

Funding selectivity, concentration and excellence – how good is the UK's research?

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Introduction

1. This report assesses the strength of the UK's research base, and at a high level examines how that strength is distributed between institutions. It concludes that a small number of institutions and individuals within them produce the truly exceptional research that puts the UK among the world's leaders in research, and that below those peaks of excellence, performance is more evenly spread between institutions. Whereas the present policy of selectively funding excellent research wherever it is found has had the effect of concentrating research funds in a relatively small number of institutions, there is no general case for explicitly funding research according to historical institutional characteristics.
2. Government policy for research over the last two decades, since the introduction in 1986 of the Research Selectivity Exercise (the predecessor to the Research Assessment Exercise – the RAE), has been perceived to have been strongly selective, consequently driving a concentration of greater amounts of research activity into a progressively smaller number of institutions.¹
3. It was therefore of some surprise when the outcomes of RAE2008 produced profiles that suggested that high quality research was in fact widely distributed across the UK higher education sector. It appears that the policy of selective funding, while leading to a fair degree of concentration of research funds, had not led to quite the concentration of research excellence that might have been expected.
4. It was not so much surprise as concern that was expressed by those institutions which held substantial research portfolios and whose strategies had evolved in a policy environment that had resulted in research funding being increasingly concentrated in its distribution. The Higher Education Funding Council for England (HEFCE) produced a funding settlement that aimed to protect these institutions while still rewarding newly recognised excellence.

¹ This report looks only at selectivity and concentration in the provision of QR money through the Research Assessment Exercise. This is one leg of the 'dual support' system of core (Funding Council) and project (Research Council) funding; although Research Council funding is not analysed here, it can be noted that Research Council funds are similarly concentrated in their allocation. In this report, selectivity is taken to mean the differential funding of research according to its quality, without regard to the institution in which it takes place. Concentration is taken to mean the explicit focusing of research funding on specific institutions, generally with regard to the intensity of research activity in those institutions. Concentration of funds may be an indirect consequence of a selective allocation process if quality is already co-located.

5. An immediate shift in the distribution of funding at institutional level was apparent. An additional 25 universities and colleges were now in receipt of core research funding. In terms of mainstream QR cash, in 2008-09 about 90 per cent of it was shared by 38 universities but from 2009 some 48 institutions were sharing this slice. There are two main reasons for this shift. First, under the previous scoring arrangements pockets of mediocre research might have become subsumed in an otherwise excellent and high-scoring department whilst, conversely, pockets of outstanding research might not have been recognised in a low-scoring department. Second, the weighting factors used in the 2009 funding formula provided greater reward for moving from the modest plains of 2* research quality to 3* than from 3* to the far more challenging peak of 4* world-leading excellence, whereas in the previous scoring arrangements the step from a 4 to a 5 rating or from a 5 to a 5* rating provided a far greater reward than the step from a 3a to a 4. Arguably this would not only affect the balance of selectivity but could also contribute to a change in concentration of funding.

6. Both HEPI and Evidence have argued against undue concentration of resources and in favour of institutional, regional and national diversity. Indeed concentration as a policy cannot be right, if it means funding less good research that happens to be conducted in a research intensive university, at the expense of better research in a university that is not marked out generally as research intensive. On the other hand any unintended diminution of the present balance of concentration might be of concern if it impacted on the overall performance of the system: presently, we just do not know whether this is the case. The 2009 outcome marked a change more profound than many will realise. There has never been enough money for the 'endless frontier' of research, so selectivity in allocation – and the consequent concentration – has a long history. It is undoubtedly the case that both the new RAE methodology and the HEFCE funding logic denoted a shift in direction: selectivity was maintained but concentration was not to be protected.

7. The weightings associated with the different RAE scores have now been changed (announced in December 2009 to apply to funding from 2010-11), and the new weightings provide for greater relative reward for high RAE scores. The effects of these changes are demonstrated and discussed below. Briefly, they have the effect of significantly increasing the concentration of funding in favour of the "Golden Triangle" of the five top performing institutions² at the expense of most of the rest of the sector.

