

REF 2021 Value for Money Metrics

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Executive Summary

Value for money is always important, but particularly so in times of increasing financial strain across the UK in general and the Higher Education sector in particular. This report presents the results of a value for money assessment using the public domain outputs of REF 2021, the UK Research Excellence Framework. The public domain data includes both output measures and also information on the income that generated this research, thus the basis for a value-for-money assessment.

The analysis was carried out for the Computer Science and Informatics area (SP11 of REF). This is an area that is dependent on financial input but where there are few major equipment expenses which might unduly skew the results; so, it is likely to give a good indication of trends across REF areas, especially in science and technology.

REF has multi-faceted outcome measures, so several forms of summary metric were used and value for money calculated for each. The results of all follow a roughly similar pattern. If ranked by raw outcome measure the top institutions were well known leaders (Imperial, Oxford, etc.), with post-1992 institutions at the tail of the league table. However, when a value for money measure is used the situation is fully or largely reversed, with post-1992 institutions on the whole offering the best value for money in terms of REF measures of research output per pound of investment. The value for money differences between top and bottom of the tables are quite large, between ten and thirty to one depending on the precise measure. These results are in accord with an earlier HEFCE value-for-money study in the late 1990s and analysis of NSERC funding in Canada in 2013.

As with any data analysis, the results should be treated with caution taking into account other contextual factors, but the general lesson is clear. While the 'obvious customers' do produce the greatest volume of high-quality research, it appears that funding directed towards these high-achieving institutions is beyond the point of diminishing returns. Channelling more funding towards traditionally less research-intensive parts of the sector could achieve greater quality research for the country as a whole.

Furthermore, a better understanding of the factors that determine how these lower-ranked institutions achieve such good results with limited income may help improve research outcomes across the whole sector.

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1. Introduction

This report outlines an initial exercise using public domain REF 2021 data to perform a value-for-money assessment of UoA11 (Computing and Informatics) submissions.

REF created results as a series of quality profiles (4* to 1*) against three areas: Outputs, Impact and Environment. There are various ways one can combine these to produce a single quality metric and three are presented here: overall GPA (weighting 4*,3*,2*,1* by 4,3,2,1 respectively), overall 'QR formula' (4* and 3* weighted 4:1 with 2* and below zero weighted [RE23, p.15]), and 4* *outputs only* (largely published papers, which some academics would regard as the gold standard). In all cases the league tables are partially or completely reversed with far higher value-for-money evident in what would normally be regarded as lower-ranking research institutions.

The analysis could be performed on any UoA, and computing was chosen for this initial analysis in large part because it is the author's discipline. However, it is probably also a good general indicator of trends as computing research is often money intensive, so one expects funding to lead to outputs, but largely in terms of people rather than large equipment (as in Physics), so less variable across different sub-areas of the discipline.

This report first describes some of the background that led to the analysis (section 2); followed by details on how the data was obtained and processed (section 3); the results (section 4); and final discussion (section 5).

It should be noted that the various 'league tables' produced by this should not be taken as an assessment of any individual institution as there are individual factors that affect the precise mapping between income and outputs that can skew results. However, the overall trends do seem robust and mirror analysis of NSERC in Canada, which found diminishing returns of funding [FC13].

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2. Background

In the late 1990s HEFCE commissioned a study of university outcome metrics, maybe this was as an exercise to see if this could be used as an alternative to the more costly Research Assessment Exercises, or possibly produced as part of the process that led to the Dearing Report [De97]. I've not been able to trace this study (if you have any information please let me know), but from memory the spreadsheet of results had columns for three output metrics: total number of publications, total number of successful PhDs, and industrial income. The last of these was considered 'output' as it was effectively a measure of esteem/respect by industrial partners. These three measures were combined into a single research outcome metric. When ordered using this metric, Oxford, Cambridge and other unsurprising universities came at the top of the league table.

However, the spreadsheet had a column for the funding provided by HEFCE and a ‘value for money’ column that divided the research outcome metric by the money input. If ordered by this value-for-money metric, a different story emerged. This time Oxford and Cambridge were at the bottom of the league table, and the winner, the university with the best research value for money, was Northampton.

Of course, the metrics used were crude and it could be argued that not all publications, nor all PhDs are equally good and that with a metric that more clearly represented quality outcomes, the value-for-money table might look very different. Certainly, maybe because it did not give the ‘right’ answers, it was quickly forgotten!

Roll on more than fifteen years and I had been a member of the REF 2021 computing sub-panel. In January 2015, after the exercise was complete, the REF organisation ran a number of feedback sessions for panel members that included focus-groups facilitated by the RANK Organisation. The event that I attended had several hundred attendees and the day ended with a panel session where the panellists included some overall REF Panel chairs, heads of funding bodies, etc.

Something in what one of the panellists said reminded me of the 1990s report, and so during the Q&A session I asked whether there were any plans to revisit this value-for-money exercise, but using the more reliable REF metrics. The answer was “No” – this was not so much a direct refusal, and without any arguments against doing it, more complete disinterest in the issue.

After the results were out the Metrics Tide report [WA15] was published using the detailed scoring data (which was then destroyed) and I did my own analysis of UoA11 using the publicly available data. As REF assessors we had access to data about the grant income of each of the institutional UoAs we were assessing, and this was used as part of the assessment of research environment (i.e. as a form of output measure). Nearly all the raw data that we had as assessors (but not the scores) was made available in the public domain after the exercise was complete, but one notable absence was this financial data. I’m not sure of the reason for this, possibly this was because the data was obtained from HESA, which charges for data retrieval, and REF had not paid for public use. It would have been possible to do a HESA request for the data, but it would have been costly, so I was not able to supplement my bias analysis with a value for money one [Dx15a, Dx15b, Dx16].

Roll on another ten years and while preparing a session recommending that people make use of the rich submission information available on the REF website, I realised that the REF2021 public domain data includes grant funding income. This has now made it possible to perform independent value-for-money assessment based on public domain data.

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### 3. Procedure for Analysing REF Value for Money

All raw data was obtained from the REF2021 results and submissions database for UoA11, Computer Science and Informatics [REF21a] and the REF2021 – Results and submissions – Environment submissions database [REF21b]. Full details of this procedure can be found in Appendix A.

Two of the downloadable CSV files were used. One has four rows for each institution listing a profile of 4\*,3\*, 2\*, 1\* and unclassified results for Overall, Outputs, Impact and Environments (Fig. 1). The other has fifteen rows for each institution listing various types of income source (excluding QR) and an overall total over different year ranges (Fig. 2). There is also an income-in-kind spreadsheet, but this appears very partial and has not been used for this analysis.

| si | Profile     | FTE of submitted staff | FTE of submitted staff for joint subm | % of eligible staff submitt | Percentage of the submission meeting the standard for: |      |      |     |            |
|----|-------------|------------------------|---------------------------------------|-----------------------------|--------------------------------------------------------|------|------|-----|------------|
|    |             |                        |                                       |                             | 4*                                                     | 3*   | 2*   | 1*  | Unclassifi |
|    | Overall     | 15.50                  |                                       | 100                         | 28                                                     | 64   | 8    | 0   | 0          |
|    | Outputs     | 15.50                  |                                       | 100                         | 35.9                                                   | 53.8 | 10.3 | 0.0 | 0.0        |
|    | Impact      | 15.50                  |                                       | 100                         | 25.0                                                   | 75.0 | 0.0  | 0.0 | 0.0        |
|    | Environment | 15.50                  |                                       | 100                         | 0.0                                                    | 87.5 | 12.5 | 0.0 | 0.0        |

Fig 1. Results spreadsheet detail (example entry, University of Aberdeen)

| Income source                                           | Income for academic year 2013 | Income for academic year 2014 | Average income for academic years 2015-16 to 2019 | Average income for academic years 2013-14 to 2019 | Total income for academic years 2013-14 to 2019 |
|---------------------------------------------------------|-------------------------------|-------------------------------|---------------------------------------------------|---------------------------------------------------|-------------------------------------------------|
| BEIS Research Councils, The Royal Society, British Acac | 3,413,128                     | 1,944,316                     | 658,227                                           | 1,235,511                                         | 8,648,580                                       |
| UK-based charities (open competitive process)           | 498                           | 0                             | 16,614                                            | 11,938                                            | 83,569                                          |
| UK-based charities (other)                              | 12,268                        | 48,957                        | 8,504                                             | 14,821                                            | 103,747                                         |
| UK central government bodies/local authorities, healt   | 6,007                         | 11,095                        | 82,858                                            | 61,627                                            | 431,395                                         |
| UK central government tax credits for research and dev  | 0                             | 89,000                        | 29,000                                            | 33,428                                            | 234,000                                         |
| UK industry, commerce and public corporations           | 605,686                       | 343,792                       | 174,662                                           | 260,398                                           | 1,822,788                                       |
| UK other sources                                        | 9,426                         | 3,092                         | 1,101                                             | 2,575                                             | 18,025                                          |
| EU government bodies                                    | 468,650                       | 329,390                       | 49,895                                            | 149,645                                           | 1,047,517                                       |
| EU-based charities (open competitive process)           | 0                             | 0                             | 0                                                 | 0                                                 | 0                                               |
| EU industry, commerce and public corporations           | 0                             | 0                             | 0                                                 | 0                                                 | 0                                               |
| EU (excluding UK) other                                 | 0                             | 0                             | 0                                                 | 0                                                 | 0                                               |
| Non-EU-based charities (open competitive process)       | 12,215                        | 0                             | 0                                                 | 1,745                                             | 12,215                                          |
| Non-EU industry commerce and public corporations        | 190,473                       | 219,784                       | 54,373                                            | 97,446                                            | 682,124                                         |
| Non-EU other                                            | 0                             | 0                             | 0                                                 | 0                                                 | 0                                               |
| Total income                                            | 4,718,351                     | 2,989,426                     | 1,075,236                                         | 1,869,137                                         | 13,083,960                                      |

