The evolution of government funding for research in UK higher education, 1978–2018

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Research careers in the UK's universities have changed significantly in structure within current academics' living memory. Anecdotally, research-inclined academics nowadays spend longer in relatively insecure and low-status roles, such as short-term postdoctoral research or teaching contracts. This growth in the share of insecure positions is widely ascribed to quasi-natural phenomena, often in terms of supply and demand, such as 'oversupply of PhD holders' (ESF 2015). This may explain competitiveness in general, but is insufficient to explain the change specifically towards insecure positions—since, barring the need for very rapid change, the overall cost of a large pool of funded positions is identical whether those positions are offered on relatively secure or insecure terms. To explain a growing shortfall specifically in (relatively) secure positions, separately from increased contention for positions in general, some change must have favoured creation of insecure positions. In what follows, I will explore both whether these anecdotal changes are identifiable in records of institutional staffing, and whether changes in funding policy over the period 1978–2018 can explain them. The answers, in brief, will be respectively yes and 'not with intent': staff mix has demonstrably changed, but not as a result of explicit policy change to that end. Rather, ongoing policy changes concerning matters which ought to be orthogonal to security—'sustainability', 'selectivity' and the the end of the 'binary system'—appear to have led unintentionally to a gradual decline in the relative share of stable funding sources which allow the creation of secure positions.

1 Background: an overview of dual support

The UK government's research funding in Higher Education has long been one of 'dual support', meaning a combination of *block grants* (sometimes called 'core' funding) and *project grants*. The former is awarded to an institution by 'funding councils' (e.g. Research England, formerly HEFCE, and peers in other British nations) as an unhypothecated block grant. By contrast, project grants are awarded by 'research councils', not merely to institutions, but to specific academic staff for spending over a short period (typically between 12 and 72 months).

In 2018, the research component of institutional block grants totalled approximately £1bn per annum (2018 prices) (RE 2018), with the most research-heavy institutions each receiving over £100m p.a. (University of Cambridge: £128m for 2018–19 (RE 2018)) while a mid-range institution around £10–20m p.a. (University of Kent: £14m for 2018–19). Since these grants are aggregated across the entire institution and vary only gradually year-to-year, they allow (potentially) for long-term planning and the appointment of staff on long-term contracts, including both academic staff and also the necessary support staff. By contrast, project grants are of short duration with little or no likelihood of direct continuation, so can support their directly funded staff only relatively insecurely. Support staff costs, by contrast, are mostly pooled across the institution as general 'overheads', so do not suffer this problem—provided that institution-wide project grant income varies only gradually. Similar project-oriented grants are also awarded by other bodies, such as charities or private companies. To assist with our focus on national policy, I focus primarily on government funds.

2 Study method

I will combine the study of primary and secondary sources documenting policy with the study of various quantitative sources on funding amounts and staff counts.

Qualitative sources To identify explicit changes in policy, I examine reports to government, notes issued by funding bodies or institutions, and historical secondary accounts of relevant policy changes.

Quantitative sources To identify changes of expenditure—which may or may not be a result of changed policy—and changes in staff mix, I analyse various quantitative data from public sources, including the Higher Education Statistics Agency (HESA 2018) and its predecessor, the Universities' Statistical Record (USR 1996).

Equating 'secure' with 'institutional funds' I have already posited an apparent decline in 'relatively secure' positions. How can these be defined? Perhaps surprisingly, contractual status is not sufficient as a marker of security, since, as required by EU law, many universities issue open-ended contracts to researchers employed only on fixed-term project grants. These may be accompanied by an explanatory letter mentioning the 'risk of redundancy' from a certain date. Besides the employer's taking on a minor liability for statutory redundancy pay, these function otherwise much like a fixed-term contract. I instead focus on the distinction between core-funded positions and project-based positions—or, more precisely, whether 'institutional funds' or 'outside funds' support an individual's employment. This is partly pragmatic: such a distinction is available in HESA and USR data. However, 'institution-funded' is also a defensible definition of 'relatively secure', since institutional funds, being a

pooled 'block' resource, have far greater stability than individual project grants. The soundness of this definition remains largely an assumption rather than a demonstrated fact. However, it is not surprising that research organisations value continuity, and evidence in our Cambridge case study bears this out somewhat (see §4).

Case studies Data appearing under identical headings is nevertheless liable to vary subtly in its significance from institution to institution. To incorporate contextual knowledge, I conduct two case studies: one of the University of Cambridge, a leading recipient of research funding, and the University of Kent, one middle-ranking on that measure. These choices owe mainly to my institutional links, but also to the fact that Cambridge (unusually) publishes partial staffing data.