8. Can it reasonably be argued that a change in resource distribution might affect the performance of the UK national research base? History provides some pointers. In 1986, selectivity in the distribution of HE research funds changed

² Oxford, Cambridge, Imperial, the London School of Economics and University College London.

from an underlying principle to an overt methodology. Research was to be funded differentially, based on quality wherever it was located, but this selectivity was to be exercised at roughly the level of the discipline or department. There was no overt policy to concentrate research funding at institution level. However, because a relatively small number of universities contained a large number of units judged to do outstanding research, the policy of selectivity had as a consequence the concentration of research funds in these universities. Around the same period, the UK's comparative international research impact changed trajectory from a downward to an upward gradient, and then continued a sustained rise against growing competition. There is a plausible argument suggesting causation as well as correlation in this relationship, but whether it was the policy of selective funding that underpinned this improvement or the consequential concentration of research funding is not known. The latter seems unlikely, but cannot be discounted.

9. A policy change today might, by extension of the argument, affect the ability of the present system to maintain that competitiveness. The management problem is that the system is complex and zero-sum funding pots create multiple interdependencies. Each correction produces new risks and challenges. Thus, the announcement in January 2010 that the funding formula used in England would indeed be adjusted to increase the degree of selectivity appeared to benefit the excellent, but at the expense of the good. The anticipated gains and losses were not described.

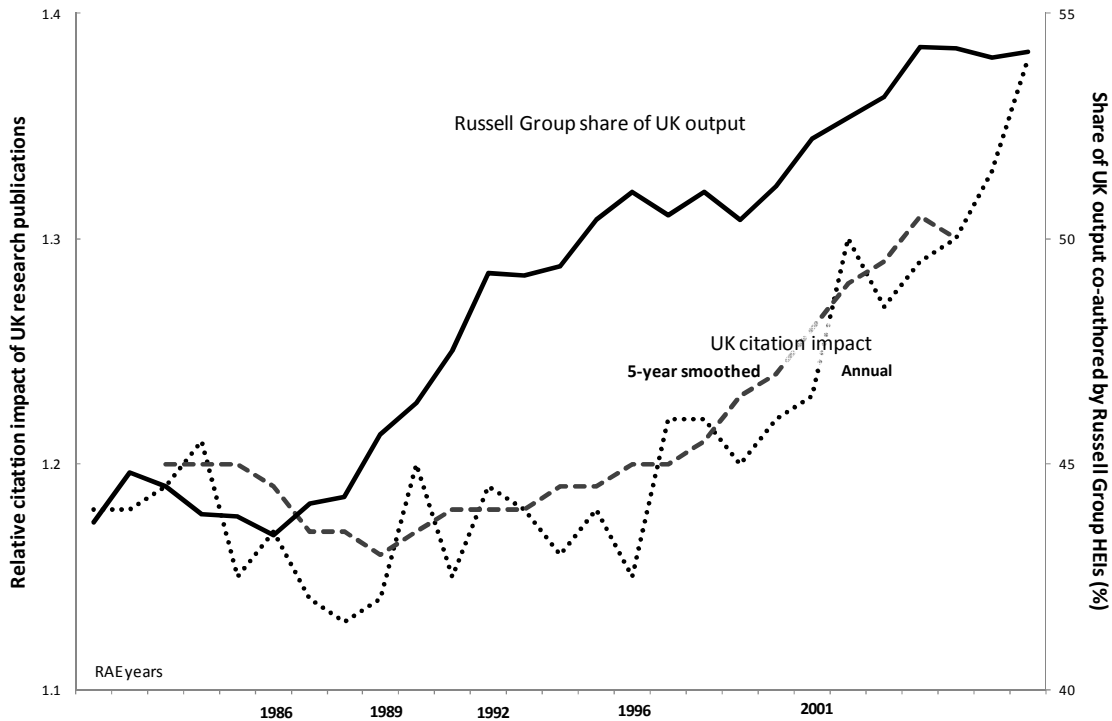
The competitiveness of the UK research base

10. To understand better the system, and the effect of change, we need to establish where we currently stand, so that we can monitor change and so that any debate can be based on firm evidence. In this report two questions are explored. One can be answered with numbers: how concentrated is the UK research base in terms of broadly-defined criteria for international excellence? The other is one on which we can only speculate: given the pattern on the ground, what consequences arise from changes in policy?