Fig 2. Income spreadsheet detail (example entry, University of Aberdeen)

These CSV files were combined using bespoke code to create a single JSON file and then an extract of this used to create a summary spreadsheet (Fig. 3), which was used for subsequent analysis. The summary spreadsheet has one row per institution including all of the profiles and three of the income figures. This analysis only used the total income from all sources as there were so many subcategories. It would be possible to repeat the analysis focusing on specific categories, for example UKRI income. The summary spreadsheet includes the figures for ‘average income for academic years 2015-16 to 2019-20’, ‘average income for academic years 2013-14 to 2019-20’ and ‘total income for academic years 2013-14 to 2019-20’, but only the last was used in the value for money calculations as the three figures correlate strongly.



|    | A                                                  | B                                        | C                | D               | E                | F               | AD                  | AE                 | AF                | AG               | AH                | AI |
|----|----------------------------------------------------|------------------------------------------|------------------|-----------------|------------------|-----------------|---------------------|--------------------|-------------------|------------------|-------------------|----|
| 1  | <b>REF 2021 UoA 11 Value for Money – GPA Based</b> |                                          |                  |                 |                  |                 |                     |                    |                   |                  |                   |    |
| 2  |                                                    |                                          |                  |                 |                  |                 |                     |                    |                   |                  |                   |    |
| 3  |                                                    |                                          |                  |                 |                  |                 |                     |                    |                   |                  |                   |    |
| 4  |                                                    |                                          |                  |                 |                  |                 |                     |                    |                   |                  |                   |    |
|    | <b>institution ul</b>                              | <b>institution name</b>                  | <b>Staffing</b>  |                 |                  | <b>GPA</b>      |                     |                    |                   |                  |                   |    |
|    |                                                    |                                          | <b>instituti</b> | <b>fte of s</b> | <b>total fte</b> | <b>% of eli</b> | <b>total income</b> | <b>GPA overall</b> | <b>GPA output</b> | <b>GPA impac</b> | <b>GPA enviro</b> |    |
| 5  | 10003270                                           | Imperial College of Science, Technology  | 64               | 58.45           | 100              | 106,041,759     | 3.93                | 3.884              | 4                 | 4                |                   |    |
| 6  | 10007774                                           | University of Oxford                     | 100              | 73.65           | 100              | 74,770,490      | 3.81                | 3.826              | 3.667             | 4                |                   |    |
| 7  | 10006840                                           | The University of Birmingham             | 14               | 42.7            | 100              | 20,885,858      | 3.77                | 3.654              | 4                 | 3.875            |                   |    |
| 8  | 10007163                                           | The University of Warwick                | 149              | 41.6            | 100              | 15,756,156      | 3.75                | 3.782              | 3.75              | 3.625            |                   |    |
| 9  | 10007784                                           | University College London                | 146              | 100.2           | 100              | 84,832,545      | 3.75                | 3.693              | 3.813             | 3.875            |                   |    |
| 10 | 10007790                                           | University of Edinburgh                  | 44               | 144             | 100              | 157,949,798     | 3.73                | 3.547              | 4                 | 4                |                   |    |
| 11 | 10007786                                           | University of Bristol                    | 21               | 59.15           | 100              | 38,967,825      | 3.68                | 3.574              | 3.9               | 3.75             |                   |    |
| 12 | 10007775                                           | Queen Mary University of London          | 105              | 68.8            | 100              | 49,769,508      | 3.65                | 3.547              | 4                 | 3.5              |                   |    |
| 13 | 10007167                                           | University of York                       | 157              | 44.4            | 100              | 26,019,405      | 3.62                | 3.495              | 3.75              | 3.875            |                   |    |
| 86 | 10003861                                           | Leeds Beckett University                 | 74               | 10.8            | 35               | 1,650,026       | 2.46                | 2.667              | 2.75              | 1.125            |                   |    |
| 87 | 10007762                                           | Glasgow Caledonian University            | 50               | 14              | 25               | 1,467,613       | 2.42                | 2.6                | 2.5               | 1.5              |                   |    |
| 88 | 10003956                                           | Liverpool Hope University                | 79               | 13.5            | 100              | 81,000          | 2.37                | 2.883              | 1.75              | 1.375            |                   |    |
| 89 | 10006566                                           | The University of West London            | 150              | 9.8             | 70               | 497,334         | 2.28                | 3                  | 1                 | 1.5              |                   |    |
| 90 | 10007848                                           | University of Chester                    | 30               | 7.6             | 50               | 485,253         | 2.23                | 2.526              | 2.25              | 1                |                   |    |
| 91 | 10007152                                           | University of Bedfordshire               | 12               | 10              | 45               | 3,954,613       | 2.2                 | 2.24               | 2.5               | 1.5              |                   |    |
| 92 | 10007166                                           | University of Wolverhampton              | 155              | 11              | 35               | 615,728         | 2.01                | 2.465              | 1.25              | 1.5              |                   |    |
| 93 | 10004048                                           | London Metropolitan University           | 83               | 9.3             | 100              | 980,000         | 1.9                 | 2.565              | 0.5               | 1.5              |                   |    |
| 94 | 10007833                                           | Wrexham Glynd_r University / Prifysgol G | 53               | 3.5             | 30               | -46,000         | 1.67                | 1.778              | 2                 | 0.75             |                   |    |

Fig 4. Ordered by GPA value (column AF)

However, if we reorder by the value for money criterion (Fig. 5), a completely different picture emerges. Now Liverpool Hope and UCLAN lead the table as giving the best GPA per pound of research investment. Notably, while some are based on small submissions, so could be argued to be subject to noise, others, notably Northumbria, have a substantial submission. Birkbeck is the only pre-1992 institution in the top ten (Loughborough is next at slot 13).

