Universities	A	2,098	241	8,702	2,609	348	7,504	-13.8
	B	4,203	426	9,878	4,847	470	10,316	4.4
	D	2,483	273	9,095	3,378	395	8,560	-5.9
	F	2,887	305	9,466	5,273	549	9,605	1.5
	G	2,316	276	8,391	4,025	445	9,040	7.7
	H	3,673	405	9,071	5,756	578	9,957	9.8
	I	4,916	571	8,609	5,557	593	9,371	8.8
	J	2,621	292	8,984	4,039	438	9,217	2.6
Universities in other Countries of the UK	K	3,441	466	7,387	4,793	523	9,172	24.2
	M	1,482	230	6,447	2,185	355	6,155	-4.5

Source: *Institutional Data*

The data in table 14 and table 15 show a great deal of variation in the changes in the income per FTE between 2007/08 and 2012/13 with changes ranging from -17.0% to 33.7%. There are a number of factors which are likely to have contributed both to the observed wide variation and to the shortfall against the expected increase arising from the full implementation of the £3,000 fee regime for home and EU full-time undergraduates in England, Wales and Northern Ireland. These include:

- A general squeeze on the level of HEFCE teaching grant within the context of overall reductions in public expenditure and increased student FTE;
- A substantial reduction in the level of SIVS funding per FTE student as a result of no uplift in the total sum allocated and no increase for the increase in relevant student numbers;
- A significant change in the policies of individual universities in the treatment of earned income, particularly in relation to the recognition of service teaching and the associated student FTEs (these changes should also affect the determination of costs so should not affect the overall financial position).

In respect of the possible impact of changes in approaches to resource allocation, it is worth noting that there is a correlation between the pairs of values for each institution, as would be expected if such changes were an important factor.

5.2 Research Income

There are seven categories of income which support research activities[21] in Higher Education Institutions:

- Funding Council main QR grant allocated on the basis of performance in the most recent RAE/REF with a factor to reflect differential costs of disciplines;
- Other Funding Council subsidiary QR grants – predominantly in England – including the Research Degree Supervision Fund, Charity Support Funding and Business Research Support;
- Research grant and contract income from public sources, predominantly from UK Research Councils but also from UK Government departments, health authorities and EU Government Funds;
- Home and EU postgraduate research student fees;
- Other support for postgraduate research supervision and training, including Centres for Doctoral Training (CDTs);
- Research grant and contract income from non-public funds including non-governmental EU sources, UK research charities, business and industry and overseas sources;
- Overseas postgraduate research student fees.

Table 16 and table 17 present the research income by category for the chemistry and physics departments in the sample respectively.

---

21. For the purposes of this study research income is the income accrued in the financial year 2012/13 (as opposed to research income won) which is particularly important in terms of long-term research contracts. It excludes grants of time on external (national or international) research facilities.

Table 16: Research Income (£000s) by Category for the Chemistry Departments for which full data were available 2012/13 (11 Departments)

University		Research Income from Public Sources							Research Income from non-Public Sources		
		Main QR (£000s)	Other Funding Council (£000s)	UK Research Councils (£000s)	Other publicly funded research grants and contracts (£000s)	Home and EU PGR student fees (£000s)	Other support for postgraduate research supervision and training (£000s)	Total (£000s)	Non-publicly funded research grants and contracts (£000s)	Overseas PGR student fees (£000s)	Total (£000s)
English Universities	**A**	707	19	3,122	441	378	2,671	7,338	574	203	777
	B	3,020	259	5,913	3,200	738	2,269	15,399	1,092	453	1,545
	D	1,558	145	3,608	1,250	259	1,380	8,200	1,165	205	1,370
	F	1,830	158	4,171	1,404	556	2,084	10,203	645	396	1,041
	G	1,189	187	4,634	1,779	437	795	9,021	1,156	407	1,563
	H	1,890	1,943	6,136	1,590	597	2,422	14,578	1,315	502	1,817
	I	1,242	247	3,863	1,416	486	2,786	10,040	2,165	522	2,687
	J	1,769	337	4,938	804	325	677	8,850	2,009	447	2,456
Universities in other Countries of the UK	**K**	3,402	0	4,256	1,158	422	651	9,889	1,412	179	1,591
	M	1,538	0	2,860	470	279	0	5,147	2,051	301	2,352
	N	972	0	1,347	2,044	207	582	5,152	1,891	586	2,477

Source: *Institutional Data*

Table 17: Research Income (£000s) by Category for the Physics Departments for which full data were available 2012/13 (12 Departments)

University		Research Income from Public Sources							Research Income from non-Public Sources		
		Main QR (£000s)	Other Funding Council (£000s)	UK Research Councils (£000s)	Other publicly funded research grants and contracts (£000s)	Home and EU PGR student fees (£000s)	Other support for postgraduate research supervision and training (£000s)	Total (£000s)	Non-publicly funded research grants and contracts (£000s)	Overseas PGR student fees (£000s)	Total (£000s)
English Universities	A	920	84	1,712	222	100	760	3,798	264	209	473
	B	1,576	95	3,863	1,731	329	1,014	8,608	483	238	721
	D	994	31	2,933	770	167	888	5,783	318	127	445
	F	1,858	88	4,912	1,339	0	1,280	9,477	889	395	1,284
	G	1,113	19	2,443	1,395	284	495	5,749	134	46	180
	H	2,108	43	2,690	250	441	1,494	7,026	112	192	304
	I	1,507	30	6,008	1,663	447	2,208	11,863	222	297	519
	J	797	0	2,974	444	223	540	4,979	151	199	350
	P	837	15	4,102	443	163	270	5,830	61	323	384
Universities in other Countries of the UK	K	3,874	388	10,046	4,593	388	2,212	21,501	485	177	662
	M	494	0	2,727	318	36	0	3,575	340	96	436
	N	1,660	0	2,749	1,613	335	553	6,910	1,300	126	1,426

Source: *Institutional Data*

These tables well-illustrate the complex pattern of funding to support research in university departments.

Table 18 and table 19 below show the division of total research income in 2012/13 between public and non-public sources for chemistry and physics departments, respectively. These data confirm the heavy dependence of chemistry and especially physics departments on public sources to support their research activities.

Table 18: Split of Total Research Income of Chemistry Departments for which full data were available (11 Departments) in 2012/13 between Public and non-Public Sources (11 Departments)

University		Publicly Funded Income (£000s)	Non-publicly funded Income (£000s)	Total Research Income (£000s)	Non-publicly funded income as % of Total
English Universities	**A**	7,338	777	8,115	9.6
	B	15,399	1,545	16,944	9.1
	D	8,200	1,370	9,571	14.3
	F	10,203	1,041	11,244	9.3
	G	9,021	1,563	10,584	14.8
	H	14,578	1,817	16,395	11.1
	I	10,040	2,687	12,727	21.1
	J	8,850	2,456	11,305	21.7
Universities in other Countries of the UK	**K**	9,889	1,591	11,480	13.9
	M	5,147	2,352	7,499	31.4
	N	5,152	2,477	7,629	32.5

Source: *Institutional Data*

Table 19: Split of Total Research Income of Physics Departments for which full data were available (12 Departments) in 2012/13 between Public and non-Public Sources (12 Departments)

University		Publicly Funded Income (£000s)	Non-publicly funded Income (£000s)	Total Research Income (£000s)	Non-publicly funded income as % of Total
English Universities	**A**	3,798	473	4,271	11.1
	B	8,608	721	9,329	7.7
	D	5,783	445	6,227	7.1
	F	9,477	1,284	10,761	11.9
	G	5,749	180	5,929	3.0
	H	7,026	304	7,330	4.1
	I	11,863	519	12,382	4.2
	J	4,979	350	5,328	6.6
	P	5,830	384	6,214	6.2
Universities in other Countries of the UK	**K**	21,501	662	22,163	3.0
	M	3,575	436	4,011	10.9
	N	6,910	1,426	8,336	17.1

Source: *Institutional Data*

The permanent academic staff in departments are the principal generators of research income through their research reputation and the preparation of successful bids to research funding bodies. Figure 14 and figure 15 below compare the level of research grant and contract income generated per FTE permanent member of academic staff for 2007/08 and 2012/13 for the chemistry and physics departments common to both samples.

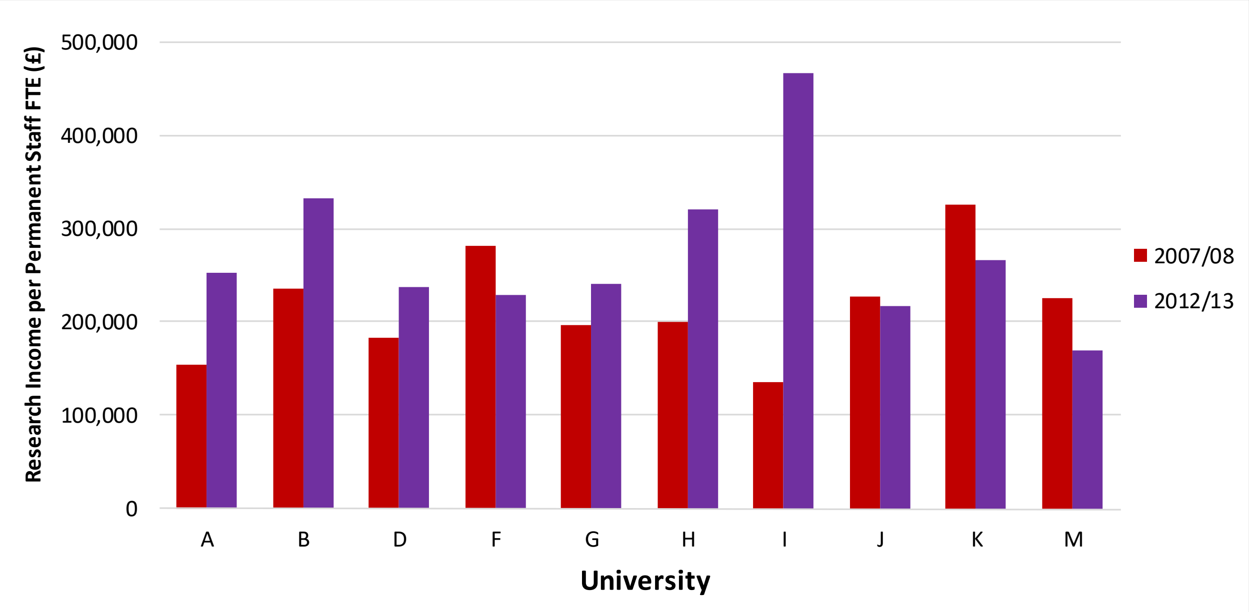


Figure **16** and figure 17 compare the level of total research income generated per FTE permanent member of academic staff for 2007/08 and 2012/13 for the chemistry and physics departments common to both samples.