11. The citation counts in Thomson Reuters' databases provide the proxy for excellence used in this report. They do not of course directly measure excellence, nor are they an infallible measure of excellence. And they are a much more powerful tool in the STEM subjects – where publication in influential journals is the most common means of scholarly communication – than in the humanities and (to a lesser extent) the social sciences. But in general citations are widely regarded as a reasonable approximation.

12. Is there any evidence that 25 years of overt selectivity, and the consequent concentration of research funding, has had an effect on international competitiveness? Citation counts provide evidence of an improvement in the UK's position over the period, which we can compare with the changing level of research concentration within the HE sector.

Figure 1: The relative³ citation impact of the UK research base (1981-2007)



13. Figure 1 shows the relative citation impact of the UK research base as annual figures and as five-year moving windows (dotted and dashed lines – left-hand axis); the RAE years are indicated. Plotted on the same time frame is the share of UK journal outputs (including articles, reviews and other material) that had at least one author from one of the Russell Group institutions (continuous line – right-hand axis). Figure 1 shows that in the early 1980s UK research impact was in the doldrums or in real decline compared to the rest of the world. From the late 1980s, there was a change in trajectory and a gradual increase in relative impact that accelerated into the late 1990s. Whether this should be accounted a consequence of the introduction of the RAE or simply a correlative outcome of the policy and management environment in which the RAE has operated is open to debate, as we noted. And even if it were the consequence of the introduction of the RAE – which seems reasonable to conclude – whether this outcome was the consequence of selectivity in funding or the concentration of research resources in a relatively small number of universities is another question.

³ Relative means relative to world average. 1.0 means world average, and anything above that is above and anything below that below world average.

14. The distribution of activity changed over the same period. Prior to the RAE, the share of publications co-authored by the Russell Group was static, perhaps declining, but it took off in 1986 and grew sharply to 1992, continuing on a steady but still markedly upward path to 2005. A separate analysis of the golden triangle institutions shows a concurrent concentration increase within the Russell Group, with a rising golden triangle share between 1981 (about 40 per cent of Russell Group) and 1996 (about 44 per cent of Russell Group).

Analysing the recent spread of citation impact

15. The UK higher education research base produced 306,661 research articles and reviews in the five year period 2002-2006. Of these, 204,307 (about two-thirds) had at least one author from an institution in the Russell Group. And of these, some 87,157 items (about 43 per cent of the Russell Group) had at least one author from one of the five golden triangle institutions. Over the same period there were 58,083 papers associated with the 1994 Group and 69,756 papers with authors from other HEIs.