|    | A                                                  | B                                        | C                | D               | E                | F               | AD                  | AE                 | AF                 | AG                                 | AH                | AI                 | AI                | AP                | AQ                | AR | AS | AT |
|----|----------------------------------------------------|------------------------------------------|------------------|-----------------|------------------|-----------------|---------------------|--------------------|--------------------|------------------------------------|-------------------|--------------------|-------------------|-------------------|-------------------|----|----|----|
| 1  | <b>REF 2021 UoA 11 Value for Money – GPA Based</b> |                                          |                  |                 |                  |                 |                     |                    |                    |                                    |                   |                    |                   |                   |                   |    |    |    |
| 2  |                                                    |                                          |                  |                 |                  |                 |                     |                    |                    |                                    |                   |                    |                   |                   |                   |    |    |    |
| 3  |                                                    |                                          |                  |                 |                  |                 |                     |                    |                    |                                    |                   |                    |                   |                   |                   |    |    |    |
| 4  |                                                    |                                          |                  |                 |                  |                 |                     |                    |                    |                                    |                   |                    |                   |                   |                   |    |    |    |
|    | <b>institution ul</b>                              | <b>institution name</b>                  | <b>Staffing</b>  |                 |                  | <b>GPA</b>      |                     |                    |                    | <b>Value for money (1000/cost)</b> |                   |                    |                   |                   |                   |    |    |    |
|    |                                                    |                                          | <b>instituti</b> | <b>fte of s</b> | <b>total fte</b> | <b>% of eli</b> | <b>total income</b> | <b>GPA overall</b> | <b>GPA outputs</b> | <b>GPA impact</b>                  | <b>GPA enviro</b> | <b>VIM/overall</b> | <b>VIM/output</b> | <b>VIM/impact</b> | <b>VIM/enviro</b> |    |    |    |
| 5  | 10003956                                           | Liverpool Hope University                | 79               | 13.5            | 100              | 81,000          | 2.37                | 2.883              | 1.75               | 1.375                              |                   | 395                | 480.5             | 291.666667        | 229.166667        |    |    |    |
| 6  | 10007141                                           | University of Central Lancashire         | 29               | 14              | 55               | 530,131         | 2.5                 | 2.734              | 2.5                | 1.5                                |                   | 66.0214173         | 72.201022         | 66.0214173        | 39.6128504        |    |    |    |
| 7  | 10001282                                           | University of Northumbria at Newcastle   | 95               | 64.41           | 90               | 3,382,680       | 2.81                | 2.993              | 2.5                | 2.625                              |                   | 53.5055341         | 56.9900582        | 47.6027883        | 49.9829277        |    |    |    |
| 8  | 10007760                                           | Birkbeck College                         | 13               | 25.6            | 100              | 1,692,167       | 3.41                | 3.517              | 3.667              | 2.5                                |                   | 51.5882889         | 53.2070416        | 55.4763212        | 37.8213261        |    |    |    |
| 9  | 10007823                                           | Edge Hill University                     | 43               | 19              | 95               | 1,012,495       | 2.5                 | 2.896              | 2                  | 1.75                               |                   | 46.9138119         | 54.3449597        | 37.5310495        | 32.8396683        |    |    |    |
| 10 | 10006566                                           | The University of West London            | 150              | 9.8             | 70               | 497,334         | 2.28                | 3                  | 1                  | 1.5                                |                   | 44.9275537         | 59.1152023        | 19.7050674        | 29.5576011        |    |    |    |
| 11 | 10007851                                           | University of Derby                      | 38               | 17              | 50               | 970,000         | 2.48                | 2.814              | 2.25               | 1.5                                |                   | 43.4639175         | 49.3175258        | 39.4329897        | 26.2886598        |    |    |    |
| 12 | 10007140                                           | Birmingham City University               | 15               | 30              | 35               | 1,928,000       | 2.51                | 2.827              | 2.168              | 1.75                               |                   | 39.0560166         | 43.9885892        | 33.7344398        | 27.2302905        |    |    |    |
| 13 | 10007148                                           | The University of Huddersfield           | 62               | 27.2            | 85               | 2,002,821       | 2.74                | 2.868              | 3                  | 1.75                               |                   | 37.2115132         | 38.9498612        | 40.7425327        | 23.7664774        |    |    |    |
| 86 | 10007784                                           | University College London                | 146              | 100.2           | 100              | 84,832,545      | 3.75                | 3.693              | 3.813              | 3.875                              |                   | 4.42931424         | 4.36198867        | 4.50372672        | 4.57695805        |    |    |    |
| 87 | 10007852                                           | University of Dundee                     | 39               | 13.5            | 100              | 11,452,544      | 3.38                | 3.4                | 3.5                | 3.125                              |                   | 3.9842676          | 4.00784315        | 4.12572089        | 3.68367936        |    |    |    |
| 88 | 10007158                                           | University of Southampton                | 127              | 47.26           | 100              | 43,155,267      | 3.59                | 3.322              | 4                  | 4                                  |                   | 3.9314645          | 3.63797355        | 4.38046183        | 4.38046183        |    |    |    |
| 89 | 10007783                                           | University of Aberdeen                   | 1                | 15.5            | 100              | 13,083,960      | 3.2                 | 3.256              | 3.25               | 2.875                              |                   | 3.79090123         | 3.857242          | 3.85013406        | 3.40588782        |    |    |    |
| 90 | 10007774                                           | University of Oxford                     | 100              | 73.65           | 100              | 74,770,490      | 3.81                | 3.826              | 3.667              | 4                                  |                   | 3.75290439         | 3.7666462         | 3.61204735        | 3.64774129        |    |    |    |
| 91 | 10007790                                           | University of Edinburgh                  | 44               | 144             | 100              | 157,949,798     | 3.73                | 3.547              | 4                  | 4                                  |                   | 3.40151875         | 3.23463459        | 3.64774129        | 3.64774129        |    |    |    |
| 92 | 10007798                                           | The University of Manchester             | 88               | 53.1            | 100              | 58,440,853      | 3.61                | 3.466              | 3.7                | 4                                  |                   | 3.28008559         | 3.14924561        | 3.36186058        | 3.63444387        |    |    |    |
| 93 | 10003270                                           | Imperial College of Science, Technology  | 64               | 58.45           | 100              | 106,041,759     | 3.93                | 3.884              | 4                  | 4                                  |                   | 2.16620794         | 2.14085283        | 2.20479179        | 2.20479179        |    |    |    |
| 94 | 10007833                                           | Wrexham Glynd_r University / Prifysgol G | 53               | 3.5             | 30               | -46,000         | 1.67                | 1.778              | 2                  | 0.75                               |                   | -127.06522         | -135.28261        | -152.17391        | -57.065217        |    |    |    |

Fig 5. Ordered by GPA value for money (column AP)

The bottom of the table is now almost a complete reverse of the raw GPA ordering with Imperial, Manchester, Edinburgh and Oxford at the tail. Wrexham is an outlier as it recorded negative research income for the period, so while it is included in Figure 5 for completeness and transparency, it should be disregarded for most purposes.

Note too that the value for money ratio between the top and low end of the table (ignoring Liverpool Hope as it is another outlier) is 30:1, that is it costs twenty to thirty times more to get a similar ‘GPA worth’ of output at universities such as Imperial or Manchester compared to those such as UCLAN or Northumbria.

The exact figures for each individual institution should not be read too precisely as there are many local factors that need to be taken into account. However, the overall pattern is clear with institutions that would normally (and largely rightly) be regarded as the front runners in terms of

overall research quality faring far less well in terms of value for money compared with those that would be regarded as far lower in terms of research esteem.

### 4.2 Overall QR-formula based orderings

The results for using the QR-formula follow a roughly similar pattern with expected institutions (Imperial, Oxford, Birmingham) leading the raw value table (Fig. 6), and post-1992 institutions (London Met, Wolverhampton, Wrexham) at the bottom.

|    | A                                                         | B                                        | C                | D               | E                | F               | AD                  | AE                | AF                | AG               | AH                | AI |
|----|-----------------------------------------------------------|------------------------------------------|------------------|-----------------|------------------|-----------------|---------------------|-------------------|-------------------|------------------|-------------------|----|
| 1  | <b>REF 2021 UoA 11 Value for Money – QR Formula Based</b> |                                          |                  |                 |                  |                 |                     |                   |                   |                  |                   |    |
| 2  |                                                           |                                          |                  |                 |                  |                 |                     |                   |                   |                  |                   |    |
| 3  |                                                           |                                          | <b>Staffing</b>  |                 |                  |                 | <b>QR measure</b>   |                   |                   |                  |                   |    |
| 4  | <b>institution ul</b>                                     | <b>institution name</b>                  | <b>instituti</b> | <b>fte of s</b> | <b>total fte</b> | <b>% of eli</b> | <b>total income</b> | <b>QR overall</b> | <b>QR outputs</b> | <b>QR impact</b> | <b>QR environ</b> |    |
| 5  | 10003270                                                  | Imperial College of Science, Technology  | 64               | 58.45           | 100              | 106,041,759     | 7.58                | 7.30              | 8.00              | 8.00             |                   |    |
| 6  | 10007774                                                  | University of Oxford                     | 100              | 73.65           | 100              | 74,770,490      | 6.86                | 6.96              | 6.00              | 8.00             |                   |    |
| 7  | 10006840                                                  | The University of Birmingham             | 14               | 42.7            | 100              | 20,885,858      | 6.62                | 5.92              | 8.00              | 7.25             |                   |    |
| 8  | 10007784                                                  | University College London                | 146              | 100.2           | 100              | 84,832,545      | 6.58                | 6.29              | 6.88              | 7.25             |                   |    |
| 9  | 10007163                                                  | The University of Warwick                | 149              | 41.6            | 100              | 15,756,156      | 6.54                | 6.74              | 6.50              | 5.75             |                   |    |
| 10 | 10007790                                                  | University of Edinburgh                  | 44               | 144             | 100              | 157,949,798     | 6.50                | 5.53              | 8.00              | 8.00             |                   |    |
| 11 | 10007788                                                  | University of Cambridge                  | 25               | 80.8            | 105              | 62,257,529      | 6.26                | 5.58              | 6.86              | 8.00             |                   |    |
| 12 | 10007786                                                  | University of Bristol                    | 21               | 59.15           | 100              | 38,967,825      | 6.08                | 5.44              | 7.40              | 6.50             |                   |    |
| 13 | 10007775                                                  | Queen Mary University of London          | 105              | 68.8            | 100              | 49,769,508      | 5.94                | 5.35              | 8.00              | 5.00             |                   |    |
| 86 | 10005500                                                  | Robert Gordon University                 | 109              | 10              | 30               | 4,668,217       | 1.28                | 1.60              | 1.00              | 0.50             |                   |    |
| 87 | 10007851                                                  | University of Derby                      | 38               | 17              | 50               | 970,000         | 1.26                | 1.91              | 0.50              | 0.00             |                   |    |
| 88 | 10007152                                                  | University of Bedfordshire               | 12               | 10              | 45               | 3,954,613       | 1.22                | 0.96              | 2.50              | 0.00             |                   |    |
| 89 | 10007159                                                  | University of Sunderland                 | 138              | 6.7             | 25               | 845,382         | 1.16                | 1.53              | 1.00              | 0.00             |                   |    |
| 90 | 10007762                                                  | Glasgow Caledonian University            | 50               | 14              | 25               | 1,467,613       | 1.10                | 1.37              | 1.00              | 0.00             |                   |    |
| 91 | 10007848                                                  | University of Chester                    | 30               | 7.6             | 50               | 485,253         | 1.06                | 1.37              | 1.00              | 0.00             |                   |    |
| 92 | 10004048                                                  | London Metropolitan University           | 83               | 9.3             | 100              | 980,000         | 1.06                | 1.74              | 0.00              | 0.00             |                   |    |
| 93 | 10007166                                                  | University of Wolverhampton              | 155              | 11              | 35               | 615,728         | 1.00                | 1.71              | 0.00              | 0.00             |                   |    |
| 94 | 10007833                                                  | Wrexham Glynd_r University / Prifysgol G | 53               | 3.5             | 30               | -46,000         | 0.12                | 0.00              | 0.50              | 0.00             |                   |    |