Research-active assumption, and caveats Comparisons drawn across this particular forty-year period are risky, given the considerable background changes. For example, academic staff numbers grew enormously, driven by growth in student numbers. Meanwhile, in 1992 a whole host of institutions (mostly former polytechnics) joined those eligible for core research funding. Our primary point of reference, although imperfect, is to focus on the pool of 'research-active' staff, i.e. those with a research element to their contract. It is these staff whom government research funding is ultimately supporting (in various ways). Such staff are admittedly more diverse than is reckoned by this analysis. As a further simplification, for now I will examine data only for full-time staff. Further caveats are listed in §B.

In what follows, 'FC' refers to the research component of funding council block grants (from UGC, UFC, HEFCE / Research England and peers), whereas 'RC' refers to research councils, whose funding is given out entirely on a project basis. Therefore, in short, 'FC' denotes block funding and 'RC' project funding.

3 Evolution of policy

Most policy changes should be seen in the context of a broadly expanding sector, illustrated by Fig. 1. Clearly, funding has changed: in 1978, over 80% of UK research-active full-time staff were supported wholly by institutional funds. In 2017 this figure was 68%. (For Cambridge the figures are starker: 63% and 27%; see §4.) The sharp change around 1992 reflects the end of the binary system (see §3.2).

Fig. 2 shows the shifting balance between government spending on core funding and project funding. Roughly, a 60/40 balance has inverted over the past forty years, from the FCs' favour to the RCs' favour. Overarching gradual changes are consistent with the broad fiscal policy of various governments (annotated on the graph by the longest-serving Prime Minister of the identified periods: Thatcher, Blair, Cameron).

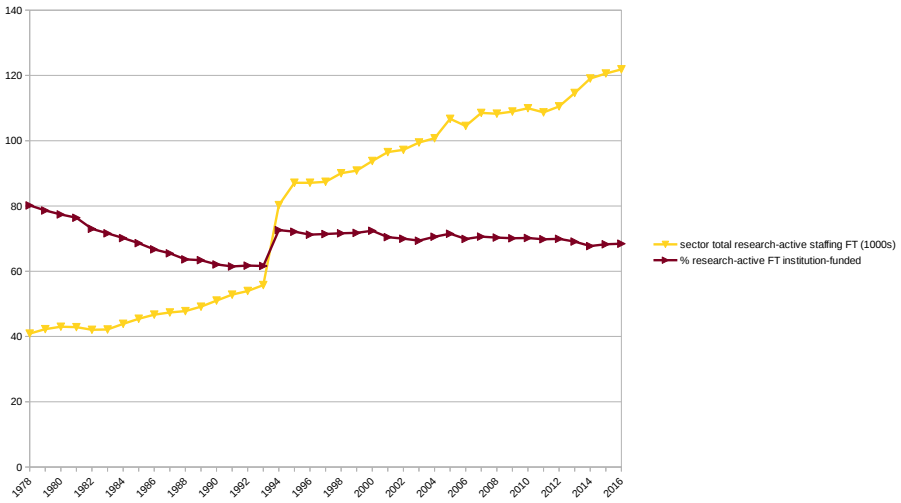

Figure 1: Increase in full-time members of academic staff having (nominally) responsibility for research, also showing change in the fraction who are institution-funded.

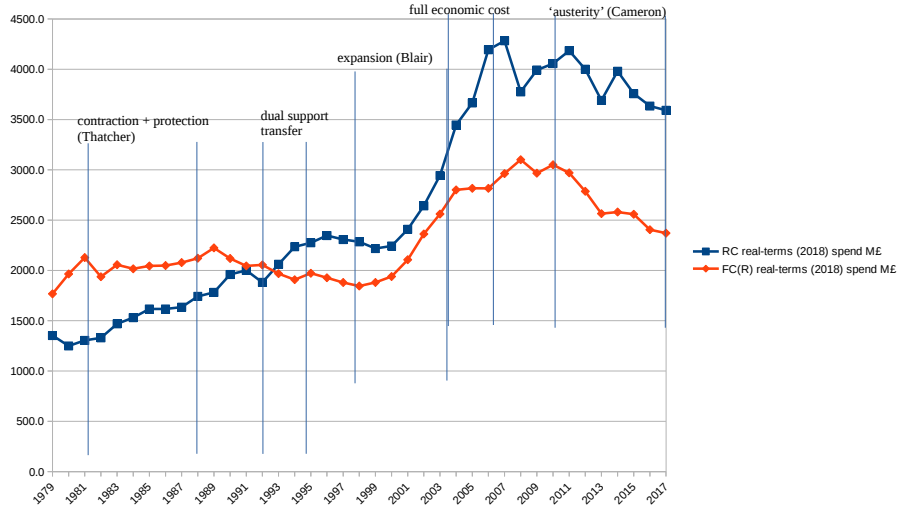

Figure 2: Real-terms change in block research funding (FC(R)) versus project funding (RC).

Specific changes can be traced to research funding policy events, as now detailed: 'protection of science', dual support transfer, and full economic costing. None of the evidence surveyed here suggests that these were intended by government to promote insecure positions, nor even to tip the *effective* balance any further in favour of RC money. I will argue that they nevertheless did so.