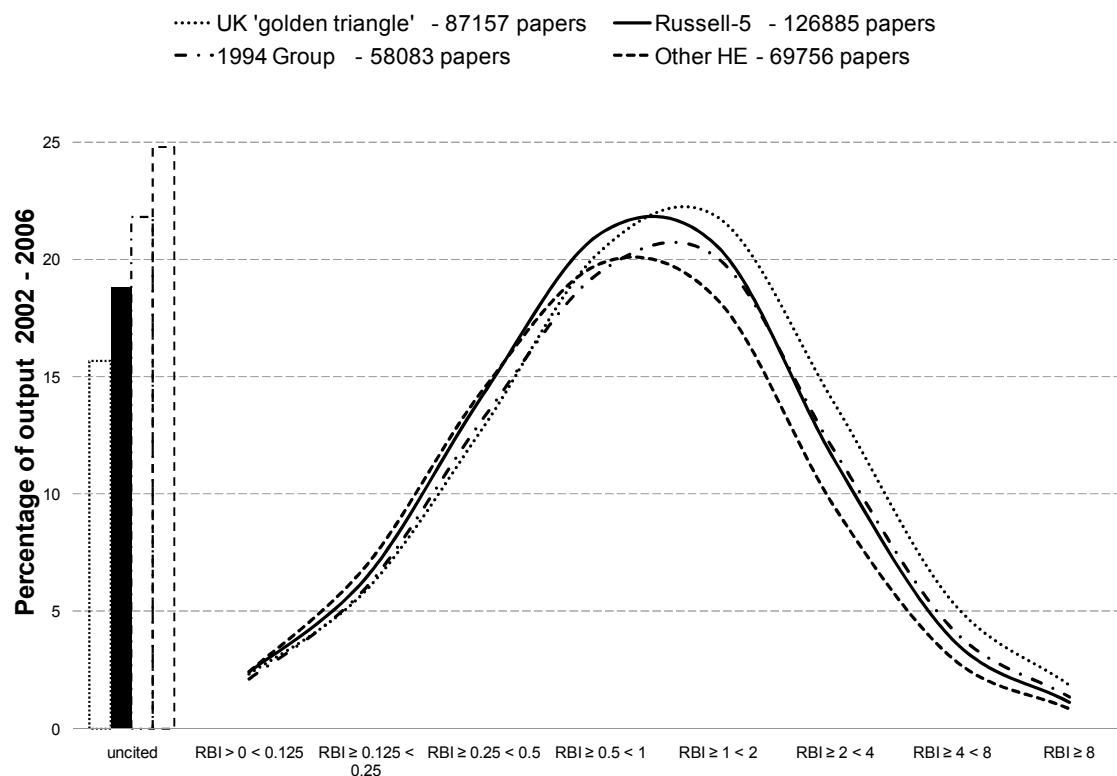
16. So, there is some degree of concentration of excellence. More than two-fifths of the output of twenty large institutions has a co-author from just five – by no means all among the largest – and those twenty themselves can claim a share in two-thirds of the output of more than 100 research active HE organisations.

17. Quantity is nothing without quality. We have looked at the distribution of more and less well cited – that is to say higher or lower impact – papers within institutions. This analyses the spread of the output that is contributing to the highest levels of excellence, not the average. Graphical profiles make the naturally skewed distribution of citation data more accessible by sorting the data into 'bins' relative to the world average.

18. The distribution of more or less frequently cited papers across the UK research base and its compartments is shown in Figure 2 below. This and subsequent analyses look separately at the performance of the golden triangle institutions, the rest of the Russell Group without the golden triangle (RG-5), the 1994 Group and the remainder of the sector.⁴

⁴ Note that our analyses are inclusive. That is to say, unless otherwise stated, the 1994 Group includes all activity linked to the group whether solely attributable to them or collaborative with others. RG-5 removes activity attributable solely to the golden triangle, but golden triangle papers co-authored with other Russell Group members are retained.

Figure 2: The distribution of citation impact relative to world average for research publications by the UK higher education sector, 2002-2006



19. Impact indices have been calculated to account for citation variation by year and field of publication. Each curve shows the percentage of papers that fall into a particular impact category for that institutional group. The bottom axis shows the range of impact categories (RBI = 1.0 is the world average). Uncited papers are shown separately on the left while the most frequently cited papers are in the impact bins on the right, which are 4-8 and >8 times world average.

20. Figure 2 above shows that the Impact Profile®, the curve of excellence, is progressively shifted to the right, towards the high impact end, as we shift the grouping to the golden triangle from other institutions. In concordance with this, as the curve shifts left so the associated proportion of uncited papers rises.