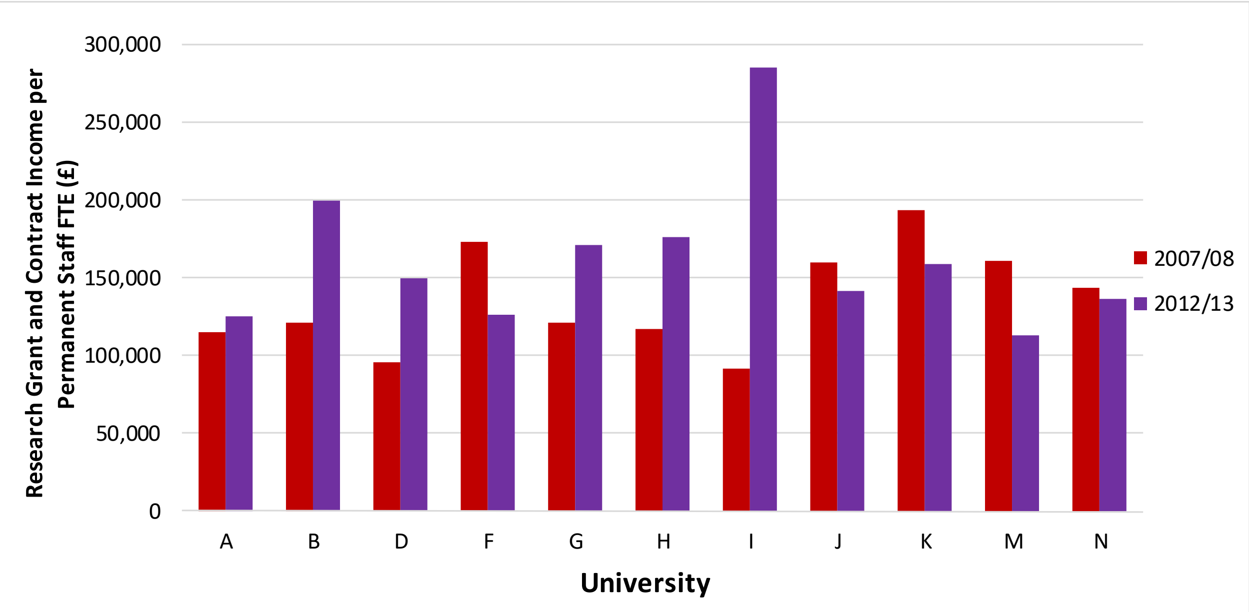


Figure 14: Comparison of Research Grant and Contract Income (£) per FTE Member for Permanent Academic Staff between 2007/08 and 2012/13* for the Chemistry Departments Common to both studies
Source: *Institutional Data*

* In 2012/13 only permanent academic staff with a research function have been included.

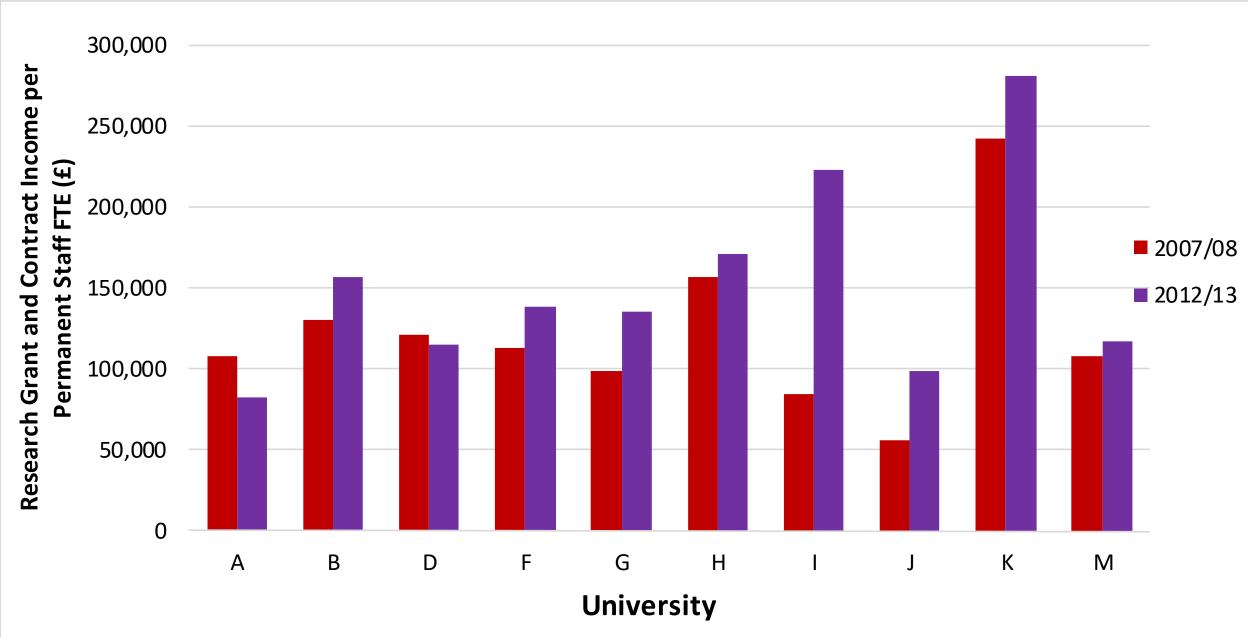


Figure 15: Comparison of Research Grant and Contract Income (£) per FTE Member for Permanent Academic Staff between 2007/08 and 2012/13* for the Physics Departments Common to both studies
Source: *Institutional Data*

* In 2012/13 only permanent academic staff with a research function have been included.

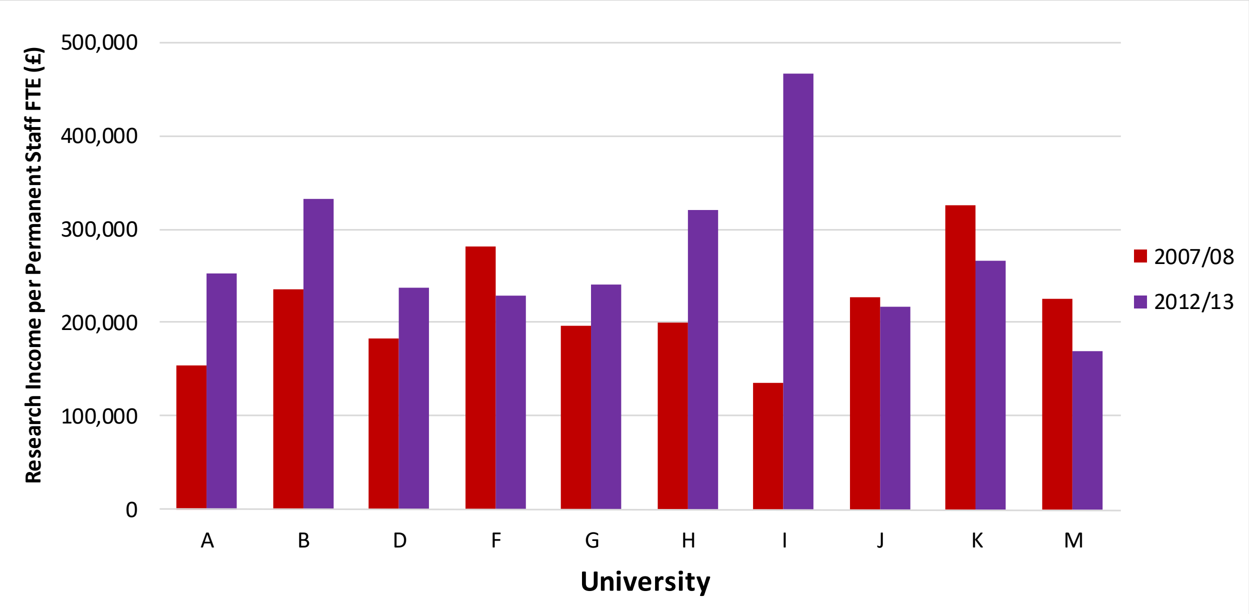


Figure 16: Comparison of Total Research Income (£) per FTE Member of Permanent Academic Staff between 2007/08 and 2012/13* for the Chemistry Departments Common to both studies

Source: *Institutional Data*

* In 2012/13 only permanent academic staff with a research function have been included.

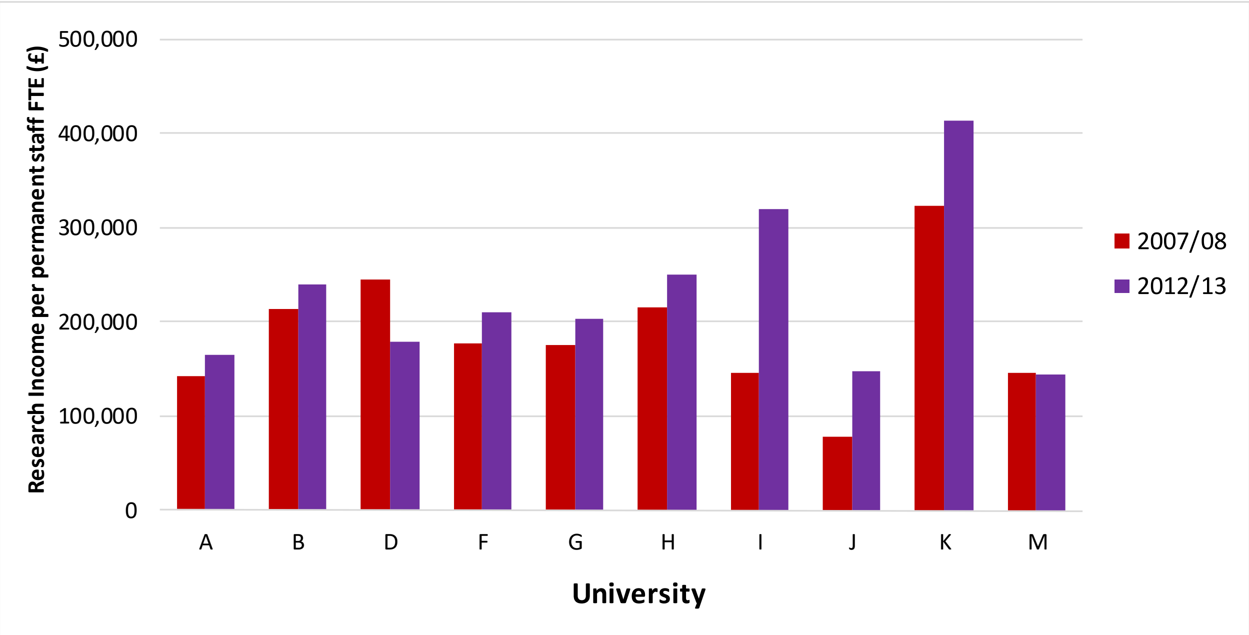


Figure 17: Comparison of Total Research Income (£) per FTE Member of Permanent Academic Staff between 2007/08 and 2012/13* for the Physics Departments Common to both studies

Source: *Institutional Data*

* In 2012/13 only permanent academic staff with a research function have been included.