3.1 Contraction with protection: 1981–88

The 1981 budget (Hansard 1981) brought severe cuts to many areas of public spending including universities, and would become infamous (BBC 1997). In research, the real-terms 1980 level of core funding would not be regained until 1988 (Fig. 2).

The Merrison Report of 1982 was commissioned partly as a reaction to this change, addressing how scientific research could best continue in this tighter regime where 'it was very doubtful if [universities] would be able to protect to any reasonable degree the research which is their responsibility' (Merrison 1982, p2). It notes that universities felt structural pressures to sacrifice research spending in particular: 'competition grows from other activities which are supported from general... funds, and which are less easy to cut in the short term'. It also quotes from the Government's 1981 public expenditure plan, as follows (abridgements are my own).

> 'the Government wish to give protection to the support of basic science... within the declining level of the total programme for education and science... it should... be possible for the research councils... to maintain their selective support for research in universities and polytechnics at broadly the current level at a time when provision generally for higher education is planned to decrease'.

In Fig. 2 we see that this move to 'protect science and engineering' translated to a slight increase in RC money during a time where FC money declined. I surmise that such a move was more convenient to arrange than selective 'protection' of FC money would have been. This is because University Grants Committee (UGC) awarded a truly unhypothecated block grant: although nominally, in Merrison's era, 40% of this grant was intended to fund research (it would fall to 33% after 1992), this was also intentionally unmonitored. Institutions were in practice able to spend it on things besides research—and, as Merrison also noted, they did: internal underfunding of research was systemic, regardless of the nominal block grant level, because the demands of teaching are inevitably more immediate. Since government cuts were made to the UGC grant *in toto*, they also applied proportionally to its research component. Rather than varying the 40% figure on an annual basis—unwieldy, and also not guaranteed to force spending on research—boosting RC money was seen as a better compensatory measure. Hence, the balance of research funding was shifted somewhat away from FCs and towards the 'protected' RCs.

I have seen no evidence suggesting that government concerned itself with the differences in the terms of employment allowed by project-based versus

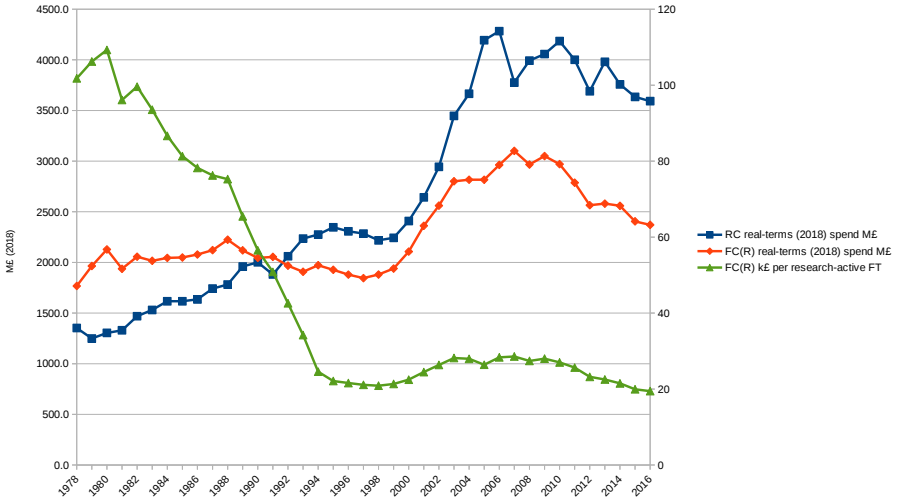

Figure 3: As Fig. 2 but also showing the average FC(R) spend per full-time member of academic staff having (nominal) responsibility for research.

core-funded positions. The view that such questions remain an institutional matter can be observed in later government documents (see §3.3).

Fig. 3 shows that when accounting for the overall expansion of the sector, the picture is more dramatic: the real-terms (2018 prices) core research funding per institution-funded research-active full-time staff member has dropped from £100k in 1978 to £20k in 2018. Perhaps surprisingly, this trend was strongly in evidence even before the introduction of 'selectivity' in 1986 and the end of the 'binary system' in 1992, both of which I discuss below. These were both moves which might be expected to dilute the average 'research share' per academic staff member, but are not sufficient explanation.

3.2 Expansion, 'debinarification' and selectivity: 1985–92

During the 1980s, student numbers would double (Watson, 2015). In an era without tuition fees for home students, this inevitably greatly increased the total government spending on higher and further education. University student numbers specifically would hugely increase with the abolition in 1992 of the 'binary' system, under which the sector had consisted of universities distinct from polytechnics and colleges. Whereas previously, research had been concentrated on the so-called 'pre-92' institutions, now it was allowed to evolve across a greatly expanded sector.