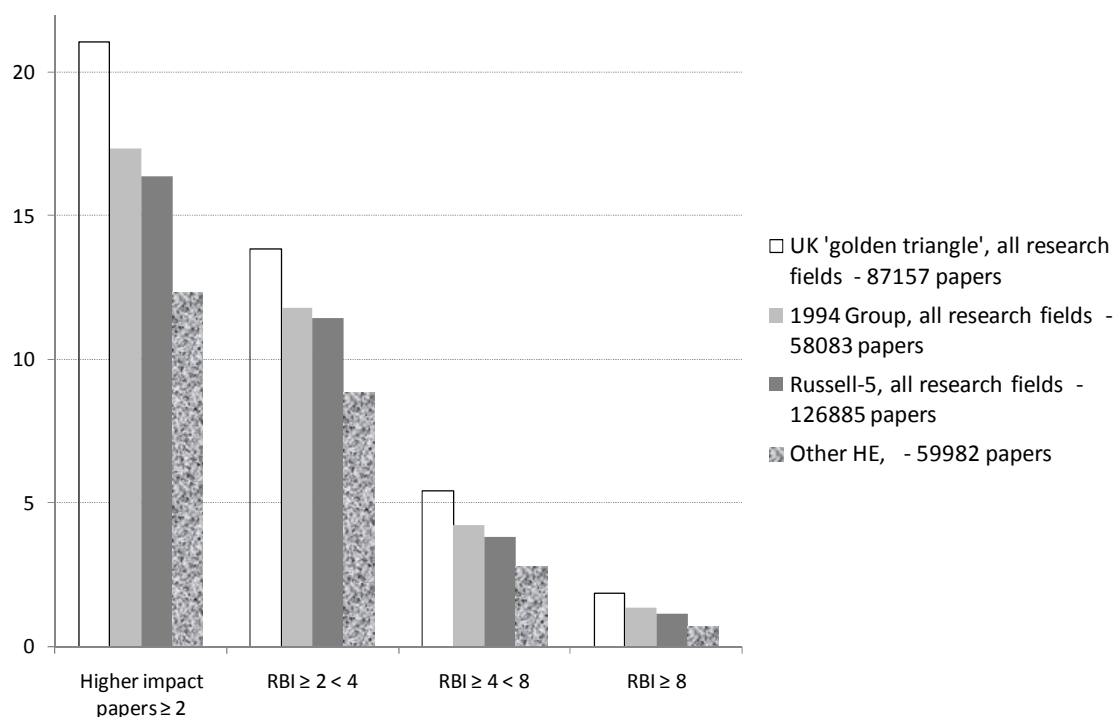
21. But the differences are not as great as might have been imagined, given the differences in the amount of funding. A substantial proportion (nearly half) of Russell Group output has impact below world average, and in the highest impact categories the percentage of RG-5 papers without a golden triangle co-author is less than for the 1994 Group curve. The overall performance of not just the Russell Group but of the entire UK research base is driven to a significant extent by the impact of papers from a small number of leading institutions.

22. The golden triangle institutions have a lower proportion of uncited papers than for the other groups, as well as a lower proportion of papers in all impact categories below world average and a higher proportion of papers across all impact categories above world average. It should not be thought that these golden triangle papers do not have other co-authors: many are collaborative with a network of HEIs and research organisations in the UK and overseas. But those papers by other (including Russell Group) institutions include golden triangle co-authors and yet their Impact Profile[®] is clearly left-shifted. Note also that, while the golden triangle sub-sample reflects excellent performance, not everything is exceptional since over 15 per cent of golden triangle research receives no citations at all. Nearly 20 per cent of RG-5 research is uncited, compared to about 25 per cent of the sector as a whole.

23. On the right of the figure are those impact categories above two times, above four times and above eight times world average. For the golden triangle institutions, some 7.24 per cent of output is in these categories, compared to 5.24 per cent of the UK HE research base overall and less than 4 per cent for 'other HEIs'. In numbers, the UK HE sector produced about 16,000 papers that exceeded the '4 times world' threshold impact over the five-year period and authorship of these is most concentrated. About 73 per cent had a Russell Group co-author and 39 per cent had a golden triangle co-author: more than half of the highly cited papers from the Russell Group had a golden triangle co-author compared to around two-fifths of the Russell Group's overall output.