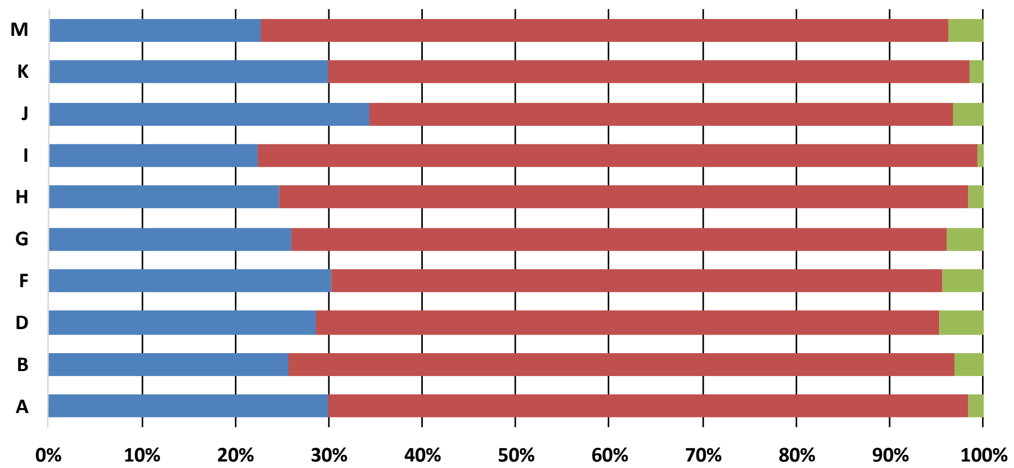
The data show that six out of ten of the chemistry departments common to both samples increased their research grant and contract income per FTE permanent academic staff member between 2007/08 and 2012/13, and eight out of the ten physics departments common to both samples increased their research grant and contract income per FTE permanent academic staff member over the same period.

For the total research income, six out of ten chemistry departments increased their research income per FTE permanent academic staff member, and eight out of ten physics departments increased their research income per FTE permanent academic staff member.

The data show that overall, physics departments earn less research income per FTE permanent academic staff member than chemistry departments which in part reflects the higher proportion of theoretical work undertaken in physics departments. However, as has already been noted the research income research income excludes grants of time on external national and international research facilities (such as telescopes, CERN, neutron sources, synchrotrons, central laser facility, national supercomputers), so in reality the income per FTE in chemistry and, even more so, physics departments in particular does not reflect the full range of research activity supported.

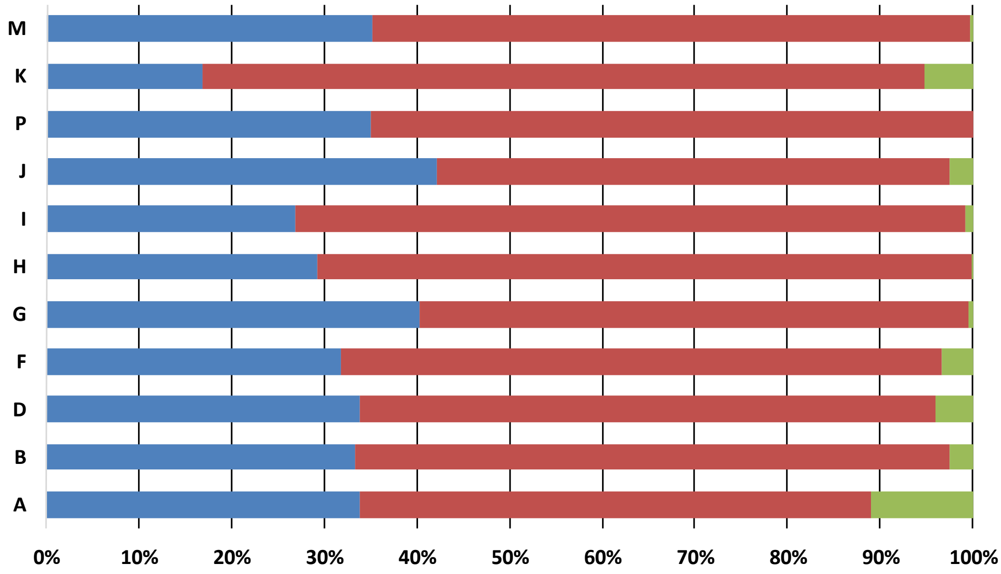
5.3 Total Income

The distribution of total income from teaching, research and other activities for the chemistry and physics departments in the sample for which full data are available is presented in figure 18 and figure 19. Other activities include consultancy payments for the use of equipment by outside organisations, short courses and continuing professional development. Some departments in the sample also received a share of their university's allocation of enterprise and innovation funding from the funding councils.



	A	B	D	F	G	H	I	J	K	M
Teaching Income (£000s)	3,540	6,083	4,119	5,201	3,930	5,474	4,032	6,202	5,018	2,310
Research Income (£000s)	8,115	16,944	9,571	11,244	10,584	16,395	13,829	11,305	11,480	7,499
Other Income (£000s)	189	733	679	736	574	341	109	573	234	384

Figure 18: Distribution of Total Income % (£000s) of Chemistry Departments for which full data were available by Activity in 2012/13 (11 Departments)
Source: *Institutional Data*



	A	B	D	F	G	H	I	J	P	K	M
Teaching Income (£000s)	2,609	4,847	3,378	5,273	4,025	5,756	5,557	4,039	3,344	4,793	2,185
Research Income (£000s)	4,271	9,329	6,227	10,761	5,929	13,890	15,022	5,328	6,214	22,163	4,011
Other Income (£000s)	844	349	397	549	47	36	168	236	0	1,477	21

Figure 19: Distribution of Total Income % (£000s) of Physics Departments for which full data were available by Activity in 2012/13 (12 Departments)
Source: *Institutional Data*

Total Income for the chemistry departments in 2012/13 ranged from £10.2m to £23.8m. For all of the chemistry departments research income was over 60% of total income and for five of the departments it was over 70% of total income. This is a similar picture to that observed in 2007/08.

Total income for the ten chemistry departments common to the samples for both studies increased by 28% between 2007/08 and 2012/13. Four departments increased their income by more than 50%, and one department more than doubled their total income; one department's income fell by 24% – the main reason for the decline was a 30% fall in research income.

Total income in the physics department in 2012/13 ranged from £6.2m to £28.4m, and for all but three of the physics departments research income was over 60% of total income and in three departments was over 70% of total income.

Total income for those physics departments which were common to the samples for both studies increased by to 24% between 2007/08 and 2012/13. Two departments' income fell by 12% and 9%, respectively, and one department increased its income by over 70%. The departments where the total income fell both experienced drops in their research income.

5.4 Capital Funding

For the 11 chemistry departments that provided full data there had been almost £27.5M capital expenditure on buildings and around £21.5M on equipment between 2010/11 and 2012/13.[22] However, it should be noted that almost half the building investment was in one department, another substantial part was invested in another department. All departments had some investment in buildings albeit smaller amounts were on refurbishment. The equipment funding was more evenly spread throughout the sample with funding ranging from about £0.5M to almost £6M.

Between 2010/11 and 2012/13, almost £16M was spent on buildings in the 12 physics departments that provided full data and about £25.5M was spent on equipment. Buildings expenditure ranged from zero to over £10M, and equipment expenditure ranged from about £150,000 to about £11.5M.

Capital investment is still being made in chemistry and physics equipment and infrastructure in universities. However, inevitably in particular when it comes to buildings, major investment is rare. Capital funding for equipment is more evenly spread across departments and years.

One factor that also needs to be considered is the knock on effects of investment in major new equipment. Monies are often, but not always, provided for installing equipment, including building works that may be required to create appropriate housing. In cases where installation funds are not provided, or more likely are not fully provided, the money needs to be found from departmental or university budgets. Additionally, major equipment will usually require dedicated staff and will require funds to pay for services, consumables, etc., the cost of which also needs to be found and reflected in departmental budgets.

HEFCE announced in December 2014 the 73 universities and colleges that will receive a share of £200M funding for science, technology, engineering and mathematics (STEM) teaching capital projects during 2015-16.[23] The purpose of the scheme is to ensure that higher education responds effectively to the increase in demand for STEM studies by developing facilities that will support an increased flow of highly employable graduates into industry. The £200M fund was provided from government and will be matched by universities on at least a one-to-one basis. Projects funded included new provision in chemistry and physics.

---

22. Funding for equipment is not included in the grants and contracts research income.
23. See *HEFCE invests £200 million to support an increase in high-quality science, technology, engineering and mathematics students* (http://www.hefce.ac.uk/news/newsarchive/2014/news98946.html).