Fig 6. Ordered by overall QR-formula weighting (column AF)

However, just as with the GPA-based measures, the value-for-money ordering (Fig. 7) radically changes this picture. The top is dominated by post-1992 institutions: Liverpool Hope, Northumbria, UCLAN, etc.) with Birkbeck again a notable exception and Loughborough also in the top ten.

|    | A                                                         | B                                          | C                | D               | E                | F               | AD                  | AE                | AF                | AG               | AH                                 | AI                 | AJ                | AP                | AQ                 | AR | AS | AT |
|----|-----------------------------------------------------------|--------------------------------------------|------------------|-----------------|------------------|-----------------|---------------------|-------------------|-------------------|------------------|------------------------------------|--------------------|-------------------|-------------------|--------------------|----|----|----|
| 1  | <b>REF 2021 UoA 11 Value for Money – QR Formula Based</b> |                                            |                  |                 |                  |                 |                     |                   |                   |                  |                                    |                    |                   |                   |                    |    |    |    |
| 2  |                                                           |                                            |                  |                 |                  |                 |                     |                   |                   |                  |                                    |                    |                   |                   |                    |    |    |    |
| 3  |                                                           |                                            | <b>Staffing</b>  |                 |                  |                 | <b>QR measure</b>   |                   |                   |                  | <b>Value for money (1000/cost)</b> |                    |                   |                   |                    |    |    |    |
| 4  | <b>institution ul</b>                                     | <b>institution name</b>                    | <b>instituti</b> | <b>fte of s</b> | <b>total fte</b> | <b>% of eli</b> | <b>total income</b> | <b>QR overall</b> | <b>QR outputs</b> | <b>QR impact</b> | <b>QR environ</b>                  | <b>VIM/overall</b> | <b>VIM/output</b> | <b>VIM/impact</b> | <b>VIM/environ</b> |    |    |    |
| 5  | 10003956                                                  | Liverpool Hope University                  | 79               | 13.5            | 100              | 81,000          | 1.56                | 2.65              | 0.00              | 0.00             | 0.00                               | 260.0              | 441.3             | #DIV/0!           | #DIV/0!            |    |    |    |
| 6  | 10007760                                                  | Birkbeck College                           | 13               | 25.6            | 100              | 1,692,167       | 4.82                | 5.23              | 6.00              | 1.00             | 1.00                               | 72.9               | 79.2              | 90.8              | 15.1               |    |    |    |
| 7  | 10001282                                                  | University of Northumbria at Newcastle     | 95               | 64.41           | 90               | 3,382,680       | 2.06                | 2.76              | 1.00              | 1.25             | 1.25                               | 39.2               | 52.6              | 19.0              | 23.8               |    |    |    |
| 8  | 10007141                                                  | University of Central Lancashire           | 29               | 14              | 55               | 530,131         | 1.42                | 1.93              | 1.00              | 0.00             | 0.00                               | 37.5               | 51.1              | 26.4              | #DIV/0!            |    |    |    |
| 9  | 10004113                                                  | Loughborough University                    | 87               | 26              | 100              | 2,923,877       | 3.72                | 3.17              | 6.00              | 2.25             | 2.25                               | 33.1               | 28.2              | 53.4              | 20.0               |    |    |    |
| 10 | 10006566                                                  | The University of West London              | 150              | 9.8             | 70               | 497,334         | 1.60                | 2.64              | 0.00              | 0.00             | 0.00                               | 31.5               | 52.0              | #DIV/0!           | #DIV/0!            |    |    |    |
| 11 | 10007823                                                  | Edge Hill University                       | 43               | 19              | 95               | 1,012,495       | 1.60                | 2.46              | 0.50              | 0.00             | 0.00                               | 30.0               | 46.2              | 9.4               | #DIV/0!            |    |    |    |
| 12 | 10007140                                                  | Birmingham City University                 | 15               | 30              | 35               | 1,928,000       | 1.86                | 2.08              | 2.34              | 0.00             | 0.00                               | 28.9               | 32.4              | 36.3              | #DIV/0!            |    |    |    |
| 13 | 10007148                                                  | The University of Huddersfield             | 62               | 27.2            | 85               | 2,002,821       | 2.12                | 2.41              | 2.67              | 0.00             | 0.00                               | 28.8               | 32.8              | 36.2              | #DIV/0!            |    |    |    |
| 86 | 10007852                                                  | University of Dundee                       | 39               | 13.5            | 100              | 11,452,544      | 4.28                | 4.40              | 5.00              | 2.75             | 2.75                               | 5.0                | 5.2               | 5.9               | 3.2                |    |    |    |
| 87 | 10007801                                                  | University of Plymouth                     | 102              | 14.62           | 100              | 7,665,321       | 2.56                | 3.89              | 0.00              | 1.50             | 1.50                               | 4.9                | 7.4               | #DIV/0!           | 2.9                |    |    |    |
| 88 | 10007802                                                  | The University of Reading                  | 108              | 10.4            | 100              | 6,929,635       | 3.18                | 2.17              | 6.50              | 1.75             | 1.75                               | 4.8                | 3.3               | 9.8               | 2.6                |    |    |    |
| 89 | 10003270                                                  | Imperial College of Science, Technology    | 64               | 58.45           | 100              | 106,041,759     | 7.58                | 7.30              | 8.00              | 8.00             | 8.00                               | 4.2                | 4.0               | 4.4               | 4.4                |    |    |    |
| 90 | 10007783                                                  | University of Aberdeen                     | 1                | 15.5            | 100              | 13,083,960      | 3.52                | 3.95              | 3.50              | 1.75             | 1.75                               | 4.2                | 4.7               | 4.1               | 2.1                |    |    |    |
| 91 | 10007793                                                  | University of South Wales / Prifysgol De C | 126              | 13.7            | 35               | 5,985,124       | 1.50                | 1.06              | 3.50              | 0.00             | 0.00                               | 3.4                | 2.4               | 8.0               | #DIV/0!            |    |    |    |
| 92 | 10007152                                                  | University of Bedfordshire                 | 12               | 10              | 45               | 3,954,613       | 1.22                | 0.96              | 2.50              | 0.00             | 0.00                               | 3.1                | 2.4               | 6.3               | #DIV/0!            |    |    |    |
| 93 | 10005500                                                  | Robert Gordon University                   | 109              | 10              | 30               | 4,668,217       | 1.28                | 1.60              | 1.00              | 0.50             | 0.50                               | 2.7                | 3.4               | 2.1               | 1.1                |    |    |    |
| 94 | 10007833                                                  | Wrexham Glynd_r University / Prifysgol G   | 53               | 3.5             | 30               | -46,000         | 0.12                | 0.00              | 0.50              | 0.00             | 0.00                               | -9.1               | #DIV/0!           | -38.0             | #DIV/0!            |    |    |    |

Fig 7. Ordered by QR-formula-weighting value for money (column AP)

The bottom of the table is a little more mixed, but the lower part is still dominated by research-intensive universities and only a few institutions bucking the trend. Of the Russell Group, only two get into the top quarter of the value for money table: Durham (slot 17) and Warwick (slot 23).

### 4.3 Four star output based orderings

As expected, if we focus entirely on 4\* outputs, the same institutions dominate the top of the league table (Imperials, Oxford, Warwick), with post-1992 institutions at the bottom.