Under the pre-1992 UGC formula, research money was apportioned to universities partly according to their student numbers: the 'SR' or 'student resource' component accounted for 37% of UGC research money in 1985, equalling 14.8% of the total block grant (Shattock, 2012, p176). Tying research money partly

to student numbers could no longer work in the post-binary era: if pursued, it would have caused a sudden reduction in the core research funding received by pre-1992 universities, who had previously shared this money only among themselves. Indeed the need for greater selectivity with FC research funding overall had been foreseen earlier partly through a desire to 'concentrate' research owing to 'varying degrees of excellence among universities' (Jarratt 1985) and perhaps partly anticipating the end of the binary system. Selectivity policies took the form of tweaking the UGC formula such that an ever-increasing component of the funds were apportioned by 'quality' as assessed by increasingly elaborate exercises (Jump, 2013). Whereas the quality-related component (then labelled 'judgemental resource' or JR) in 1985 accounted for less than 35% of the total, and was assessed informally (some would say untransparently), its equivalent in 2007 ('mainstream QR'[1]) accounted for 65% of the same. As noted by Shattock (2012, p183), selectivity has over time become very selective indeed: in 2011 25% of core funding was drawn by four institutions, and 75% by the 'top' 25 institutions.

In research funding terms, the net effect of this period was that eligibility for core research funding extended over a greater area, but the rate of redistribution of this income was damped by increasing selectivity—based on the extent and (assessed) quality of research already ongoing. Since this had initially been concentrated in the pre-1992 universities, although it was expected to diffuse somewhat. For example, in the data, we see a rapid increase in teaching-and-research academics (visible in Fig. 1), with a corresponding gradual reduction in teaching-only contracts in the data returned to the Higher Education Statistics Agency during 1994–2000 (HESA 2018). (Put differently, the data suggests that many positions that were formerly teaching-only were transitioned to 'teaching and research'. This reveals a methodological caveat: the relative share of research work in the load of one nominally 'research-active' academic can vary hugely, and almost certainly varies systematically between pre- and post-92 institutions or at least did so around this period in history. We have no way to allow for this. For example, Fig. 1 shows a sharp increase in the proportion of research-active staff who were institution-funded, but this is unlikely to constitute an increase in institution-funded *research* per se.)

Selectivity need not have had a direct bearing on staffing or security, except to concentrate positions on particular universities. However, by construction it encourages what Adams and Bekhradnia (2004) noted had transpired by 2004: institutions' FC and RC funding levels had become closely correlated. This correlation appears to have enabled their 'dual' purposes to be conflated—an outcome explicitly warned against by Merrison 1982, p30, whereby funding councils' spending amounts to 'match funding' of project grants. This defeats 'dual support' since it can fund only 'existing and recognised' projects (conducted

[1] In a rather confusing switch of terminology, the new abbreviation 'QR' would be applied not to a single component, as had other 'xR' labels, but to the entire pot. Despite this, the pot was still subdivided into various components, now lacking such convenient labels: in 2007 these subdivisions included 'mainstream QR' but also 'charity support', 'business research' and others (Shattock, 2012, p180).

by existing and recognised academic proponents) and neglects the 'seedcorn efforts' (by which a more junior researchers might make an initial impact). We will see evidence later (§4) that this trend has reduced institutions' ability to support early-career researchers in their own right.

3.3 Sustainability

Merrison had already warned that core funding levels were in danger of becoming inadequate for the research they were intended to support. Although the cause of his concern was a top-down fiscal contraction, another source of similar pressure, occurring at various times (as seen in Fig. 2), has been the increase in the share of money apportioned to project grants. Historically, this was because project grants paid only *direct costs* (principally equipment, consumables and directly employed staff time) whereas considerable indirect costs arise through the administration and upkeep of university buildings, laboratories and other facilities. By 1991 a systematic shortfall was recognised. A 'dual support transfer' was initiated, transferring budget from funding councils to research councils, between 1992 and 1995. This change by itself was arguably less significant than it first appears. When seen in real-terms figures, it merely exaggerated a trend that was already occurring: in the four years to 1991, RCs had seen an 8% real-terms gain against FCs' −5%, whereas these figures became 25% and −14% in the four years to 1995.

Internal transfer of funds can never provide a means to redress an overall deficit, which instead requires reducing the real-terms rate of expenditure. Adams and Bekhradnia (2004) remarked that the transfer's intention had been to achieve this by yielding 'better funded [project] grants, but no increase in their number', hence lowering the indirect costs to be footed by core funding. However, the opposite occurred: FCs simply funded more research. This is likely because no hard rules around costings had been developed. Existing practice therefore continued, but awarding from an enlarged budget. Yet again, the effect was to accelerate the shift in balance from FC to RC funding.