6. Financial Position: Costs and Income

The approach used here to assessing the overall financial position starts from a comparison of the total income generated by each department and TRAC-derived costs, as used in the earlier studies of the finances of chemistry and physics departments. This approach is unlikely to produce a readily recognisable bottom line for the heads of departments but does allow comparisons to be drawn across different universities. There are a number of reasons why the approach adopted here might produce an unfamiliar result for heads of departments:

- Several of the departments operate within faculty or similar structures under which central costs and charges (including in some cases premises costs) are allocated to faculties. Each department is given its own target contribution to meeting the faculty target;
- Some of those departments that are standalone budget centres are also set target contributions to central costs rather than having a full income and expenditure budget;
- The basis for calculating teaching income varies between universities, particularly in relation to the treatment of service teaching student FTEs and the associated income;
- Most of the universities in this study do not use TRAC-derived full economic costs as basis for budgeting. TRAC derived full economic costs incorporate two adjustments to reflect the sustainable position of an institution. The adjustments are an “infrastructure adjustment” to account for the true capital costs of maintaining its asset base and “the return for financing and investment” which is intended to ensure that institutions take account of the economic cost of capital.[24] In 2012/13, the infrastructure adjustment represented 3.1% of total expenditure and the return for financing represents 5.0% of expenditure across all higher education institutions in England.[25] These adjustments are not reflected in departmental budgets, but in 2012/13 the overall adjustments for chemistry and physics departments in the sample for which full data were available was 9.2% and 7.5% of total costs, respectively.

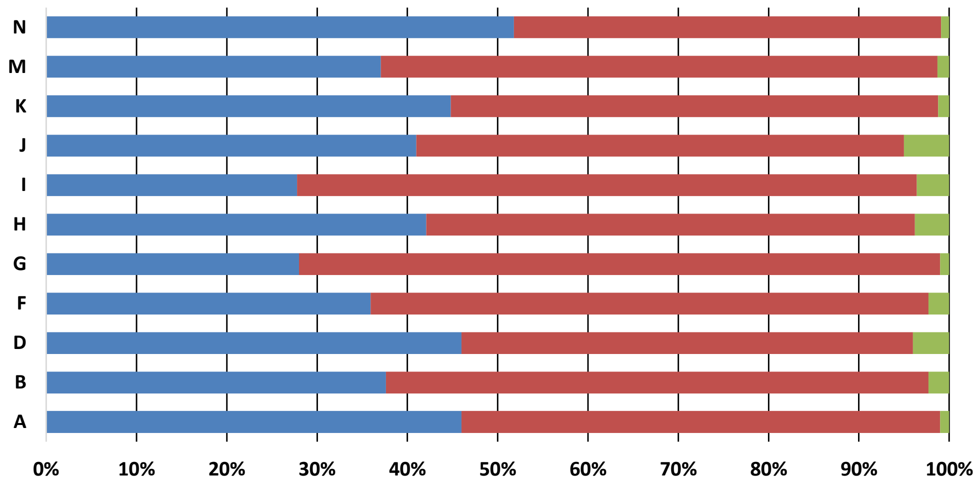
To try and overcome this difficulty the observed financial position on this basis is compared below with the budgetary position of the departments.

The key element within TRAC for dividing costs between the principal activities (teaching, research, other and support) is the allocation of the time to those activities of academic staff (as the principal income generators) based on data collected from individual academic staff whose activity is not confined to a single TRAC category. One way of examining imbalances between the income and costs of the principal activities is to compare the proportion of total income from the principal activities with the proportion of staff time allocated to those activities.

Figure 20 and figure 21 below show the allocation of academic staff time between teaching, research and other activities with support time allocated to the main activities for chemistry and physics departments.

---

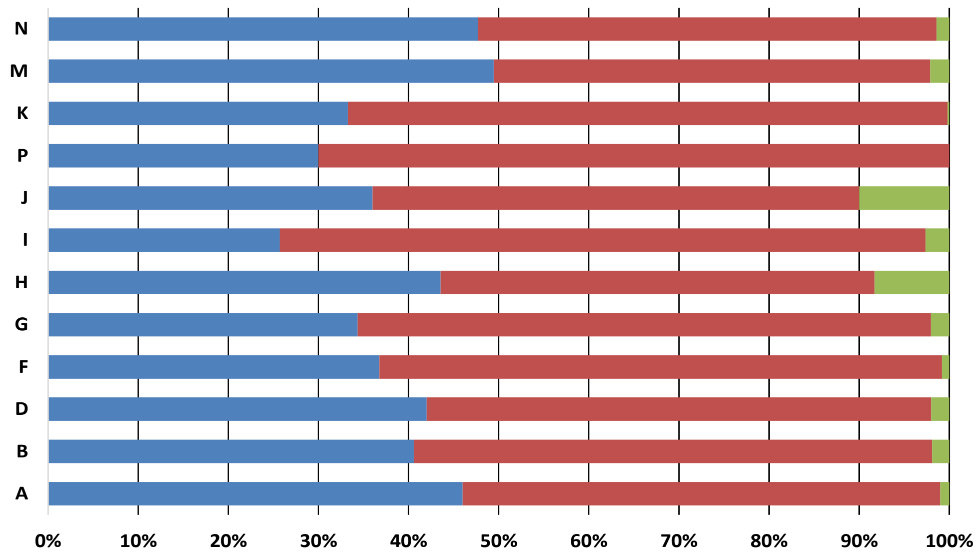
24. This covers the financing costs of institutions, including the existing costs of borrowing and the opportunity cost of institutional cash used for financing; it also provides funds for the rationalisation and development of institutions’ business capability and capacity. It does not however, specifically adjust for inadequate spend in areas such as student support and facilities, staffing levels, etc.
25. *Financial health of the higher education sector 2013-14 to 2016-17 forecast*, HEFCE Publication Reference 2014/26, October 2014.



	A	B	D	F	G	H	I	J	K	M	N
% Time Teaching	46.0	37.6	46.0	35.9	28.0	42.1	27.8	41.0	44.8	37.1	51.8
% Time Research	53.0	60.0	50.0	61.7	71.0	54.1	68.7	54.0	54.0	61.7	47.3
% Time Other Activities	1.0	2.3	4.0	2.3	1.0	3.8	3.6	5.0	1.2	1.3	0.9

Figure 20: Distribution of Academic Staff Time (%) by Principal Activities for Chemistry Departments for which data were available 2012/13 (11 Departments)
Source: *Institutional Data*

For chemistry departments in 2012/13 the data show that in all cases the proportion of staff time allocated to teaching activities is greater than the proportion of income which teaching represents (see figure 18) with the difference lying in the range of 2 to 17%.



	A	B	D	F	G	H	I	J	P	K	M	N
% Time Teaching	46.0	40.6	42.0	36.8	34.0	43.6	25.7	36.0	30.0	33.3	49.5	47.7
% Time Research	53.0	57.5	56.0	62.5	63.0	48.2	71.7	54.0	70.0	66.5	48.5	50.9
% Time Other Activities	1.0	1.9	2.0	0.8	2.0	8.3	2.6	10.0	0.0	0.2	2.1	1.4

Figure 21: Distribution of Academic Staff Time (%) by Principal Activities for Physics Departments for which data were available 2012/13 (12 Departments)
Source: *Institutional Data*

For physics departments in 2012/13 the differences between the proportion of staff time allocated to teaching and the proportion of income teaching represents (see figure 19) lies in the range -6 to 17%.

Comparing the chemistry and physics departments common to both the current study and the 2009 study the range of variance between staff time allocated to teaching and the proportion of income generated the range of variation was greater in 2012/13.

There are a number of factors that contribute to this difference:

- Although as already noted there are variations in teaching income reflecting different approaches to resource allocation used by different universities there is much greater inherent variation in research income depending on the nature of the research;
- Time allocation under TRAC is based on a range of methods, including surveys, individual staff returns and time planning systems which seek to measure the proportions of the total "managed time" of individuals.[26] Research activity that is undertaken outside managed time will not be recorded and thus the proportion of total (managed and unmanaged) time spent on teaching will be overstated;
- Any time using external national or international facilities has no "income" associated with it, so the proportion of income spent on research will be understated.

6.1 Teaching Income and Costs

Table 20 and table 21 below show total teaching income and total TRAC teaching costs (publicly-funded and non-publicly funded) in 2012/13 for the sample chemistry and physics departments, respectively, for which full data are available.

As discussed above there are several reasons why heads of departments may not readily be able to relate these surplus/deficits figures to their budgetary position. Since budgets cover all departmental activities these issues are considered further below in Section 6.4.

26. See *TRAC Guidance* (www.hefce.ac.uk/whatwedo/lgm/finsustain/trac).

Table 20: Total Teaching Income and Costs for the Sample Chemistry Departments for which full data were available 2012/13 (10 Departments)

University		Teaching Income (£000s)	Teaching Costs (£000s)	Surplus/ Deficit (£000s)	% of Income
English Universities	A	3,540	4,299	-759	-21.4
	B	6,083	6,587	-504	-8.3
	D	4,119	6,566	-2,447	-59.4
	F	5,201	5,401	-200	-3.8
	G	3,930	4,221	-291	-7.4
	H	5,474	5,784	-310	-5.7
	I	4,032	4,641	-609	-15.1
	J	6,202	6,479	-277	-4.5
Universities in other Countries of the UK	K	5,018	6,261	-1,243	-24.8
	N	4,661	4,091	570	12.2

Source: *Institutional Data*

In England using the available data the chemistry departments had, on this basis, deficits on teaching activities which ranged from 4% to almost 60% of total teaching income. Outside England, one department showed a large teaching deficit and one department showed a surplus of 12% on teaching activity.

For the eight chemistry departments in English universities for which full and reliable TRAC data were available in 2007/08 and 2012/13 on the same basis the overall deficit on teaching activities fell slightly from 16.6% of income in 2007/08 to 14.0% of income in 2012/13.

Table 21: Total Teaching Income and Costs for the Sample Physics Departments for which full data were available 2012/13 (10 Departments)

University		Teaching Income (£000s)	Teaching Costs (£000s)	Surplus/ Deficit (£000s)	% of Income
English Universities	A	2,609	3,126	-517	-19.8
	B	4,847	5,788	-941	-19.4
	D	3,378	4,813	-1,435	-42.5
	F	5,273	5,206	67	1.3
	G	4,025	3,728	297	7.4
	H	5,756	5,176	580	10.1
	I	5,557	4,966	591	10.6
	J	4,039	4,740	-701	-17.4
Universities in other Countries of the UK	K	4,793	7,008	-2,215	-46.2
	N	3,999	4,352	-353	-8.8

Source: *Institutional Data*

In England in 2012/13 four physics departments had surpluses on teaching activity, on this basis ranging between 1% and 11%, and the other four had deficits ranging between 17% and 42.5%. Outside England, the two departments showed teaching deficits in 2012/13 of 9% and 46%.