|    | A                                                        | B                                          | C                | D               | E                | F               | AD                  | AE                   | AF                | AG               | AH                | AI |
|----|----------------------------------------------------------|--------------------------------------------|------------------|-----------------|------------------|-----------------|---------------------|----------------------|-------------------|------------------|-------------------|----|
| 1  | <b>REF 2021 UoA 11 Value for Money – 4* output based</b> |                                            |                  |                 |                  |                 |                     |                      |                   |                  |                   |    |
| 2  |                                                          |                                            |                  |                 |                  |                 |                     |                      |                   |                  |                   |    |
| 3  |                                                          |                                            | <b>Staffing</b>  |                 |                  |                 |                     | <b>4 star counts</b> |                   |                  |                   |    |
| 4  | <b>institution ul</b>                                    | <b>institution name</b>                    | <b>instituti</b> | <b>fte of s</b> | <b>total fte</b> | <b>% of eli</b> | <b>total income</b> | <b>4* overall</b>    | <b>4* outputs</b> | <b>4* impact</b> | <b>4* environ</b> |    |
| 5  | 10003270                                                 | Imperial College of Science, Technology    | 64               | 58.45           | 100              | 106,041,759     | 0.93                | 0.88                 | 1.00              | 1.00             |                   |    |
| 6  | 10007774                                                 | University of Oxford                       | 100              | 73.65           | 100              | 74,770,490      | 0.81                | 0.83                 | 0.67              | 1.00             |                   |    |
| 7  | 10007163                                                 | The University of Warwick                  | 149              | 41.6            | 100              | 15,756,156      | 0.76                | 0.79                 | 0.75              | 0.63             |                   |    |
| 8  | 10007784                                                 | University College London                  | 146              | 100.2           | 100              | 84,832,545      | 0.77                | 0.73                 | 0.81              | 0.88             |                   |    |
| 9  | 10006842                                                 | The University of Liverpool                | 78               | 40.75           | 100              | 12,225,088      | 0.52                | 0.68                 | 0.13              | 0.50             |                   |    |
| 10 | 10006840                                                 | The University of Birmingham               | 14               | 42.7            | 100              | 20,885,858      | 0.77                | 0.65                 | 1.00              | 0.88             |                   |    |
| 11 | 10007788                                                 | University of Cambridge                    | 25               | 80.8            | 105              | 62,257,529      | 0.73                | 0.61                 | 0.86              | 1.00             |                   |    |
| 12 | 10007790                                                 | University of Edinburgh                    | 44               | 144             | 100              | 157,949,798     | 0.76                | 0.61                 | 1.00              | 1.00             |                   |    |
| 13 | 10007786                                                 | University of Bristol                      | 21               | 59.15           | 100              | 38,967,825      | 0.68                | 0.57                 | 0.90              | 0.75             |                   |    |
| 86 | 10007800                                                 | University of the West of Scotland         | 152              | 25              | 55               | 4,238,337       |                     | 0.04                 | 0.06              | 0.00             | 0.00              |    |
| 87 | 10000824                                                 | Bournemouth University                     | 18               | 45.75           | 80               | 4,309,376       |                     | 0.13                 | 0.06              | 0.38             | 0.00              |    |
| 88 | 10007848                                                 | University of Chester                      | 30               | 7.6             | 50               | 485,253         |                     | 0.03                 | 0.05              | 0.00             | 0.00              |    |
| 89 | 10007152                                                 | University of Bedfordshire                 | 12               | 10              | 45               | 3,954,613       |                     | 0.09                 | 0.04              | 0.25             | 0.00              |    |
| 90 | 10007762                                                 | Glasgow Caledonian University              | 50               | 14              | 25               | 1,467,613       |                     | 0.02                 | 0.03              | 0.00             | 0.00              |    |
| 91 | 10007793                                                 | University of South Wales / Prifysgol De C | 126              | 13.7            | 35               | 5,985,124       |                     | 0.08                 | 0.03              | 0.25             | 0.00              |    |
| 92 | 10007833                                                 | Wrexham Glynd_r University / Prifysgol G   | 53               | 3.5             | 30               | -46,000         |                     | 0.00                 | 0.00              | 0.00             | 0.00              |    |
| 93 | 10007159                                                 | University of Sunderland                   | 138              | 6.7             | 25               | 845,382         |                     | 0.00                 | 0.00              | 0.00             | 0.00              |    |
| 94 | 10005500                                                 | Robert Gordon University                   | 109              | 10              | 30               | 4,668,217       |                     | 0.00                 | 0.00              | 0.00             | 0.00              |    |

Fig 8. Ordered by 4\* output volume (column AG)

Note that three, Wrexham, Sunderland and Robert Gordon have no 4\* outputs in UoA11, which lead to anomalous results (Excel “#DIV/0!” error) in the value for money spreadsheet (Fig. 9). Ignoring these, post-1992 institutions again rank high (Liverpool Hope, Northumbria, etc.), with Birkbeck as an exception and this time other pre-1992 institutions in the top 10 with Universities of Liverpool, Kent and Warwick at positions 8, 9 and 10.

|    | A                                                        | B                                          | C                | D               | E                | F               | AD                  | AE                   | AF                | AG               | AH                | AI                                 | AJ                 | AP                | AQ                 | AR   | AS | AT |
|----|----------------------------------------------------------|--------------------------------------------|------------------|-----------------|------------------|-----------------|---------------------|----------------------|-------------------|------------------|-------------------|------------------------------------|--------------------|-------------------|--------------------|------|----|----|
| 1  | <b>REF 2021 UoA 11 Value for Money – 4* output based</b> |                                            |                  |                 |                  |                 |                     |                      |                   |                  |                   |                                    |                    |                   |                    |      |    |    |
| 2  |                                                          |                                            |                  |                 |                  |                 |                     |                      |                   |                  |                   |                                    |                    |                   |                    |      |    |    |
| 3  |                                                          |                                            | <b>Staffing</b>  |                 |                  |                 |                     | <b>4 star counts</b> |                   |                  |                   | <b>Value for money (1000/cost)</b> |                    |                   |                    |      |    |    |
| 4  | <b>institution ul</b>                                    | <b>institution name</b>                    | <b>instituti</b> | <b>fte of s</b> | <b>total fte</b> | <b>% of eli</b> | <b>total income</b> | <b>4* overall</b>    | <b>4* outputs</b> | <b>4* impact</b> | <b>4* environ</b> | <b>VfM/overall</b>                 | <b>VfM/output4</b> | <b>VfM/impact</b> | <b>VfM/environ</b> |      |    |    |
| 5  | 10007833                                                 | Wrexham Glynd_r University / Prifysgol G   | 53               | 3.5             | 30               | -46,000         | 0.00                | 0.00                 | 0.00              | 0.00             | 0.00              | #DIV/0!                            | #DIV/0!            | #DIV/0!           | #DIV/0!            |      |    |    |
| 6  | 10007159                                                 | University of Sunderland                   | 138              | 6.7             | 25               | 845,382         | 0.00                | 0.00                 | 0.00              | 0.00             | 0.00              | #DIV/0!                            | #DIV/0!            | #DIV/0!           | #DIV/0!            |      |    |    |
| 7  | 10005500                                                 | Robert Gordon University                   | 109              | 10              | 30               | 4,668,217       | 0.00                | 0.00                 | 0.00              | 0.00             | 0.00              | #DIV/0!                            | #DIV/0!            | #DIV/0!           | #DIV/0!            |      |    |    |
| 8  | 10003956                                                 | Liverpool Hope University                  | 79               | 13.5            | 100              | 81,000          | 0.12                | 0.21                 | 0.00              | 0.00             | 0.00              | 20.00                              | 34.33              | #DIV/0!           | #DIV/0!            |      |    |    |
| 9  | 10007760                                                 | Birkbeck College                           | 13               | 25.6            | 100              | 1,692,167       | 0.50                | 0.55                 | 0.67              | 0.00             | 0.00              | 7.56                               | 8.32               | 10.09             | #DIV/0!            |      |    |    |
| 10 | 10001282                                                 | University of Northumbria at Newcastle     | 95               | 64.41           | 90               | 3,382,680       | 0.11                | 0.19                 | 0.00              | 0.00             | 0.00              | 2.09                               | 3.64               | #DIV/0!           | #DIV/0!            |      |    |    |
| 11 | 10006566                                                 | The University of West London              | 150              | 9.8             | 70               | 497,334         | 0.10                | 0.16                 | 0.00              | 0.00             | 0.00              | 1.97                               | 3.15               | #DIV/0!           | #DIV/0!            |      |    |    |
| 12 | 10007823                                                 | Edge Hill University                       | 43               | 19              | 95               | 1,012,495       | 0.10                | 0.17                 | 0.00              | 0.00             | 0.00              | 1.88                               | 3.13               | #DIV/0!           | #DIV/0!            |      |    |    |
| 13 | 10007141                                                 | University of Central Lancashire           | 29               | 14              | 55               | 530,131         | 0.06                | 0.10                 | 0.00              | 0.00             | 0.00              | 1.58                               | 2.64               | #DIV/0!           | #DIV/0!            |      |    |    |
| 86 | 10007158                                                 | University of Southampton                  | 127              | 47.26           | 100              | 43,155,267      | 0.62                | 0.37                 | 1.00              | 1.00             | 0.00              | 0.68                               | 0.41               | 1.10              | 1.10               |      |    |    |
| 87 | 10007800                                                 | University of the West of Scotland         | 152              | 25              | 55               | 4,238,337       | 0.04                | 0.06                 | 0.00              | 0.00             | 0.00              | 0.24                               | 0.37               | #DIV/0!           | #DIV/0!            |      |    |    |
| 88 | 10007165                                                 | The University of Westminster              | 153              | 21.4            | 40               | 4,381,542       | 0.13                | 0.07                 | 0.33              | 0.00             | 0.00              | 0.63                               | 0.36               | 1.63              | #DIV/0!            |      |    |    |
| 89 | 10007773                                                 | The Open University                        | 99               | 44.7            | 55               | 18,979,643      | 0.19                | 0.14                 | 0.25              | 0.25             | 0.00              | 0.45                               | 0.34               | 0.59              | #DIV/0!            | 0.59 |    |    |
| 90 | 10007762                                                 | Glasgow Caledonian University              | 50               | 14              | 25               | 1,467,613       | 0.02                | 0.03                 | 0.00              | 0.00             | 0.00              | 0.19                               | 0.28               | #DIV/0!           | #DIV/0!            |      |    |    |
| 91 | 10007807                                                 | University of Ulster                       | 145              | 69.6            | 100              | 28,646,180      | 0.20                | 0.10                 | 0.42              | 0.25             | 0.00              | 0.49                               | 0.24               | 1.01              | 0.61               |      |    |    |
| 92 | 10007802                                                 | The University of Reading                  | 108              | 10.4            | 100              | 6,929,635       | 0.26                | 0.13                 | 0.75              | 0.00             | 0.00              | 0.39                               | 0.19               | 1.13              | #DIV/0!            |      |    |    |
| 93 | 10007152                                                 | University of Bedfordshire                 | 12               | 10              | 45               | 3,954,613       | 0.09                | 0.04                 | 0.25              | 0.00             | 0.00              | 0.23                               | 0.10               | 0.63              | #DIV/0!            |      |    |    |
| 94 | 10007793                                                 | University of South Wales / Prifysgol De C | 126              | 13.7            | 35               | 5,985,124       | 0.08                | 0.03                 | 0.25              | 0.00             | 0.00              | 0.18                               | 0.07               | 0.57              | #DIV/0!            |      |    |    |