24. Figure 3 below focuses on just these high end papers, summing everything with a greater impact than twice world average. The separation may not seem great but the overall extent to which the golden triangle exceeds others in its production of papers of relatively high impact is a major part of the UK's total research strength. Figure 3 shows, for example, that over 20 per cent of all research produced in golden triangle institutions has an impact over twice world average.

Figure 3. The distribution of publications in the higher impact categories above twice world average citation impact, by institutional grouping and in total



25. The peak of performance does not exist in isolation. We cannot truncate the spread of UK research activity and expect the rest to survive. But it is arguable that research with great academic impact is also likely to contribute to exceptional social and economic impact. If this argument is accepted, then it should also be noted that the very highest category of impact, above 8 times world average, represents less than 2 per cent of UK total output. Within this top slice of 3,715 papers, the five golden triangle institutions are co-authors on 1600 or around 43 per cent. Just the University of Cambridge alone counts as a co-author on 15 per cent of the UK total.

26. For the avoidance of doubt, if we drill down into the data, to various levels of discipline, then we find that the pattern is repeated. So, a high proportion of the UK's exceptional academic research is strongly associated with a relatively small number of institutions (Figures 2 and 3). Whatever the broader mapping of archipelagos of excellence, and the curve of relative excellence extends across the full range of categories for all institutional groups (Figure 2), as this concentration has grown there has been a correlated – if not consequential – change in the concentration and impact of the UK research base (Figure 1).

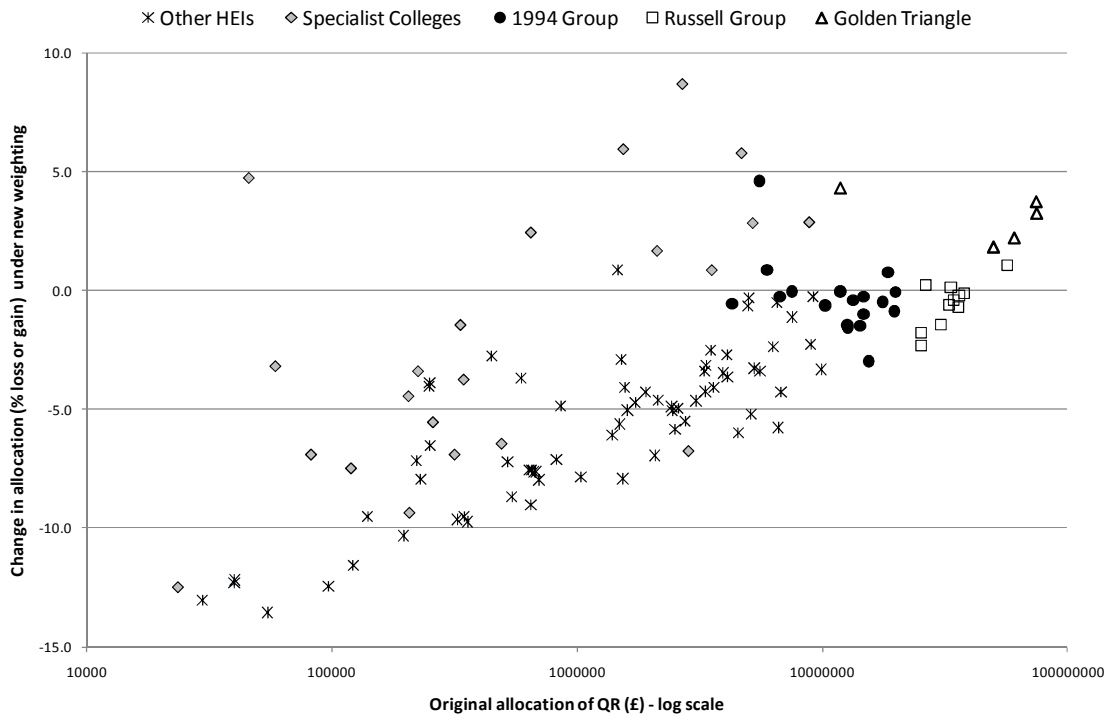
27. On the other hand, over 20 per cent of the UK's research output is uncited, and as much as 15 per cent of research done in the golden triangle institutions is uncited. It seems that a significant amount of the research done