For the eight physics departments in English universities for which full and reliable TRAC data were available in 2007/08 and 2012/13 the overall deficit on the same basis on teaching activities increased from 0.3% of income in 2007/08 to 5.8% of income in 2012/13.

Deficits on teaching activity, on this basis, in chemistry are higher than those in physics. Although the majority of chemistry departments show a deficit on teaching, a number of physics departments show a surplus. Nonetheless, surpluses/deficits measured on this basis do vary over a wide range for both chemistry and physics departments.

Because the deficits on teaching activity in a couple of universities were particularly large we have checked back with them to validate these results. In one case the TRAC costs were confirmed; in the case of this university the allocation of academic staff time to principal activities changed significantly between 2007/08 and 2012/13 with the result that teaching costs rose significantly leading to the large deficits observed, deficits which have risen since 2007/08. In the other case the teaching deficits have actually fallen significantly between 2007/08 and 2012/13. Here the allocation of academic staff time to principal activities is essentially the same in 2012/13 as in 2007/08 leading the TRAC teaching costs to show little change. However, the teaching income in both chemistry and physics has risen leading to a smaller deficits in 2012/13 than in 2007/08, albeit in the case of the chemistry department being the second largest deficit and in the case of the physics departments being the largest deficit in the sample.

It is informative to examine the difference that the additional SIVS funding makes. In chemistry the eight English departments had an overall teaching deficit of 14.0% in 2012/13. Without the SIVS income that deficit would have been 20.9%. If hypothetically SIVS funding was at the same rate per chemistry FTE as in 2007/08 (in effect for chemistry an additional £300 per FTE) the deficit recorded would have been 10.3%. Similarly for physics, the nine English departments had an overall deficit of 11.6% in 2012/13. Without the SIVS funding that deficit would have risen to 19.7%. With SIVS funding at the same rate as in 2007/08 (in effect for physics an additional £370 per FTE) the overall deficit recorded would have been 7.3%.[27]

In conclusion, the financial position in respect of teaching for chemistry departments appears to have been relatively stable since 2007/08 albeit the majority of departments show deficits. Similarly the position of physics departments was reasonably stable but with a reasonable number of departments achieving a surplus on teaching activity in 2012/13.

---

27 For physics, the equivalent figures for the eight English departments for which robust data were available in 2007/08 and 2012/13 are that the overall deficit was 5.8% and that figure would have been 14.4% without SIVS funding. With SIVS funding at the same rate as in 2007/08 the overall deficit would have been 1.5%.

6.2 Research Income and Costs

Table 22 and table 23 below present the total income and TRAC-based costs for each of the chemistry and physics departments, respectively, for which full income and cost data were available.

Table 22: Total Research Income and Costs for the Sample Chemistry Departments for which full income and cost data were available in 2012/13 (10 Departments)

University		Research Income (£000s)	Research Costs (£000s)	Surplus/ Deficit (£000s)	% of Income
English Universities	A	8,115	9,975	-1,860	-22.9
	B	16,944	22,709	-5,765	-34.0
	D	9,571	12,428	-2,857	-29.9
	F	11,244	15,939	-4,695	-41.8
	G	10,584	15,572	-4,988	-47.1
	H	16,395	18,531	-2,136	-13.0
	I	13,829	18,900	-5,071	-36.7
	J	11,305	14,716	-3,411	-30.2
Universities in other Countries of the UK	K	11,480	12,853	-1,373	-12.0
	N	7,629	9,604	-1,975	-25.9

Source: *Institutional Data*

The chemistry departments in the sample showed on this basis a wide variation in 2012/13 in their deficits on research activity ranging from 12% to 47%. The overall deficit on this basis in 2012/13 on research activity across the ten chemistry departments for which full TRAC data were available was 29.1% of income.

Comparing the nine chemistry departments for which full and reliable TRAC data were available for 2007/08 and 2012/13 the overall deficit on this basis across the common departments narrowed from 33.1% to 29.4% of income. Focussing on the eight English departments alone, the deficit was 34.6% in 2007/08 and 31.4% in 2012/13.

Table 23: Total Research Income and Costs for the Sample Physics Departments for which full income and cost data were available in 2012/13 (10 Departments)

University		Research Income (£000s)	Research Costs (£000s)	Surplus/ Deficit (£000s)	% of Income
English Universities	A	4,271	5,525	-1,254	-29.4
	B	9,329	11,336	-2,007	-21.5
	D	6,227	7,729	-1,502	-24.1
	F	10,761	14,130	-3,369	-31.3
	G	5,929	8,608	-2,679	-45.2
	H	13,890	16,631	-2,741	-19.7
	I	15,022	19,994	-4,972	-33.1
	J	5,328	6,911	-1,583	-29.7
Universities in other Countries of the UK	K	22,163	25,879	-3,716	-16.8
	N	8,336	8,101	235	2.8

Source: *Institutional Data*

The physics departments also showed a similarly wide variation in 2012/13 in their surpluses and deficits on research activity on this basis ranging from a surplus of 3% to a deficit of 45%. The overall deficit in 2012/13 on research activity across the 10 departments for which full TRAC data were available was 23.3% of income on this basis.

Comparing the nine departments for which full and reliable TRAC data were available for 2007/08 and 2012/13 the overall deficit across the physics departments common to both samples increased from 20.5% in 2007/08 to 25.6% in 2012/13. Focussing on the eight English departments alone, the deficit was 20.1% in 2007/08 and 28.4% in 2012/13.

6.3 Total Income and Total Costs

Table 24 and table 25 present the total (teaching, research and other) income and TRAC-based costs for 2012/13 covering all activities (teaching, research and other activities) for the chemistry and physics departments, respectively, for which full income and cost data were available.

Table 24: Total Income and TRAC-based Costs for all activities for the Sample Chemistry Departments for which full income and cost data were available 2012/13 (10 Departments)

University		Total Income (£000s)	Total Costs (£000s)	Surplus/ Deficit (£000s)	% of Income
English Universities	A	11,844	14,430	-2,586	-21.8
	B	23,760	29,377	-5,617	-23.6
	D	14,369	19,371	-5,002	-34.8
	F	17,181	21,986	-4,805	-28.0
	G	15,088	20,747	-5,659	-37.5
	H	22,210	24,554	-2,344	-10.6
	I	17,970	23,908	-5,938	-33.0
	J	18,080	21,494	-3,414	-18.9
Universities in other Countries of the UK	K	16,732	20,501	-3,769	-22.5
	N	13,894	15,929	-2,035	-14.6

Source: *Institutional Data*

Table 25: Total Income and TRAC-based Costs for all activities for the Sample Physics Departments for which full income and cost data were available 2012/13 (10 Departments)

University		Total Income (£000s)	Total Costs (£000s)	Surplus/ Deficit (£000s)	% of Income
English Universities	A	7,724	8,833	-1,109	-14.4
	B	14,525	17,085	-2,560	-17.6
	D	10,002	12,754	-2,752	-27.5
	F	16,583	19,670	-3,087	-18.6
	G	10,001	12,541	-2,540	-25.4
	H	19,682	22,117	-2,435	-12.4
	I	20,747	25,376	-4,629	-22.3
	J	9,603	11,754	-2,151	-22.4
Universities in other Countries of the UK	K	28,433	38,019	-9,586	-33.7
	N	12,409	12,688	-279	-2.2

Source: *Institutional Data*

These data show a range of deficits for chemistry departments on the basis of full economic costs in 2012/13 from 10.6% to 37.5%. Research incomes and costs are in general substantially larger than teaching incomes and costs and so the deficits are to a large degree driven by departments' research activity deficits. The overall deficit across the departments in the sample was 24.1%.

Comparing the deficit with that for 2007/08, for the nine departments for which reliable costing data are available the deficit was 25.9% in 2007/08 and 24.9% in 2012/13%. In the eight English universities the overall deficit was 25.2% in 2012/13 and 24.8% in 2007/08. The overall financial position appears to be similar to that in 2007/08, so, on a full economic cost basis deficits in chemistry departments were still substantial in 2012/13.

The overall deficits across all activities for the physics departments in 2012/13 for which full income and cost data are available range between 2% and 34%. The overall deficit for all the physics departments was 20.8%.

For the nine physics departments that were in both the sample for the earlier study and the current study and for which reliable cost and income data were available the overall deficit increased from 13.6% in 2007/08 to 22.5% in 2012/13. In the eight English departments, the overall deficit was 10.6% in 2007/08 and 19.5% in 2012/13. So the overall position of the physics departments has worsened between 2007/08 and 2012/13 which is in line with the observed increased deficits in teaching and research activities.

Figure 22 shows the comparison between the deficits for chemistry and physics departments by university.