As noted earlier, the explicit UGC formula in place by 1985 contained several components, of which two—'DR' ('dual') and 'CR' ('contract')—were intended as 'match funding' components, to make up at least some of the indirect costs incurred while carrying out (respectively) RC-funded projects and external contract research. These components amounted to only about 30% of the total in that year. Apparently this figure was not enough, hence the deficit which prompted the dual-support transfer. This reveals a limit to our current methodology: a latent cross-subsidy phenomenon acts to obscure the 'true' level of genuinely unhypothecated core funding. Put differently: for each unit of RC money awarded, some amount of the FC award is silently consumed, but exactly how much is a varying factor. In 1985 this had likely already outgrown the explicit DR and CR components, leaving some 'latent' match funding to occur implicitly. In the QR era, this match-funding is mostly implicit, but is acknowledged openly: the University of Cambridge in its response to the Stern review of REF (Cambridge 2016) noted that '[Cambridge's] QR allocation…

provides critical match funding for RCUK grants and other research funding won in competition and it is essential for the financial sustainability of the University'. As one example, Cambridge received approximately £515m in research grants and contracts during 2018, against £121m in QR funds. If grants pay 80% of full economic cost, they require £103m of match funding, which if claimed from QR money leaves only £18m truly unhypothecated. The reality may be worse, since some funders, notably charities such as the Wellcome Trust, pay less than 80% FEC. In short, despite Merrison's warning, very little money appears left for 'seed-corn' efforts. A historical analysis along these lines, although not pursued here, is necessary to establish how levels of truly 'unclaimed' FC money have varied over time.

In 2005, the necessary step of reforming grant costing practices was instigated, in the form of the TRAC methodology for 'full economic costing' (RCUK 2005). This was accompanied by another increase in RCs' share, from £3.7bn to £4.2bn, with FC money frozen in real terms over 2004–06. Moreover, in the interest of 'maintaining volume' (DTI 2003), match funding was not eliminated but rather enshrined. In other words, to avoid a presumed academic outcry from suddenly funding fewer projects, and with only a limited increase in FC budget forthcoming from the Treasury, the issue of 'full' costing was fudged: rather than insisting on truly full costing, the then-necessary level of match support was locked in, at 20%. Yet again, the effect was to make official a cross-subsidy that was already *de facto* in place, rather than put project grants into a truly self-supporting regime. Perhaps not coincidentally, the 80% figure mirrors the *de facto* match funding level noted by Cambridge (as quoted above): its core FC funding only slightly exceeds the 20% indirect funding required by the incoming grants and contracts, leaving little or no QR funding available to create positions for research independent of project grants.[2]

Around the same time as the introduction of TRAC, the House of Commons Science & Technology Committee published a damning report (STC 2002) on 'Short-term research contracts in science and engineering', noting that 'Research Council funding... is directed and gives universities little room to manoeuvre in the way it [sic] employs its [sic] staff' and that 'the situation demands an urgent rebalancing of the dual support system'. The government response tended to inaction, and stated that 'universities, as the employers of research within their institutions, are themselves responsible for the working conditions and career development of their research staff' (UK Government 2002). Government continued to be unconcerned with how funding terms directly impacted both employment contracts and organisational structures. Owing to the differing natures of FC and RC funding, increasing RCs' share—the biggest single pattern emerging across our entire 40-year span—naturally damps down longer-term, more independent and more strategic appointments, in favour of shorter-term appointments tied to project topics and timeframes, and existing under the

[2]In the case of Cambridge and one or two other UK universities, a small capacity for independent research also exists in the Colleges. In all cases our data relates only to funds passing through the central university and its departments and faculties, rather than the (financially independent) Colleges.

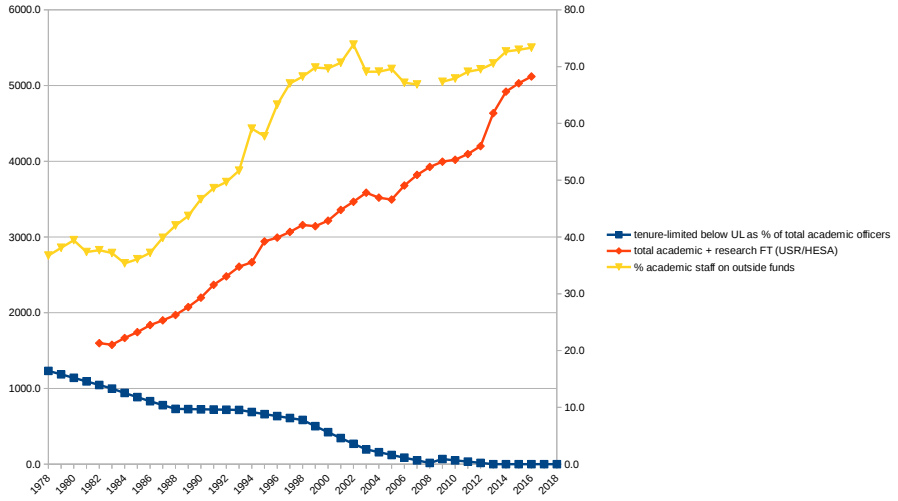

Figure 4: Growth of total academic staff (including research staff) at Cambridge, and of the *percentage* (not total) who are on outside funds. The bottom line shows the fraction of academic offices which were 'early career', in a particular sense: that of holding an office below the grade of University Lecturer on a tenure-limited (typically five-year) basis. Academic offices are by definition institution-funded, and constitute higher-status positions of greater independence than those funded from the outside. Such early-career officers accounted for 16.4% of all officers in 1978, but became near-extinct by the mid-2000s.