Fig 9. Ordered by 4\* output volume value for money (column AQ)

The bottom of the table is also a little more mixed with Imperial managing about a quarter of the way up from the bottom and Oxford at around the half way point. Also, the overall ratio of value-for-money varies a little less across the table.

## 4.4 Result summary

In each case the results follow very similar trends. If one ranks by raw quality metrics then the well-known leaders are at the top, mostly Russell Group, with mainly post-a992 institutions towards the end of the table.

However, when we apply value-for-money measures the opposite trend is seen, with post-1992 institutions largely dominating the top of the value-for-money tables. One could argue that REF is about research *excellence*, and therefore metrics should focus most highly towards the 4\* and 3\* and the QR-formula weighted metric reflects this. Others would focus entirely on publications and impact *within* the research community (of course, this this is not the view of government, nor REF as a whole), and so the 4\* outputs only measure focuses entirely on this. However, while this extreme picture is a little more mixed, even using this more heavily 4\* and publication weighted measure, the overall value for money trends are still apparent.

It should be noted also that in my analysis of the REF2014 outcomes [Dx15b], it was clear that in UoA11, we had very strong implicit bias towards the more obvious institutions, tending on average to under-rate post-1992 institutions and over-rate Russell Group with respect to internationally normalised metrics. If the above analysis were repeated with, say, Scopus field-weighted citation data the results would be likely to be more extreme.

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5 Discussion

5.1 Factors that might affect the accuracy or trends of results

As noted there may have been implicit bias affecting REF results, but based on the 2014 outcomes if anything this would have acted to make the value for money more extreme.

There might also be differences across different areas of computing. While there are few areas requiring large-scale equipment as there are in Physics, theoretical computing may require less resources than more application-oriented areas. However, within computing the post-1992 institutions are more likely to have application-focused research, so again this would mean if anything that the underlying trend is even more extreme than is apparent in the REF data.

Academics have multiple demands on their time conflicting with research. However, one would expect these time demands to be greater in teaching-intensive institutions, so one might therefore expect less efficient use of research time, but that is the opposite of the trend seen. However, competing workloads may well be a factor at the level of individual institutions.

Similarly, one would expect the research environment in research-heavy institutions to be more conducive to effective use of research resources, but this is the opposite of what is seen in the data.

5.2 Alternative analyses

Funding comes for various purposes, some is focused on pure research (esp. UKRI), some for industrial projects, some for work with communities or local business, some for doctoral training, etc. The different value-for-money measures all use the *overall* income figure and do not attempt to model the individual types of income and how they map to the three main REF criteria areas. Given there are only around ninety institutions and many factors, a more complex analysis would struggle to avoid overfitting, but this could perhaps be attempted by pooling data from several UoAs with similar characteristics.

5.3 Individual institution results vs overall trends

I was Director of the Computational Foundry at Swansea University over a substantial part of the REF period, so it is somewhat embarrassing that Swansea sits low in the income–GPA curve in Figure 10. However, I am also aware that during the period the Computational Foundry hosted Cherish DE a large network-style grant that registered as Swansea income but had widespread benefits across UK HE; in addition, student numbers grew far faster than staff during the REF period leading to one of the worst computing SSRs in the UK. Without making excuses (!), there will be similar stories across every institution and so the data in these ‘league tables’ should not be read as producing an accurate value-for-money estimate for each institution in UoA11. However, the overall trends across sectors of UK HE are likely to be robust.

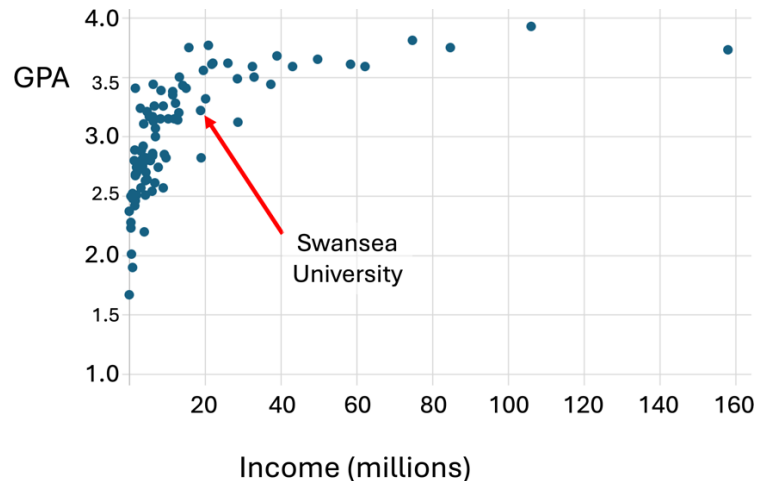


Fig 10. Graph of overall GPA vs Total income for academic years 2013-14 to 2019-20 (Swansea University highlighted)

5.4 Possible reasons for the trends seen

Assuming these results are robust, why are we seeing the overall trend to greater effectiveness in lower-ranked institutions. This is an important question as understanding this might allow improved research effectiveness everywhere.

Here are some possible reasons for the differing value for money across the sector, which may all apply to some extent. Some are about the overall funding system:

- *implicit bias within the funding system* – In principle, UKRI and similar funding tries to avoid institutional bias, but, as was evident from REF2014, it is hard to avoid the halo effect of a proposal from a ‘good’ institution.
- *money follows money* – The presence of lots of money, lab resources, etc., may make funders feel that existing centres of expertise are a safer bet for further investment. Indeed, the QR funding formula to some extent follows this pattern.

Both of the above effects could mean that weaker proposals from high-esteem institutions are more likely to obtain funding, thus dragging down their institutions’ net efficiency.

Some reasons are about potential problems within the high-esteem institutions:

- *overcommitment of big hitters* – In many institutions a relatively small number of academics are responsible for a large proportion of grant funding. This may lead to some projects not getting suitable levels of supervision/management.
- *surface veneer of well-written grant applications* – The collective knowledge and critical mass within a research-intensive institution may mean that a fundamentally less good ideas may be written in ways that appear to be stronger, leading to better funding success of lower quality research.

Others relate to strengths within the lower-esteem institutions:

- *greater staff selection* – Teaching intensive institutions with small numbers of research active staff have often made stronger distinctions between staff types, offering research active staff lower teaching and admin loads. While this must be set against higher overall loads, this could still be a net benefit. Of course, given changes in submission criteria post REF 2014, there are increasing numbers of teaching-only staff across the entire university sector.
- *targeted support* – Many universities have targeted internal funding and research support services. It is hard to compare the total volume of these, but where the university as a whole has a smaller number of research active staff accessing these internal funds and services, so there might be a higher net service level.
- *greater expectations* – Where external funding, especially ‘cherished’ sources, is rare even small grants are seen as special and often lead to outcomes well out of proportion to the monies received.
- *greater investigator input* – Because funding levels are lower, this may mean that there is a greater proportion of investigator/academic time (whether or not properly costed!) dedicated to each pound of grant funding; the obverse of ‘*overcommitment of big hitters*’!

5.5 Potential policy implications

The obvious take-away is that a shift to rebalance funding across the sector is likely to lead to a greater overall volume of high-quality research. The mechanisms for this however may not be

easy as UKRI peer review is notoriously resistant to policy nudges. Also this is not about a complete levelling, it is clear that there are centres of excellence producing a large volume of world-leading work, but this seems to carry with it a far less effective tail.

Structurally there may be value in encouraging more projects that cross between facets of the sector nurturing islands of research excellence across the whole of HE and leveraging the greater efficiency of those pockets. Of course, any such initiatives would need to ensure they leverage the best of both, rather than regress to the mean! Devolved nations may be well placed to facilitate and encourage such cross-institutional connections.

Since the Thatcher years, the government pressure for centres of excellence has focused on creating critical mass. In a digital age, these communities of practice need not be physically based within single institutions. Again, positive pressure may be needed, as cross-institutional collaborations more often seem to be *within* pre- or post-1992 sectors rather than between them.