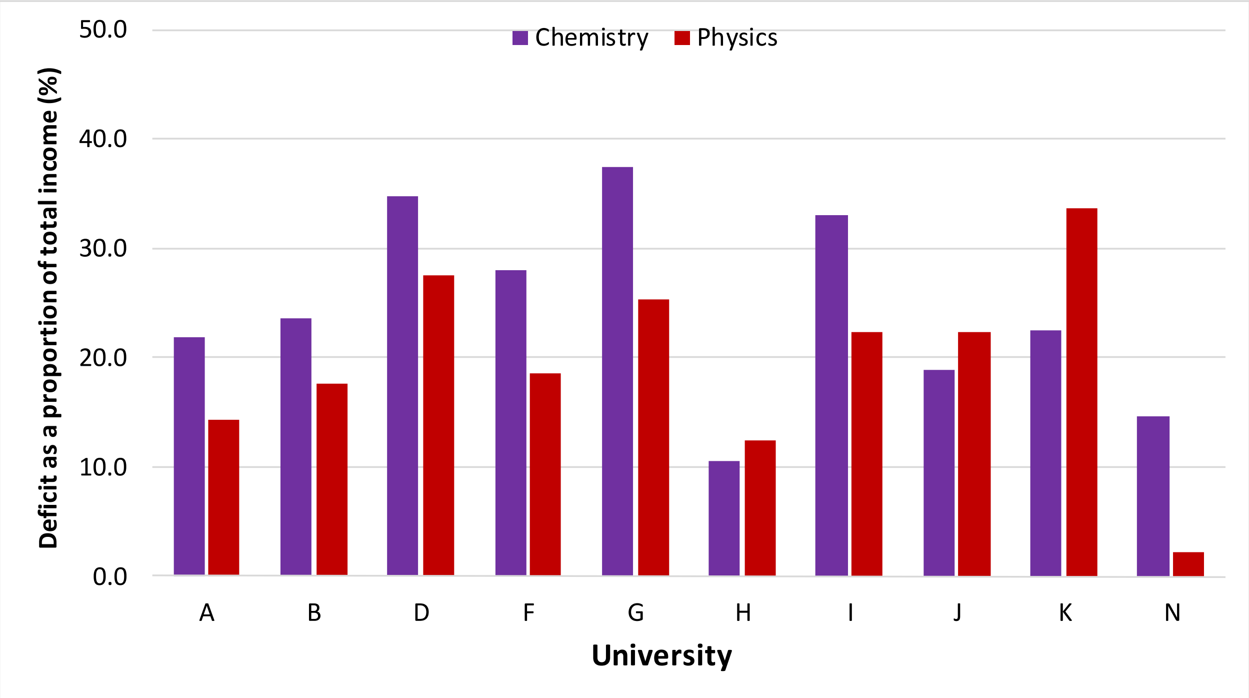


Figure 22: Comparison of the overall deficit across all activities for chemistry and physics departments for which full TRAC data were available 2012/13

6.4 Relationship to Departmental Budgets

The comparison of these findings on surpluses/deficits at a departmental level is complicated by a number of factors:

- Some departments are within a faculty structure where only a small subset of departmental costs are devolved to departments with a requirement to generate a surplus against total income to provide a contribution to central costs, including in some cases premises costs as well as other central costs. These contribution targets are set by the faculty, based on the overall faculty contribution set by the university;

- Even for many of those departments with fully devolved budgets, the financial requirement is to meet a target contribution to the university's central costs rather than a surplus/deficit target;
- Only one university in the sample operates with anything approaching a full economic cost basis, for its resource allocation and budgetary systems, although others are considering the use of such a system.

Bearing these factors in mind, nearly every department in the sample was either in deficit in 2012/13 or had a shortfall against its target contribution rate to central costs. This appears consistent with the findings of this study.

It is clear from the comments made by departments and their universities that many universities have been prepared to accept a degree of cross-subsidy for those departments with high fixed costs, provided those cross subsidies are transparent. However, driven in part by concerns over long-term sustainability (see below) some universities are putting in place a requirement on budget centres to generate surpluses of at least 5% of income or increased contributions to central costs.

In this context the recently published HEFCE report on the financial health of the higher education sector (in England) 2013/14 to 2016/17 is of particular relevance.[28] Although institutions' financial accounts showed a surplus of 4.6% of total income in 2011/12 and 4.3% in 2012/13, the two adjustments to the financial accounts under full economic costing – the infrastructure adjustment and the return for financing investment – revealed a sustainability gap (the difference between the value of the economic adjustments). In 2011/12 this sustainability gap was £726 million or 3.3% of total income and had increased to £869 million or 3.8% of total income by 2012/13.

When comparing income with costs, the TRAC data for 2012/13 show that the higher education sector in England recovered 96.5% on the full costs of all its activities. However for research activities the recovery rate was only 75.5% of research income in 2012/13. This provides the best available context in which to judge the surpluses/deficits achieved by chemistry and physics departments in English universities on a full economic cost basis.

Premises costs are of particular concern to departments like chemistry and physics because they need a reasonably large area of high cost space both for teaching and research. Overall for the chemistry departments for which reliable TRAC available 19.5% of the teaching TRAC costs and 15.1% of research TRAC costs are on premises. For the physics departments 16.6% of teaching TRAC costs and 10.3% of research TRAC costs are on premises.

The majority of universities consulted reported that they include a general estates charge in their resource models rather than explicitly making a charge for the quantity and type of space occupied. The charge is set on the results of periodic surveys of space usage. Furthermore, based on the universities in the sample, metering of individual departments' use of services appears rare. Again charges are generally fixed and are based on estimates of power and water usage. One department reported that its financial position had improved significantly when the university abandoned its space charging model. The anecdotal evidence is that physics and, in particular, chemistry departments benefit in terms of their overall budgetary position from methodologies that do not explicitly charge for space and services used. Such methodologies allow implicitly for some cross-subsidy of the most expensive space. Nonetheless

---

28. *Financial health of the higher education sector 2013-14 to 2016-17 forecast*, HEFCE Publication Reference 2014/26, October 2014.

universities can still encourage departments to make better use of the space they have by limiting department's physical expansion as student numbers increase.

Some chemistry departments report that they are increasingly taking initiatives to use resources more sustainably by, for example, recycling heat from extracted air and by recycling water. It is estimated that substantial savings can be made but in order to quantify these savings more general use of metering of services is necessary, and departments will need incentives to make savings, perhaps by crediting them with a proportion of the savings made.

7 Analysis and Conclusions

As found in the previous study, which examined data for the academic year 2007/08, data for 2012/13 show that all the chemistry and physics departments were operating in deficit on the basis of TRAC costs. The overall deficits for all activities were similar for chemistry and physics departments, 24.1% and 20.8%, respectively. The overall deficit for the nine chemistry departments for which full TRAC data were available in both the current and earlier study fell by 1.0% between 2007/08 and 2012/13 while that for physics increased by 8.9%. These data suggest that the ten chemistry and ten physics departments for which full data were available in 2007/08 and 2012/13, taken as a whole, are continuing to operate with significant deficits.

In 2012/13 all chemistry departments in the study were operating in deficit as in 2007/08. In 2007/08, however around half of the physics departments were operating in surplus or close to break-even, but in 2012/13 only one out of 10 departments was close to breaking even.

In 2012/13 all the chemistry departments and around half the physics departments in the sample for which robust data were available were in deficit on total teaching costs on the basis of TRAC derived costs. Four physics departments were in surplus on teaching activity in 2012/13. The position was similar with research activity in 2012/13 with all the chemistry departments and all but one of the physics departments showing deficits.

Given the substantially higher level of research income than teaching income (2.5 times as much for chemistry departments and 2.3 times as much for physics), the financial position on research activity tends to dominate the overall financial position of these departments. It is interesting to note in this context that in 2008/09 it was estimated that across the whole sector, research income represented 28% of total income,[29] and in the Russell Group (excluding LSE) research income represented 46% of total income.[30] It appears that chemistry and physics departments are significantly more dependent on research income than the sector average.

Overall these data on deficits in 2012/13 are consistent with the information available on departmental budgets, although these are often framed in terms of a shortfall against the budgeted contribution to the university's central costs (including premises in some cases) rather than surpluses or deficits on income. Furthermore, the balance between income and TRAC-derived full economic costs cannot be compared directly with income and expenditure accounts, which for nearly all universities exclude the full economic cost adjustments. The recently published HEFCE issues report[31] shows up the shortfall between the overall surplus of income over expenditure for the higher education sector in England based on financial reports and the level of surplus required to cover full economic costs.

Most of the universities and departments confirmed that they were prepared to accept a degree of cross-subsidy for departments with high fixed costs like chemistry and physics, provided that level of

---

29. It should be borne in mind that around 20% of universities' income comes from non-academic activities such as residences, catering, endowments and exploitation of PI. That being so at department level the proportion of total income that research represents should be higher than 28% (35% for the whole sector and 60% in the Russell Group (excluding LSE) assuming that on average departments do not have significant sources of other income).

30. *Financial sustainability and efficiency in full economic costing of research in UK higher education institutions*, Report of the RCUK/UUK Task Group, Universities UK and Research Councils UK, June 2010.

31. *Financial health of the higher education sector 2013-14 to 2016-17 forecast*, HEFCE Publication Reference 2014/26, October 2014.

cross-subsidy was transparent to the university as a whole and that departments continued to bear down on costs to improve the financial position.

7.1 Teaching

Data from the eight chemistry and physics departments in English universities for which full and reliable TRAC data are available for both 2007/08 and 2012/13 illustrate that in chemistry departments the deficit on the basis of comparing teaching income as recorded by the university with total TRAC teaching costs improved slightly from 16.6% to 14.0% and in physics departments it increased by 0.3% to 5.8% over the same period.

Data from the original separate studies of chemistry departments and physics departments, between 2002/03 and 2007/08 for chemistry and 2003/04 and 2007/08 for physics, showed that the finances of teaching had improved substantially in English universities. Since 2007/08 the finances appear to have stabilised, albeit with all chemistry departments still operating at a deficit and physics departments reporting a range of surpluses/deficits. There are not enough data from departments outside England to draw firm conclusions.

Increased tuition fees were introduced in England and Northern Ireland in 2006/07 and in Wales from 2007/08, but they were not introduced in Scotland. The additional funding for high cost and vulnerable laboratory based subjects (SIVS) was also introduced for English universities from 2007/08. It was these factors that lead to the improvement in the financial position of English universities in respect of teaching activities up to 2007/08.

In the period since 2007/08 up to 2011/12 the overall funding for teaching did not change substantially. The full implementation of the top up fee regime in England, Wales and Northern Ireland with fees increased in line with the Treasury's Gross Domestic Product (GDP) deflator was accompanied by a squeeze on the monies given to universities through block grants (especially after 2008/09) and SIVS has meant little change in the level of publicly funded income.

Prior to the introduction of the increase in the maximum fee to £9000 for home and EU full-time undergraduate fees embarking on their courses from 2012/13 in England, concerns were raised by the higher education sector and by some subject communities as to the effect on demand of fees of up to £9,000 in England. In particular worries were raised whether longer courses such as chemistry and physics courses leading to MChem and MPhys qualifications, respectively, would attract fewer students, against a general background of possibly fewer students deciding to apply to university at all.

Data in table 26 show first year enrolment of English domiciled students into first-degree chemistry courses and into first-degree physics and/or astronomy courses. As well as noting the rise in enrolments up to 2011/12, it is also interesting that the proportions of students enrolling on the shorter bachelor courses rose in 2012/13.