aegis of the (usually relatively senior) grant-holding academics. Earlier this year, the minister responsible for universities, Chris Skidmore, evidenced the same belief that early-career research structures could be improved by '[calling] on all universities to reconsider' their practices (Hansard 2020).

4 Case study: University of Cambridge

Staffing data on the University of Cambridge is available from HESA and its predecessor USR, and also from the University's own publications. Fig. 4 shows the trends. We see that the historically greater share of money distributed by FCs coincided with a greater share of 'established' early-career positions which, although fixed-term, were longer—typically five years—relative to currently typical postdoctoral appointments, and offered greater independence and higher status within the institution. For example, a Senior Assistant in Research (SAR) could expect membership of the University's governing body and an entitlement to sabbatical leave. They were also more independent, with duties determined (at least formally speaking) in a similar way as with lecturers and the like. By contrast, holders of the equivalent title for unestablished researchers, Research

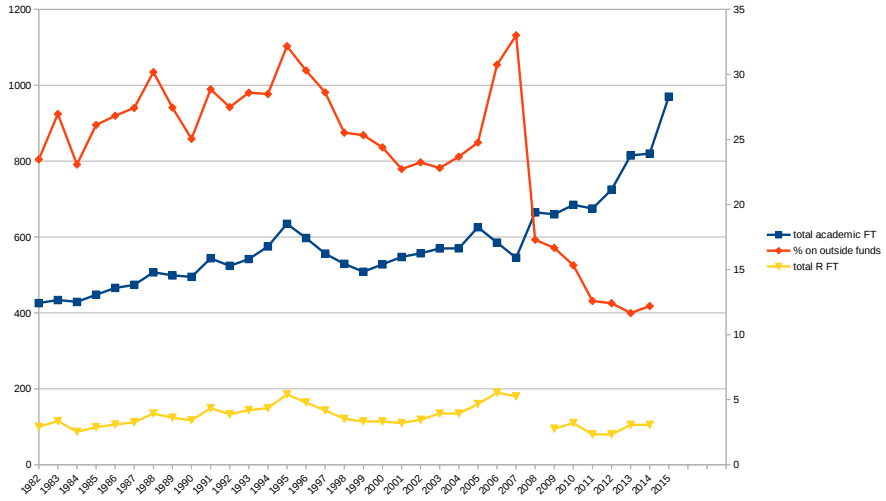

Figure 5: Growth of total academic staff (including research staff) at Kent, and of the *percentage* (not total) who are institution-funded.

Associate,[3] would usually receive none of those privileges, typically be appointed for far less than five years and work under the direction of the project's principal investigator. Although SARs never existed in large numbers, University Assistant Lecturers were on the same pay scale and accounted for over 10% of all academic officers in 1978.

I assume, while acknowledging a threat to validity, that the meaning of the University Lecturer (UL) grade is unchanged at the junior end.[4] In ongoing work I am examining this assumption, by consulting public information on the career histories of past UL appointees sampled at various points in time. Initial findings suggest that this assumption is broadly correct: University Lecturers in 1978 were appointed at similar age and experience levels as current appointees to the same office—but many had previously held institution-funded positions at lower grades, which no longer exist. Further research, including study of other institutions, is necessary to confirm this trend.

5 Case study: University of Kent

Data have been less forthcoming on the University of Kent's staffing and funding history. However, the Research Reports of 1984 and 1985 (UKC 1984) list all Teaching and Research Staff, showing a sprinkling of 'research fellows' and 'tutorial fellows'. At least the latter of these are known to have been institution-funded; it seems likely that some of the former also were, as the list also shows distinct titles for 'research associate', 'Leverhulme fellow' and similar *external*-funded roles. One passage of text describes a 'promotion' from Tutorial Fellow to Lecturer—suggesting a continuous career path not nowadays afforded to staff below the Lecturer grade, who are almost universally employed on outside grants. (An anecdote received from Peter McGill, Professor at the University of Kent's Tizard Centre, related how, after the Centre received a large capital sum, the university created a single core-funded research position. However, this 'did prove rather difficult to organise' and the employee in question has now reverted to being directly funded on a project grant.)

A further complicating factor here is that there are obvious anomalies in Kent's HESA record. For details, see §C.

6 Conclusions

We have explored two key coinciding trends: the shift in balance of government funding from FCs to RCs, and the relative increase of the fraction of academic staff who are employed on external funds. Correlation by itself does not imply causation; however, a plausible causal mechanism is clear.