We clearly need a better understanding of the factors that make research spend more or less effective. The suggestions in section 5.4 are based purely on the author's personal experience and anecdotal evidence. This suggests the need for richer studies of academic practice at a more detailed level so that funding policy can be rooted more solidly in evidence and data. This need for 'science of science policy' was also one of the recommendations of the Metric Tide report [WA15].

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[REF21b] REF2021 – Results and submissions – Environment submissions database. <https://results2021.ref.ac.uk/environment>

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Acknowledgements

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Appendix – obtaining data

This appendix contains details of how the data for this report is extracted from the official REF public domain data and then processed to create the summary spreadsheets.

The spreadsheet of institution-by-institution results is accessed from the REF results and submissions database starting at the main page for the UoA results (Fig A1).

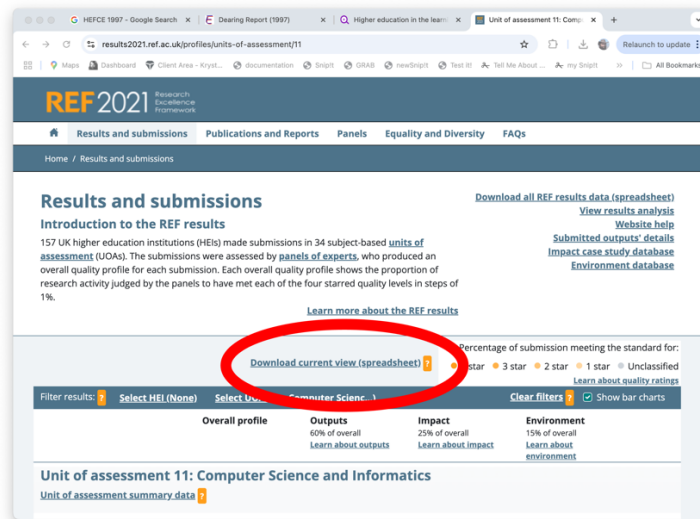


Fig A1. UoA11 main page – ‘Download current view’ creates spreadsheet of results <https://results2021.ref.ac.uk/profiles/units-of-assessment/11>

This produces a spreadsheet with four rows for each institution listing a profile of 4*,3*, 2*, 1* and unclassified results for Overall, Outputs, Impact and Environments respectively (Fig. A2).

| Institution code | Institution name | Unit of assessment | Unit of assessment name | Profile | FTE of submitted staff | % of joint staff eligible | Percentage of the submission meeting the standard for: | | | | |
|------------------|--------------------------------------|--------------------|----------------------------------|-------------|------------------------|---------------------------|--|------|------|-----|--------------|
| | | | | | | | 4* | 3* | 2* | 1* | Unclassified |
| 10007783 | University of Aberdeen | 11 | Computer Science and Informatics | Overall | 15.50 | 100 | 28 | 64 | 8 | 0 | 0 |
| 10007783 | University of Aberdeen | 11 | Computer Science and Informatics | Outputs | 15.50 | 100 | 35.9 | 53.8 | 10.3 | 0.0 | 0.0 |
| 10007783 | University of Aberdeen | 11 | Computer Science and Informatics | Impact | 15.50 | 100 | 25.0 | 75.0 | 0.0 | 0.0 | 0.0 |
| 10007783 | University of Aberdeen | 11 | Computer Science and Informatics | Environment | 15.50 | 100 | 0.0 | 87.5 | 12.5 | 0.0 | 0.0 |
| 10007856 | Aberystwyth University / Prifysgol A | 11 | Computer Science and Informatics | Overall | 27.82 | 100 | 29 | 59 | 12 | 0 | 0 |
| 10007856 | Aberystwyth University / Prifysgol A | 11 | Computer Science and Informatics | Outputs | 27.82 | 100 | 34.3 | 58.6 | 7.1 | 0.0 | 0.0 |
| 10007856 | Aberystwyth University / Prifysgol A | 11 | Computer Science and Informatics | Impact | 27.82 | 100 | 33.3 | 66.7 | 0.0 | 0.0 | 0.0 |
| 10007856 | Aberystwyth University / Prifysgol A | 11 | Computer Science and Informatics | Environment | 27.82 | 100 | 0.0 | 50.0 | 50.0 | 0.0 | 0.0 |
| 10007759 | Aton University | 11 | Computer Science and Informatics | Overall | 34.00 | 100 | 16 | 53 | 30 | 1 | 0 |
| 10007759 | Aton University | 11 | Computer Science and Informatics | Outputs | 34.00 | 100 | 25.9 | 58.8 | 14.1 | 1.2 | 0.0 |
| 10007759 | Aton University | 11 | Computer Science and Informatics | Impact | 34.00 | 100 | 0.0 | 66.7 | 33.3 | 0.0 | 0.0 |
| 10007759 | Aton University | 11 | Computer Science and Informatics | Environment | 34.00 | 100 | 0.0 | 12.5 | 87.5 | 0.0 | 0.0 |
| 10007850 | The University of Bath | 11 | Computer Science and Informatics | Overall | 29.00 | 100 | 37 | 61 | 2 | 0 | 0 |
| 10007850 | The University of Bath | 11 | Computer Science and Informatics | Outputs | 29.00 | 100 | 45.2 | 50.7 | 4.1 | 0.0 | 0.0 |
| 10007850 | The University of Bath | 11 | Computer Science and Informatics | Impact | 29.00 | 100 | 16.7 | 83.3 | 0.0 | 0.0 | 0.0 |
| 10007850 | The University of Bath | 11 | Computer Science and Informatics | Environment | 29.00 | 100 | 37.5 | 62.5 | 0.0 | 0.0 | 0.0 |
| 10007152 | University of Bedfordshire | 11 | Computer Science and Informatics | Overall | 10.00 | 45 | 9 | 25 | 43 | 23 | 0 |

Fig A2. Quality Profiles Spreadsheet with separate rows for Overall, Outputs, Impact, and Environment

The income spreadsheets are accessed from the Environment submissions database (Fig. A3). One must first select the desired unit of assessment (UoA11 in the case of this report) and then navigate to the Downloads area.

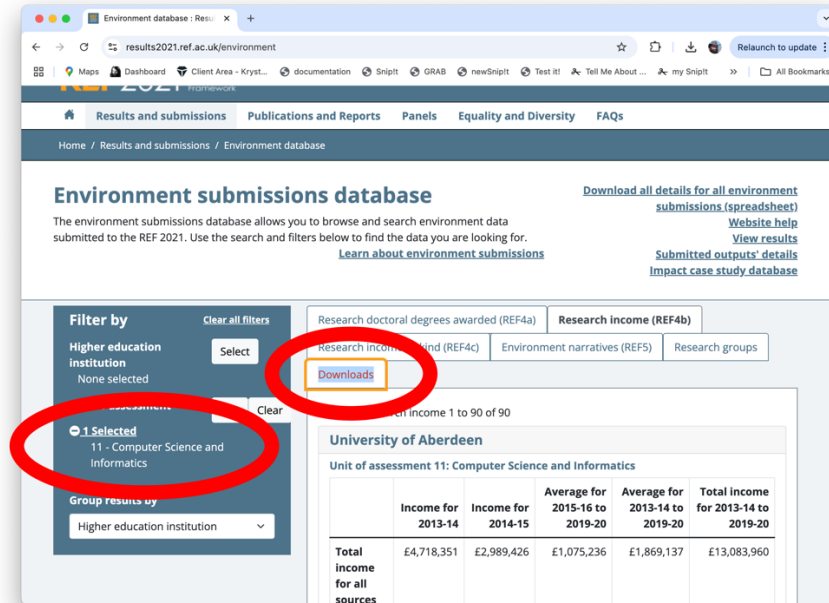


Fig A3. UoA11 main page – ‘Download current view’ creates spreadsheet of results <https://results2021.ref.ac.uk/environment>

This then contains download links for the income and income-in-kind CSV files (Fig A4).

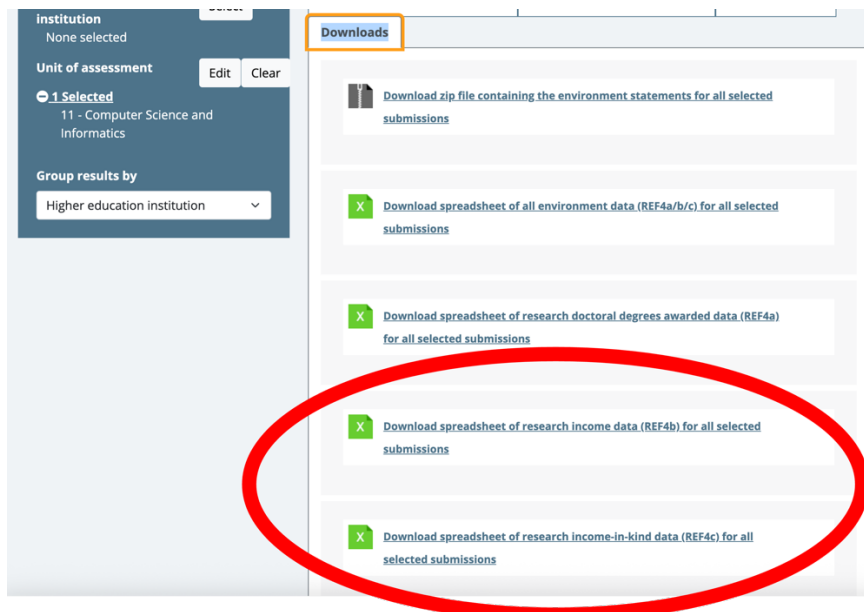


Fig A4. Downloads tab including income and income-in-kind CSV files

The income spreadsheet (Fig. A5) covers 14 different types of income and a overall income total each on a separate row with five columns each containing yearly averages and overall totals covering different time periods.