Table 26: First-degree enrolment* 2008/09 to 2012/13 of English domiciled students into principal subject chemistry and into principal subjects physics and astronomy.

Year	First-degree enrolments in chemistry			First-degree enrolments in physics and astronomy		
	Proportion on enhanced first-degree courses	Proportion on bachelor-degree courses	Total	Proportion on enhanced first-degree courses	Proportion on bachelor-degree courses	Total
2008/09	49.5%	50.5%	3380	51.2%	48.8%	2975
2009/10	47.4%	52.6%	3430	55.7%	44.3%	3000
2010/11	50.1%	49.9%	4025	57.0%	43.0%	3195
2011/12	47.8%	52.2%	4350	57.8%	42.2%	3705
2012/13	44.7%	55.3%	4015	54.3%	45.7%	3660

Source: *HESA Student Data*

* *First-degree enrolment is estimated by using a headcount of students registered as being in the first year in principal subject chemistry and in principal subjects physics and astronomy for 0.5 or more FTE. In the physics and astronomy figures there will be some double counting of students who are registered 0.5 FTE physics and 0.5 FTE astronomy.*

Although 2012/13 was only the first year of the new regime fees, the effect on the finances of teaching activities does not appear to have been very significant. Recruitment in England fell for chemistry and physics in 2012/13, but this follows a number of years where recruitment was healthy which has led to year on year increases in total student loads. The indications are that recruitment in England is rising again and so it appears unlikely that chemistry and physics departments will suffer significant falls in their student loads, however, to be sure of this the long-term trend in respect of students' choices of three and four-year courses will need to be monitored.

Furthermore, the high cost nature of chemistry and physics teaching continues to be recognised by HEFCE through the continuation of SIVS funding, albeit on a revised basis from 2012/13, and by the continuation of some per capita funding for high-cost subjects in addition to the £9,000 tuition fee.

Since 2007/08 most departments appear to have increased their permanent and contract staff numbers and their student to staff ratios. Although more difficult to generalise, overall the space per permanent academic staff member has fallen slightly in chemistry but has increased in physics.

The differential impact of the various changes in student and staff numbers and space on income and costs of teaching can be seen from the data from the institutions common to both samples for the two years set out in table 27 and table 28 below.

Table 27: Income and Costs per FTE student for Teaching in Chemistry Departments common to both samples in 2007/08 and 2012/13 for which full data were available (9 Departments)

University		2007/08				2012/13			
		Total UG and PGT FTEs	Income per FTE student (£)	Costs per FTE student (£)	Surplus/ Deficit per FTE student (£)	Total UG and PGT FTEs	Income per FTE student (£)	Costs per FTE student (£)	Surplus/ Deficit per FTE student (£)
English Universities	A	343	9,146	9,697	-551	467	7,588	9,215	-1,627
	B	516	9,748	10,849	-1,100	617	9,864	10,681	-817
	D	294	8,842	7,964	878	472	8,733	13,922	-5,188
	F	407	8,589	9,115	-526	550	9,462	9,825	-364
	G	243	8,255	12,267	-4,012	380	10,343	11,109	-766
	H	303	9,412	13,193	-3,782	488	11,215	11,850	-635
	I	366	8,694	10,516	-1,822	430	9,379	10,796	-1,417
	J	491	9,112	8,770	342	679	9,133	9,541	-408
University in other Countries of the UK	K	477	7,529	13,349	-5,820	518	9,682	12,081	-2,398

Source: *Institutional Data*

Table 28: Income and Costs per FTE student for Teaching in Physics Departments common to both samples in 2007/08 and 2012/13 for which full data were available (9 Departments)

University		2007/08				2012/13			
		Total UG and PGT FTEs	Income per FTE student (£)	Costs per FTE student (£)	Surplus/ Deficit per FTE student (£)	Total UG and PGT FTEs	Income per FTE student (£)	Costs per FTE student (£)	Surplus/ Deficit per FTE student (£)
English Universities	A	241	8,702	10,187	-1,485	348	7,504	8,991	-1,487
	B	426	9,878	9,859	19	470	10,316	12,319	-2,003
	D	273	8,997	7,656	1,341	395	8,560	12,197	-3,637
	F	305	9,358	10,145	-787	549	9,605	9,483	122
	G	276	8,159	10,688	-2,529	445	9,040	8,373	667
	H	405	8,898	9,983	-1,084	578	9,957	8,954	1,003
	I	571	8,573	6,089	2,483	593	9,371	8,374	997
	J	292	8,984	9,395	-411	438	9,217	10,817	-1,600
Universities in other Countries of the UK	K	466	7,387	17,892	-10,505	523	9,172	13,411	-4,239

Source: *Institutional Data*

It is difficult to draw any clear conclusions from the data as there are no clear patterns in the changes to either the income or costs per FTE. In most cases though, despite all departments increasing their FTEs, and some increasing numbers substantially, income per FTE has not changed dramatically and in many cases has actually increased. Increases were to be expected as not all students were paying the higher variable fees in England and Wales in 2007/08 and so the income per FTE should have risen up to 2009/10 as those fees were fully implemented. However, costs per FTE have moved up and down depending on the department. In chemistry costs per FTE have increased in the case of four departments and have fallen in the other six departments. In physics costs per FTE have fallen in six departments and increased in the other four. Increased FTEs has not necessarily led to a fall in the unit costs. Perhaps increased numbers of students has led to increased investment in staff and infrastructure which in turn has led to more costs being loaded onto chemistry and physics departments. It is also probably fair to assume that as time has gone on universities have become better at implementing TRAC. This is especially the case for teaching with the introduction of TRAC (T) which specifically seeks to relate costs to publicly funded teaching income. Teaching costs returned for 2012/13 may be a more accurate reflection of the true position than those returned in 2007/08.

In order to understand the factors affecting teaching income, universities were contacted to explore in more detail the way in which their resource allocation models work. In all cases in England universities reported that the additional SIVS money is passed on to departments. In addition universities reported that the general principle is that departments are given the income they earn. However, the way in which the teaching income passed to departments is calculated varies. In order to distribute funding council teaching income universities reported that they use algorithms which weight different subjects in line with funding council algorithms. However, whereas funding councils use student loads (total FTEs taught by departments) in their algorithms, universities use a variety of student number drivers:

- At one extreme departments' income is calculated based on the number of students enrolled in specific departments and no subsequent adjustment is made for service teaching;[32]
- At the other extreme departments' income is calculated using full net student load, i.e. a figure which takes account of service teaching;
- Between these two extremes a variety of models operate whereby the "home" department keeps a proportion of the student income for administration, and the remainder of the income is distributed based on which department delivers teaching. Alternatively income is passed to the home department and adjustments are made subsequently based on service teaching.

A variety of models operate for distributing old regime and new regime fee income:

- At one extreme the full fee income is passed to the home department;
- At the other extreme fee income is calculated based on student load;
- As with funding council-derived income, between the two extremes a variety of models also operate whereby the "home" department keeps a proportion of the fee and the remainder is distributed depending in which departments deliver teaching.

32. In this case it was reported that a study had been made that showed the net result was little different from a model where adjustments were made for service teaching.

It does not necessarily follow that universities apply the same model to distribute funding council income and fee income. It is also a possible that, as the balance of funding council and fee income changes over the next year or so, universities may change the ways in which they distribute teaching income.

All universities reported that they fund fee waivers (additional funding for students from less well-off backgrounds) out of central funds. However, the pressure to increase support for less well-off students inevitably leads to a reduction in the overall unit of resource per FTE.

Whether or not the resource allocation model favours or disadvantages chemistry and physics departments ultimately depends on the model and the net service teaching position. The model in operation is also likely to drive different behaviours: for example, some models may make it financially advantageous to teach mathematics in house and other may make it advantageous to outsource mathematics teaching.

The future financial position of teaching remains uncertain:

- Although the distribution of additional SIVS income to departments was been recalibrated for 2013/14, the total amount distributed remains approximately the same so the erosion in the value per student FTE will continue if the student FTEs continue to increase. In addition, the real terms value of the SIVS money has diminished due to the effect of inflation since 2007/08;
- One challenge with the introduction of the up to £9,000 new regime fees and reduction of funding council support (or elimination in the case of non-laboratory subjects) is that the amount of fee income associated with each home and EU FTE is known and, alongside increasing pressure for universities to provide 'value for money' for students,[33] it might therefore be more difficult for universities to cross-subsidise more expensive subjects. If the funding gap in teaching is not met, it may become increasingly difficult for universities to allow deficits on teaching in chemistry and physics departments to continue. It is also clear from what departments and universities have reported that they will increasingly be setting targets not only to breakeven but to deliver surpluses over the next few years to meet sustainability targets and cover full economic costs. This is in line with the analysis in the HEFCE report on the financial health of the higher education sector in England 2013/14 to 2016/17[34] based on institutional financial forecasts. In HEFCE's view institutions need to redouble their efforts to generate increased surpluses if long-term sustainability is to be achieved;
- There remains a good deal of uncertainty as to the long-term financial viability of the new regime fees supported by publicly-funded loans. Modelling suggests that most people with average career earnings will not repay all their loans the remainder of which will be written off after 30 years; in other words there is an implicit subsidy in the loans. However, the Government believes that taking together a reducing level of public sector net borrowing as a result of the reforms to higher education finance and proceeds from the sale of the pre-reform income-contingent student loan book will more than meet the cost of this subsidy;

---

33 *Student expectations and perceptions of higher education*, Kings Learning Institute, 2013 (https://www.kcl.ac.uk/study/learningteaching/kli/research/student-experience/QAAReport.pdf); *2013 Student Academic Experience Survey*, Higher Education Policy Institute and Which?, 2013 (http://www.hepi.ac.uk/2013/05/15/2013-student-academic-experience-survey/)

34. *Financial health of the higher education sector 2013-14 to 2016-17 forecast*, HEFCE Publication Reference 2014/26, October 2014.