We have also seen, particularly in the Cambridge case study, a concurrent change in staffing profiles. Even under any given level of demand (from qualified candidates) and supply of funding to satisfy that demand (by providing positions), the funding streams and terms by which that funding is supplied can have a significant effect on not only job security but also the status and independence of employment. Government has repeatedly shown itself unaware of the power that its policies have over research career structures.

Much of the dialogue around research funding today concerns the REF, while research councils' processes are seen as business-as-usual—even though their running costs are far greater, as noted by Adams and Bekhradnia (2004). That is not to say that more labour-efficient equivalents of REF could not be devised. However, I contend that a questioning spotlight on research councils is very much overdue, and there are many strong arguments to support 'turning the dial' back towards core funding. Doing so would inherently involve managing

[3]Note that despite the first of these titles' use of the word 'senior', there is no intended difference in seniority between SAR and RA; 'senior' in Cambridge historically refers to having the MA degree.

[4]Its senior end was altered both by the introduction of University Senior Lecturer in 1999, and by a clear ongoing increase in the fraction of academic positions at Professor and Reader level—especially between 1998 and 2008 when those two offices increased their combined share from 34% to 55%.

the political objections to any corresponding reduction in the available budget for project grants—a task notably avoided during the introduction of TRAC, leading to the 80% fudge. This rebalancing could be framed not in terms of 'less money' (indeed it would not imply that) but as investing in an improved career structure for future generations, and hence in the academic profession's best interests. As Merrison noted, if core funding serves simply as a top-up for project grants, its main purpose is defeated.

Wider awareness of the interplay between project grants and core funding appears to be lacking. In its response to the Stern Review of REF (Cambridge 2016), Cambridge write that 'it is imperative for the success of the UK's future research capability that the QR be fully protected from erosion'—apparently not aware of the considerable extent to which it had already been eroded in the preceding four decades. These changes are seldom remarked, partly for the reason that, as we have shown, they have not been the explicit focus of policy; rather, they have been side-effects of policies nominally concerned with other issues. Aside from the periodic REF song-and-dance, academics are somewhat removed from the flow of FC money; 'research income' and 'project grant income' are considered synonymous.

The primacy and visibility of only the research council grants has perhaps contributed to the relative a vacuum in academic leadership. Within the Higher Education sector, established dialogues are between academics, research councils and institutions, but seldom directly with central government. Since the policy decision of 'rebalancing' necessarily rests above both Funding Councils and Research Councils, the question can essentially be asked only at the government level. So far, academic leaders have not appeared inclined towards asking it, although, again, perhaps only for lack of upward pressure or awareness. With both RCs' and FCs' research funding now under the common umbrella of UKRI, there is fresh opportunity for this dialogue to revisit the issue of funding balance.

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A Notes on the raw data

Longitudinal comparison A key challenge in longitudinal analysis of figures is to accommodate changes in counting methodologies. For example, from 2003–04 HESA's counting method switched from counting staff active 'during the reporting period', to use of a single census date. The former method was shown to over-count; I have used an extrapolation method to back-estimate comparable figures for the previous years, by estimating the overcount factor. Another anomaly is that from 2012–13, HESA's definition of 'academic staff' was changed; the same year, the dominant change in the figures is a sudden marked increase in teaching-only staff. The reason for this is not clear[5], although since it does not create any sudden change in the count of research-active staff, I do not correct for it.

HESA 2003 bridging Some work was needed to bridge the HESA staff counting method changes in 2003. The older method is known to overcount. We extrapolate changes over the preceding 3-year window (1999–2002) in order to predict an 'old-method' figure for 2003. From these predicted old-method

[5]One might speculate that this could be be explained independently by contract manipulations in attempts to game the 2014 REF—but the change is not accompanied by a corresponding decrease in teaching-and-research staff.

2003 figures and the actual new-method figures, we calculate 'overcount factors'. We then estimate historical new-method figures by dividing the old-method figures by these factors. Significantly, this factor is calculated independently for each institution (Cambridge, Kent, and all-institutions figures) and also for the 'other funds' versus 'institutional funds' staff, since the overcounting arises from staff turnover, which we would expect to vary considerably across these (e.g. we expect a greater factor in the case of 'other-funds' staff, since we expect greater turnover in that group; we also expect inter-institutional differences such as the more research-intensitve institutions holding project grants of longer average length). The sum of the resulting estimated new-method figures for 2002 (the last year of the old method) was validated against the 'true' 2002 'new method' total-staff figure quoted by HESA for backward comparison purposes, and found to be within 0.8%. However, the accuracy of our method's split between institutional-funds and other-funds staff remains unvalidated, and is increasingly questionable as one looks further back in time. An outstanding weakness is that we apply the same overcount correction multiplier to *all* previous years, even though our only point of validation is for 2003; in effect, we are assuming the absence of longitudinal changes in the relevant factors, even though such changes are plausible (e.g. consider perhaps an increase in average duration of RC-funded projects, either globally or at a given institution).