even in golden triangle institutions might be considered to be not very good at all, and that the money provided for such research could be better – or at least as well – spent elsewhere. At the very least this suggests that care should be exercised in pursuing a general policy of increased concentration as distinct from selectivity based on merit. The evidence presented in this report confirms the outcomes of the RAE2008 profiling, that research quality is far more widely spread than might previously have been thought, and shows that much of the research produced in institutions where research funds have been concentrated is not of particularly high quality. Evaluation to stimulate institutional management to improve this balance must continue, and allocation by historical precedents will not do that.

Recent changes in selectivity

28. On 1 February 2010, HEFCE announced changes to its research funding formula for 2010. To correct the more dispersed allocations made post-RAE2008, it said that it would use revised weighting factors to shift the balance across 1*/2*/3*/4* units from 0/1/3/7 to 0/1/3/9, so increasing the concentration of resources towards the research with the highest impact. How will this affect funding at the institutional level and what consequences might arise?

Figure 4: The hypothetical gains and losses of QR funding that would have occurred had HEFCE’s 2010 corrections to grade-related weightings been applied to the 2009 HEI allocations



29. To illustrate this, we examined the implications for the different parts of the system of applying the 2010 funding formulae to the 2009 pot of money and (with the same grade weightings across subjects and institutions) and comparing that with the 2009 outcomes. The results are shown in Figure 4.

30. As might be expected, there is a shift of resources towards golden triangle institutions where the high impact captured in Figure 2 is reflected in a high density of 4* activity assessed by RAE peer review panels. But this is a fixed pot of resource, so from where is that increase in concentration drawn? It comes from a wide spread of institutions, as Figure 4 reveals.

31. Data are displayed to show where the sub-sector groupings described elsewhere in this report would fall in the overall spectrum. Note in Figure 4 that the horizontal axis is scaled logarithmically, so the absolute gains and losses to the right-hand institutions are much greater than to the left-hand.

32. The total budget is over £1 billion whilst we calculate that the total gains (or total losses) from the revised formula are more in the order of £10 million. Thus no more than 1 per cent of total research funding would have moved from some institutions and towards some others. The spread of different institutional groups in this graph is, however, clearly not even and this is as would be expected.

33. It must be understood that this is *not* the actual change in funding that institutions will actually see in 2010. That is because there is a general uplift to the system of about 2 per cent in cash (not real) terms, because the changes to weightings will be associated with some changes to subject pools and also because there are some other agreed changes to specific subjects. This analysis is simply a broad indication of what the 2009 allocations would have been like with a different formula. So, at an aggregate level, what would that scenario have looked like? Table 1 below shows the gains and losses for some of the broad sector groupings, and shows the extent to which the new formula will lead to gains for golden triangle institutions at the expense of the rest.

Table 1: The hypothetical gains and losses of QR funding that would have occurred had the 2010 formula been applied to the 2009 HEI allocations

Sub-sector group	Extent of hypothetical loss or gain
Golden Triangle	Gain = £7,953,000
Russell Group – 5	Loss = £1,483,000
1994 Group	Loss = £1,237,000
Specialist colleges (creative arts, business schools, medical, agricultural and veterinary)	Gain = £777,000
Other HE institutions	Loss = £6,011,000

Data are aggregated to the sub-sector groupings described elsewhere in this report.