- The Chancellor of the Exchequer confirmed in the 2014 Autumn statement the removal of the student number cap from 2015/16 in England to enable institutions to expand their provision to meet demand from an estimated 60,000 young people a year who have the grades to enter higher education but cannot currently secure a place. It is difficult to forecast how this will affect the numbers enrolling for chemistry and physics courses. Universities are likely to make decisions about whether increased numbers in subjects like chemistry and physics can only be achieved by lowering entry requirements, and whether departments have the facilities to accommodate additional students. Clearly additional capital funding may be needed to create the facilities needed. To ensure that institutions provide places in the subjects most needed in the economy, the Government will provide extra funding for STEM students of £50M per academic year from 2015-16. The government also believes that the cost of the additional loan subsidy involved can be met by the savings already in place;[35]
- If changes are made to the loan system (or the funding system more generally) for political or financial reasons student demand may fall or the amount of funding received for each student might decline. However, given the current student loan system, it is unlikely the fees will rise without concurrent changes to the loan system. It also follows that if loans are ultimately to be written off, then perhaps lowering fees is also viable so long as the difference is made up through increased funding council grant – in effect the money that will be written off in the future can be given to the funding councils now. But, given the current and continuing emphasis on austerity the latter outcome seems unlikely;
- Public sector pay restraint has to some extent controlled the staff costs in the last few years but in due course there will be increasing pressure to restore at least some of the real reduction in salary levels especially if universities are to continue to attract and retain the best young researchers against world competition;
- The debate around how to limit the liabilities of the Universities Superannuation Scheme also continues and it is likely that higher employer contributions will be required as the recent HEFCE issues report on institutions financial forecasts up to 2016/17 observes "…there continues to be much uncertainty and volatility of, and hence the level of pension contributions required to fund, the sector's pension scheme deficits. The current valuation indicates that HEIs could face substantial increases in their future pension contributions;"[36]
- As was noted in the 2009 report there is a continuing decline in the number of 17 and 18 year olds in the population through to 2019. So far this demographic change does not appear to have had any significant impact on student demand. Chemistry and physics have in practice both increased their shares of new entrants in recent years but the pressure to continue to do this remains if existing departments are to remain viable;
- The Chancellor of the Exchequer announced in the 2014 Autumn statement that government-backed student loans of up to £10,000 will be available to all people under the age of 30 undertaking postgraduate masters degrees from 2016/17. Loans will be offered in any master's

35. Autumn Statement 2013, HM Treasury, December 2013 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/263575/Autumn_Statement_2013.pdf).
36. *Financial health of the higher education sector 2013-14 to 2016-17 forecast*, HEFCE Publication Reference 2014/26, October 2014.

subject and will be repaid concurrently with undergraduate loans. A consultation is planned ahead of the announcement of the final loan details, but they could be charged at a higher rate than undergraduate loans, while remaining below commercial rates.[37] The changes should increase demand for postgraduate masters courses.

The increase in the undergraduate tuition fee to a maximum of £9,000 brings with it higher expectations on the part of students on the quality of what is delivered and on the additional services they receive. This will apply across all disciplines and may increase pressures to reduce further the current cross subsidy of teaching for chemistry and physics. Clearly the RSC and IOP, as the professional accrediting bodies, have an overriding interest in the maintenance of the quality of undergraduate teaching.

7.2 Research

As noted above, the relative size of the teaching and research spend in most chemistry and physics departments means that overall financial position tends to be dominated by research activity. All but one of the chemistry and all the physics departments for which full TRAC data were available showed deficits on their research activities in 2012/13. Overall the position of chemistry departments has improved slightly between 2007/08 and 2012/13 and that of physics departments worsened.

All universities reported that essentially all research income earned by individual departments flows through to those departments and appears in their budgets. Research income is much more transparent than teaching income as QR funding for each cost centre is published by the funding councils and information on the value of research grants and contracts is also publicly available.

In 2007/08, research councils were part way through the introduction of an increased overhead element albeit the increase was still short of the full economic costing. That should have resulted in an improvement in the financial position relative to 2007/08. It does appear that research deficits have reached an equilibrium which may reflect some of the following permanent and temporary factors:

- As noted above, research councils (and other research sponsors) do not pay the full economic costs of the research they support although the situation has improved. The recent HEFCE report on institutional financial forecasts noted that in 2012/13 the recovery of the full costs of research was only 75.5% of research income;
- As the data collected in this report confirm, chemistry and physics are particularly dependent on public sources of research income and hence on the metrics used to distribute that funding;
- As was the situation in 2007/08, which coincided with the run up to the RAE 2008, 2012/13 coincided with the run up to the REF2014 and therefore once again the proportion of managed academic staff time spent on research may have been sanctioned to increase shifting costs from teaching to research;
- Chemistry and physics have particularly high numbers of postgraduate research students and there remains a good deal of uncertainty as to whether the income for research

37. Autumn Statement 2014, HM Treasury, December 2014 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/382327/44695_Accessible.pdf).

students actually covers the costs. The Wakeham Report published in 2010[38] examined TRAC research income and costs across the sector and estimated that in 2008/09 the deficit as a percentage of costs for post graduate research students was 45% which was the largest deficit of any of the categories of income and expenditure examined.[39] Furthermore universities are not always clear how the finances of Doctoral Training Centres (DTCs) operate. Universities bid for DTCs and often include in-kind funding, for example, in the form of space the cost of which needs to be found from somewhere. Although the funding for DTCs is greater than that for other research council studentships, the costs are also greater and at this relatively early stage it is difficult to know whether the income covers all the costs;

- There also remains uncertainty as to how undergraduate and taught post graduate research projects in chemistry and physics departments are funded and whether there is cross-subsidy of teaching activities by research activities. Of course, addressing any cross-subsidy will not affect the bottom line but rather will move costs from research to teaching.

The outcome of the REF will clearly affect the level of QR funding for some departments which, given the high level of research spending in many chemistry and physics departments, will likely impact on the financial position of the departments concerned.

Despite the restraint on public expenditure, public research spending has to some extent been protected but as the national deficit has taken longer to come down than some had hoped, it is always possible that future rounds of public spending cuts will mean that research can no longer be protected. It is encouraging that capital investment in chemistry and physics departments has continued both in the form of new buildings and refurbishment. But, the new or newly refurbished facilities are also likely to be more expensive to run and maintain and therefore it is imperative that facilities are used to their full extent. There are nonetheless pressures building as some of what were new facilities early this millennium (e.g. fume cupboards in chemistry departments) will need refurbishing and possibly replacing in the near future.

However, the HEFCE report on financial forecasts offers a somewhat gloomy view of the future of capital investment by HEIs, given the substantial reductions in public funding for capital and the general financial pressures limiting HEI's ability to finance capital investment through borrowing.

Whatever the cost drivers and the future prospects, research in university chemistry and physics departments is operating in deficit on a full economic cost basis.

7.3 Conclusions

The overall financial position, as measured by the balance between departmental income and TRAC-based costs of chemistry and physics departments was about the same in 2012/13 as it was in 2007/08 for chemistry departments and worsened for physics departments. There has been some overall improvement in the position of research activities in chemistry departments, but the position of teaching

---

38. *Financial sustainability and efficiency in full economic costing of research in UK higher education institutions*, Report of the RCUK/UUK Task Group, Universities UK and Research Councils UK, June 2010.
39. 2008/09 TRAC research income and expenditure deficits/surpluses as a % costs identified in the Wakeham Report were as follows: Institution own-funded +9%; PGR Students -45%; Research Councils -26%; Other Gov't Departments -25%; EU -39%; UK charities -38%; Other sources including industry -24%. The overall deficit was -24%.

activities in chemistry and physics departments, and research activities in physics departments is little changed. As things now stand, the deficits in chemistry and physics research are similar, and the deficits in physics teaching are less than those in chemistry teaching. The continued existence of these deficits is borne out by the budgetary information supplied by the departments, even though the basis for determining budgets is different: in the majority of cases departments are set a target contribution to central costs rather than a full income and expenditure account. Only one or two institutions in the sample had any element of full economic costing in their budgetary or resource allocation procedures

The signs are that both chemistry and physics are withstanding the perturbations caused by the introduction of new regime maximum £9,000 fees in England. However, the new system is not yet fully implemented so the effects need to continue to be monitored.

The pressure on universities to be more transparent in how teaching income flows to departments is likely to result in pressure to reduce cross subsidies for chemistry and physics teaching. Although universities as a whole are currently generating surpluses of around 4% of total income, there is a clear understanding that surpluses at this level are insufficient to ensure sustainability through covering the full economic cost adjustments to expenditure as recorded in institutional accounts. Some institutions are beginning to incorporate the need to generate these extra surpluses within the budgetary processes. In practice this will mean even stronger pressures to eliminate deficits or increase contributions to central costs through a combination of increased income and holding down costs. This is likely to be particularly difficult for high cost departments like chemistry and physics and it seems likely that their financial performance will be put increasingly in the spotlight at university level.

The increased undergraduate enrolments in chemistry and physics departments over the last few years means that both subjects have withstood the pressures of the demographic decline in the number of 17 and 18 year olds. However, the recent changes to the fee regime may cause students to question whether they wish to take four-year enhanced first degree courses which would lead to reductions in the student load for chemistry and physics. Chemistry and physics are unusual in that compared to other subjects they are have a significant proportion of their undergraduate students on four-year courses leading to MChem and MPhys qualifications, respectively. This makes them particularly sensitive to any changes in the student loan system that that might cause students to re-evaluate the costs versus benefits of longer courses.

Although the science budget has been protected to some extent despite public spending cut backs, it may be that as more cuts are required that protection can no longer be afforded. Given chemistry and physics dependence on public research funding, both are particularly vulnerable to cuts in that spending.

More generally, despite the public spending climate, overall in 2012/13 84% of the total income in chemistry departments in the sample and 90% in physics departments was from public funds as compared to 85% and 88% in 2007/08, respectively. Consequently both chemistry and physics departments remain particularly sensitive to changes in public expenditure.

Furthermore, chemistry and physics departments have relatively low level of activity in areas such as postgraduate taught provision, where universities have greater freedom to charge market-level fees, and in other activities which use existing resources to generate additional income on a commercial basis. The recent announcement of income contingent loans for those under 30 years old wishing to undertake a postgraduate taught masters course may present an opportunity for chemistry and physics departments to expand their taught postgraduate provision.

Chemistry and physics and departments as currently operated have less scope for generating additional income than some other departments in universities. However, as already noted, there may be significant opportunities for reducing costs and improving value for money. Budgetary mechanisms could provide a way of incentivising the identification of such savings.