B Further methodological caveats

Government funding only We do not examine changes in the prevalence of project or core funding from charities, even though many charities, both in sum and sometimes individually (notably the Wellcome Trust), do constitute a substantial and increasing part of the funding picture.

Separating core funding from outside funds Another, more slippery confounding factor is the 'research funding gap': core funds are not allocated independently of outside funds, and may be used implicitly as a cross-subsidy when outside funds do not meet full costs. We discuss this under 'sustainability' (§3.3).

Defining 'research-active' By 'research-active' we refer to staff whose contracted duties include a research component, possibly alongside a teaching component; teaching-only staff are excluded. USR data does not provide a separate teaching-only category (presumably since such staff were almost unknown in the pre-1992 universities with which the data is exclusively concerned). We assume all USR-reported 'teaching or teaching and research' staff to be research-active. This obviously hides the fractions to which these academics' time is in practice dedicated to research, which will vary considerably.

Arts & Humanities Perhaps surprisingly, since 1998 research into the arts and humanities has been funded from the 'science budget', following the creation

of the Arts & Humanities Research Board. This is counted among the research council funding in our figures, which principally come from the Office of Science and Technology. Before this, related funding was available from the British Council, but this is not currently counted.

Other funders We have not examined growth in charity funding, nor in EU funding (which mostly follows the project model, albeit usually on longer timescales). Some years' USR and HESA data does offer a fuller breakdown, making investigation of these feasible. In the case of Cambridge, college-funded academics generally appear not to be included in the USR and HESA data, so our view of the institution is incomplete.

Part-time working Part-time staff are currently ignored in our analysis, but it seems likely that their share will have grown considerably since 1978. One main problem is that HESA data does not record FTE units, so does not let us weight part-time staff according to their hours. Interestingly though, USR data does provide this.

Salary drift and cohorts Another factor affecting the staffing levels possible with a given pot of FC money is the gradual migration of junior to senior pay-grades following a burst of expansion (such as in the 1960s). Another factor is the historically varying extent to which senior academics receive more generous pay than their junior colleagues; anecdotes suggest the gap may have widened in recent years, and our Cambridge data on the relative growth in Readers and Professors appears to agree.

Growth of administration Many academics remark that university administration has grown disproportionately over their career. If true, this would consume a greater share of core funding. A study of administrative staff numbers could be done with broadly similar sources of data.

Tracking the pre-1992 cohort It would perhaps be better to study pre-1992 universities longitudinally, to isolate the distortions caused by the sudden introduction of the post-1992 institutions (seen as sharp changes in Fig. 1).

Polytechnics and colleges In 1978, the UK university sector was much smaller both in student numbers and in institutions: many institutions which in 1992 would become universities had in 1978 only polytechnic or college status. These institutions received no explicit research component to their core funding, and their academic contracts did not include research as a responsibility (Shattock, 2012, p29). When UGC was transformed into the University Funding Council, in 1989, the Polytechnics and Colleges Funding Council was also created. Its 1991 accounts (PCFC 1991) mention that the objectives of the council's funds are 'the continued development of high quality and cost-effecting teaching and research', although they otherwise do not mention research. Our figures,

where appropriate, include PCFC research funds (over the period 1989–1992) as reported in the 2004 OST SET data. Since the 1987 Annual Review of Government-Funded R&D (Cabinet Office 1988) mentions only the universities, via the UGC, with no mention of polytechnics, our data assume they received no core research funding. This is certainly a questionable simplification; undoubtedly research did go on in them to some extent. Therefore, while their staff salaries could be considered to include a research component, this is not currently counted in our data.

C Kent HESA anomalies

Kent's count of institution-funded teaching-and-research staff appears to double between 2002 and 2003. Since this coincided with a change in HESA-mandated counting methodology, it seems likely to be an error. (As anecdotal explanation, a local senior academic offered a recollection that a double-counting error crept into the HESA return over a certain period—and, when corrected, saw the university sink many places in published rankings, whose staff/student ratio calculations had used this incorrect data!) The mistake appears to be corrected from 2009 onwards, although 2015's figures are also anomalous a different way: the count of institution-funded research staff, which had been 20 in 2014 and (at least from 1978) was otherwise never above 25, suddenly reaches 85. This data appears questionable or at least in need of further review. One possible explanation is a change in how outside-funded researchers are returned to HESA in the case where they are on open-ended contracts. In Cambridge's case these are still returned as 'outside funds'.

Consequently, when plotting Kent's staffing over time. the picture is much less conclusive. The fraction of outside-funded has actually sharply decreased in the past few years, but research staffing levels have also declined, whereas overall academic appointments have increased at above historical rates. Research staff numbers are low enough to be subject to considerable year-to-year variation. To untangle this, an analysis of research income will be necessary.