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
|----|------------------------|----------------------------|----|----------------------------------|----------------------------------|----------------|-----------|-----------|-----------|-----------|------------|---|---|---|---|---|---|---|---|
| 1 | Institution UKPRN code | | | | | | | | | | | | | | | | | | |
| 2 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | BEIS Researc | 3,413,128 | 1,944,316 | 658,227 | 1,235,511 | 8,648,580 | | | | | | | | |
| 3 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | UK-based ch | 498 | 0 | 16,614 | 11,398 | 83,569 | | | | | | | | |
| 4 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | UK-based ch | 12,268 | 48,957 | 8,504 | 14,821 | 103,747 | | | | | | | | |
| 5 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | UK central go | 6,007 | 11,095 | 82,858 | 61,627 | 431,395 | | | | | | | | |
| 6 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | UK central go | 0 | 89,000 | 29,000 | 33,428 | 234,000 | | | | | | | | |
| 7 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | UK industry, r | 605,686 | 343,792 | 174,662 | 260,398 | 1,822,788 | | | | | | | | |
| 8 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | UK other sou | 9,426 | 3,092 | 1,101 | 2,375 | 16,025 | | | | | | | | |
| 9 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | EU governme | 468,650 | 329,390 | 49,895 | 149,845 | 1,047,517 | | | | | | | | |
| 10 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | EU-based ch | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 11 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | EU industry, r | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 12 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | EU (excluding | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 13 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | Non-EU bank | 12,215 | 0 | 0 | 1,745 | 12,215 | | | | | | | | |
| 14 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | Non-EU indust | 190,473 | 219,794 | 54,373 | 97,446 | 682,124 | | | | | | | | |
| 15 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | Non-EU othe | 0 | 0 | 0 | 0 | 0 | | | | | | | | |
| 16 | 10007783 | University of Aberdeen | B | 11 | Computer Science and Informatics | Total income | 4,718,351 | 2,989,426 | 1,075,236 | 1,869,137 | 13,083,960 | | | | | | | | |
| 17 | 10007856 | Aberystwyth University / B | 11 | Computer Science and Informatics | BEIS Researc | 180,000 | 230,000 | 156,000 | 170,000 | 1,190,000 | | | | | | | | | |
| 18 | 10007856 | Aberystwyth University / B | 11 | Computer Science and Informatics | UK-based ch | 45,000 | 25,000 | 400 | 10,285 | 72,000 | | | | | | | | | |
| 19 | 10007856 | Aberystwyth University / B | 11 | Computer Science and Informatics | UK-based ch | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| 20 | 10007856 | Aberystwyth University / B | 11 | Computer Science and Informatics | UK central go | 273,000 | 137,000 | 96,400 | 127,428 | 892,000 | | | | | | | | | |
| 21 | 10007856 | Aberystwyth University / B | 11 | Computer Science and Informatics | UK central go | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |

Fig A5. Income Spreadsheet with separate rows for fourteen categories and overall total

The spreadsheets were processed by a small PHP script to create a single JSON file with all the information gathered together for each institution [JSON DATA]. This was then run through a second script to extract a summary CSV with one row per institution (Fig. A6), which was then used to calculate the various metrics and tables [EXCEL DATA]. All of the different outcomes profiles are included as separate columns, but only three of the income measures were included as there would have been 75 income totals plus a further eight research in kind columns.

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | AA | AB | AC | AD | | |
|----|---|---|----------|---------|---------|--------|-------------|--------|----|------|------|------|------|-----|------|------|------|------|----|----|---|----|----|---|------|------|------|------|----|----|---|
| 1 | REF 2021 Uoa 11 Value for Money - 4* output based | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Institution al | Institution name | Staffing | Overall | Outputs | Impact | Environment | Income | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | 10007783 | University of Aberdeen | 1 | 15.5 | 100 | 28 | 54 | 6 | 0 | 35.9 | 53.8 | 10.3 | 0 | 0 | 25 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 6 | 10007856 | Aberystwyth University / Prifysgol Aberys | 3 | 27.82 | 100 | 29 | 59 | 12 | 0 | 34.3 | 58.6 | 7.1 | 0 | 0 | 33.3 | 66.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 7 | 10007759 | Aston University | 8 | 34 | 100 | 16 | 53 | 30 | 1 | 0 | 25.9 | 58.8 | 14.1 | 1.2 | 0 | 0 | 66.7 | 33.3 | 0 | 0 | 0 | 0 | 0 | 0 | 12.5 | 87.5 | 0 | 0 | 0 | 0 | |
| 8 | 10007850 | The University of Bath | 10 | 29 | 100 | 37 | 61 | 2 | 0 | 0 | 45.2 | 50.7 | 4.1 | 0 | 0 | 16.7 | 83.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37.5 | 62.5 | 0 | 0 | 0 | 0 | |
| 9 | 10007152 | University of Bedfordshire | 12 | 10 | 45 | 9 | 25 | 43 | 23 | 0 | 4 | 32 | 48 | 16 | 0 | 25 | 25 | 25 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | |
| 10 | 10007780 | Birkbeck College | 13 | 25.6 | 100 | 50 | 41 | 9 | 0 | 0 | 55 | 41.7 | 3.3 | 0 | 0 | 66.7 | 33.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | |
| 11 | 10006940 | The University of Birmingham | 14 | 42.7 | 100 | 77 | 23 | 0 | 0 | 0 | 65.4 | 34.6 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87.5 | 12.5 | 0 | 0 | 0 | |
| 12 | 10007140 | Birmingham City University | 15 | 30 | 35 | 11 | 49 | 28 | 4 | 8 | 10.7 | 61.3 | 28 | 0 | 0 | 16.7 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33.3 | 0 | 0 | 75 | 25 | 0 |
| 13 | 10000824 | Bournemouth University | 18 | 45.75 | 80 | 13 | 37 | 39 | 10 | 1 | 6.1 | 48.3 | 41.2 | 3.5 | 0.9 | 37.5 | 25 | 12.5 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 12.5 | 75 | 12.5 | 0 | 0 | |
| 14 | 10007785 | The University of Bradford | 19 | 19 | 65 | 5 | 62 | 30 | 3 | 0 | 8.3 | 58.4 | 31.2 | 2.1 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12.5 | 75 | 12.5 | 0 | 0 | |
| 15 | 10000886 | University of Brighton | 20 | 15 | 40 | 19 | 54 | 27 | 0 | 0 | 10.5 | 60.6 | 28.9 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37.5 | 62.5 | 0 | 0 | 0 | |
| 16 | 10007786 | Birkbeck College | 21 | 59.15 | 100 | 68 | 32 | 0 | 0 | 0 | 57.4 | 42.8 | 0 | 0 | 0 | 90 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 25 | 0 | 0 | 0 | |
| 17 | 10000951 | Brunel University London | 22 | 37.3 | 100 | 27 | 42 | 24 | 0 | 7 | 39.8 | 41.9 | 17.2 | 0 | 1.1 | 12.5 | 37.5 | 25 | 0 | 25 | 0 | 50 | 50 | 0 | 0 | 0 | 50 | 50 | 0 | 0 | 0 |
| 18 | 10007788 | University of Cambridge | 25 | 80.8 | 105 | 73 | 21 | 2 | 0 | 4 | 60.9 | 35.6 | 3.5 | 0 | 0 | 85.7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14.3 | 100 | 0 | 0 | 0 | 0 |
| 19 | 10007814 | Cardiff University / Prifysgol Caerdydd | 28 | 45.55 | 100 | 45 | 51 | 4 | 0 | 0 | 42.1 | 51.8 | 6.1 | 0 | 0 | 62.5 | 37.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 75 | 0 | 0 | 0 | |
| 20 | 10007141 | University of Central Lancashire | 29 | 14 | 55 | 6 | 47 | 38 | 9 | 0 | 10 | 56.7 | 30 | 3.3 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | |
| 21 | 10007848 | University of Chester | 30 | 7.6 | 50 | 3 | 41 | 32 | 24 | 0 | 5.3 | 47.3 | 42.1 | 5.3 | 0 | 0 | 50 | 25 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 |

Fig A6. Combined Spreadsheet with separate columns for each type of profile and small selection of income measures

[JSON DATA] <https://alandix.com/data/REF2021/ref2021-uoa11.json>

[EXCEL DATA] <https://alandix.com/data/REF2021/summary-REF-FfM-UoA11-20250408.xlsx>