34. In the last group, of other HEIs, only one of some 60 institutions actually benefits while the others would see larger or smaller losses compared to the funds they were actually allocated.

35. There are some marked gains for the specialist colleges (Figure 4, Table 1). This is to some extent driven by the relatively high proportion of 4* activity identified in those UoAs in which they were active at RAE2008. This shift in resources might now be seen as an unexpected and unintended consequence of that outcome, and might invoke some need for review and standardisation of criteria across broad subject areas.

36. To what extent are the new weightings a sufficient response to the need to protect the UK's peak of international competitiveness? Getting the concentration balance right is a challenge that policy makers are expected to anticipate and regulate in a timely fashion; managers are there to manage. The additional funds directed towards the golden triangle should be of value: they amount to 2-3 per cent of institutional core QR. But this is a small part of the total funding to those institutions and may have little evident impact. The change has been achieved at significant cost to other institutions where losses in some cases amount to more than 5 per cent, even 10 per cent, of institutional core QR. Entire sub-sectors will see this as a raid; some of those sub-sectors are contributing research of considerable value to the UK, as Figure 2 shows. Would an analysis of the relationship between input and likely outcomes confirm that the net losses will be outweighed by the net gains?

Conclusions and policy consequences

37. We have argued elsewhere that there would be a danger in over-concentration of the UK research base, and that it is healthy because of its regional structure and diversity. The peak of research is supported by a platform that feeds highly trained people, excellent ideas and corroborative data to the wider system. Ideas are explored, details are illuminated, regional industry is advised – and that allows enterprise to thrive. Moreover, it is apparent that there is good research throughout the system, and there is also modest – even poor – research in all types of institution.

38. Nonetheless, as described, the UK research base has been subject to a long period of selective funding allocations and a consequent concentration of research resources and activity. This has been accompanied by a simultaneous period of improvement in the UK's relative international impact, which should not be taken in any sense as a 'given'. There has been a huge rise in R&D expenditure in many jurisdictions as governments focus on the value of a 'knowledge economy'. The phenomenal research expansion of China is reflected in other parts of south-east Asia, in Brazil and increasingly in India. To maintain share in such a competitive environment would be a good achievement, and is one in which the USA has not succeeded: the USA's share was around 38-39 per cent of world output in the 1990s, fell to 34 per cent by 2000 and dropped

further to 31.5 per cent by 2007. The impact of its research (measured by citation analysis) showed a less dramatic but nonetheless evident decline. To have improved impact and increased its share of world research excellence, as the UK has done, is extraordinary.

39. The data in this report show that this exceptional achievement is in significant part the result of the outstanding performance of a very small number of individuals in an even smaller number of institutions. The majority of the research done in this country – throughout the sector, from the most exalted institutions to the least, and from those that have received the most research funds to the least – is very much more modest, although this would be true of a profile for any other country.

40. Although after the 2008 RAE, funding was more widely spread, in recognition of the fact that research excellence was found to be widely spread, the new arrangements due to be implemented from 2010-11 will have the effect of focusing funding even more on the very small number of institutions with a concentration of truly outstanding international excellence in research, and at the expense of the generality of universities, including those that have traditionally received the most research funds. That would be consistent with the evidence in this report that suggests that there may be an argument for more selective funding to the rare peaks of internationally outstanding excellence; and of course funding for expensive, specialised and shared facilities needs separately to be considered. That is a real dilemma for policy makers. What seems clear, though, is that there is no case for a general and wider policy to concentrate funding based on historical characteristics.

41. It is highly desirable that the checks and balances that have allowed the system to continue to bear fruit over a century of growth and fluctuating resource levels should continue. Policy through the 1990s has not just maintained this balance but has sustained the UK research base against increasingly challenging and well-funded competition. The present level of concentration – however it has evolved – supports research that gains global recognition. We disrupt it at our peril and we should expect to see sound analysis underpinning any change in policy or practice. It remains to be seen whether recent policy perturbations will deliver the most effective outcome for UK research competitiveness.