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Section 1: Behind the data

The evolution of brain drain and its measurement: Part II

Dr Andrew Plume

Brain circulation in the UK context: a sea of talent

As part of the report '[International Comparative Performance of the UK Research Base: 2011](#)', commissioned by the UK's Department for Business, Innovation and Skills (BIS), a fresh way of looking at researcher mobility was sought. In the report, published in October 2011, Scopus data were used to produce a conceptual map of the stocks and flows of human capital (i.e. researchers) in the UK over a 15-year period 1996–2010 (conceptual and methodological details were discussed in Part I of this article in the previous issue of **Research Trends**). Thinking of the global researcher population as a sea of talent, the study aimed to quantify the size of the waves and the direction of the current from the UK's perspective.

The main findings of the analyses are (see [Figure 1](#)):

- Using each author's affiliation(s) listed in their published articles to determine their mobility patterns, 37.2% of active UK researchers appear never to have published outside the UK in the period 1996–2010. While it is possible that many of these researchers did travel and collaborate internationally, such activities never resulted in published articles in which they listed their address as being outside the UK. These researchers show low 'productivity' (articles published per year since their first appearance as an author, relative to benchmark of 1.00 for

all UK researchers over this period) at just 0.60. They also display a low relative 'seniority' (i.e. number of years since their first appearance as an author, relative to benchmark of 1.00 for all UK researchers over this period) of 0.82.

- 5.8% of UK researchers moved out of the UK and show no indication of having returned to the UK since, while 5.8% of UK researchers moved into the UK and showed no indication of having left the UK since. The actual difference in this period was a net inflow of just 61 researchers to the UK (of the 210,923 total researchers in the dataset). Researchers moving out of the UK were slightly less productive than average (0.91) but also slightly more senior (1.15), and those moving to the UK had a very similar profile (0.89 and 1.13, respectively). The most common destination countries were the US, Australia, Canada, Germany and France, while the most common source nations were the US, Germany, Australia, France and Italy.
- 2.6% of UK researchers moved out of the UK and subsequently returned after more than two years abroad ("returnees inflow"), while 4.2% of UK researchers



moved into the UK and subsequently left after more than two years in the country ("returnees outflow"). While the latter group are slightly less productive than average (0.95), the former group are highly productive (1.66). Both groups have a very similar relative seniority, at 1.20 for the returnees outflow and 1.23 for the returnees inflow. The most common destination countries amongst the returnees outflow group were the US, Australia, Germany, France and Canada, while the most common source nations in the returnees inflow group were the US, Australia, Canada, Germany and Ireland. Owing to their small number, these two groups of "returnees" contributed a relatively small amount to the UK's brain circulation, compared to the whole. Despite this, returnees may contribute a great deal to their home country after their return.

- Taking together the outflow and returnees outflow group and the inflow and returnees inflow group, the net brain outflow from the UK is about 1.5%. However, the inflow groups together constitute a more productive population than the outflow groups, despite their very similar seniority profiles.

- The most prominent groups identified in this analysis are the large numbers of researchers with transitory mobility (with stays either in the UK, or out of the UK, of less than two years as indicated by their country listed in their published articles). In the period 1996-2010, 13.6% of researchers based mainly in the UK showed transitory mobility to non-UK countries (as indicated by their country listed in their published articles), while a very large number (30.8%) of researchers based mainly in non-UK countries showed transitory mobility into the UK. While the former group is about as productive as the average (0.98) and slightly more senior (1.05), the latter group is highly productive (1.35) and somewhat more senior (1.11). The most common destination countries for the mainly UK-based group were the US, Australia, Germany, Canada and France, while the most common source nations for the mainly non-UK-based group were the US, Germany, France, Italy and Australia.

Thinking about brains: refining the map

While clearly of great value in showing the overall ebbs and flows of researchers in and out of the UK, the conceptual map derived

using the above approach does come with some caveats and areas for future improvement. For example, while the map shown in [Figure 1](#) shows the rest of world as a single collective entity, the data behind it contain the source and destination (and often intervening) countries for all the researchers it represents; these data have yet to be exploited fully (for a preview, see the report's Appendix F [here](#)). Moreover, only two national brain circulation maps have been produced to date: one for the UK and a comparative map for Germany, the latter with an overall pattern similar to the former but with a slightly higher proportion of researchers who have apparently never been affiliated with institutions beyond Germany, and therefore a lower proportion flowing in and out of the country.

Dr Grit Laudel of the University of Twente, Netherlands, pioneered the development of a methodological framework for bibliometric studies of brain circulation over the last decade. We asked Dr Laudel to offer her thoughts on future refinements of this approach, and her comments are reflected in the discussion overleaf.

In contrast to the seminal works on bibliometric approaches to brain circulation by Laudel (see Part I of this article in the previous issue of **Research Trends**), the analyses presented here do not take a subject-level view but look across all disciplines. How does the picture differ for mathematics versus life sciences, or social sciences versus physics? Laudel notes: "The most important differentiation that needs to be introduced concerns scientific specialties. The present picture of mobility aggregates researchers from all fields, masking any differences between scientific specialties. However, the specialty is the locus of knowledge production. Conditions of research such as positions available and funding (which are likely to have a strong effect on mobility and migration) are specific for each specialty." A disaggregated view would therefore be of great value for studies of the science system and research policy. Assigning authors into subject field(s) is not unproblematic, but if a reasonable approach could be devised (such as using the most common subject classification applied to the journals used by each author as a proxy, for example) it would clearly yield valuable insights. Laudel agrees: "Measuring scientific mobility on the level of specialties is methodologically challenging. The approach suggested - to use journal classifications - seems to be promising, at least for mobility patterns in the disciplines whose publication oeuvre is well presented in the publication database and if a specialty's core journals are used."

Still thinking in terms of differences between subjects, thought could be given to subject-specific thresholds for the publication productivity filters applied to focus on 'active researchers', as the filters used currently have a clear potential for bias against those working in fields with a reduced focus on publication in journals (humanities and some social sciences, for example) or researchers working not in academia but in industry. It is also quite likely that, given differences in the lifecycle of research projects across different disciplines, the definitions of migratory and transitory mobility applied here may not be appropriate for all fields.

Laudel says: "The authors distinguish between transitory and migratory mobility. This distinction between moves to another country for a limited period of time, which is a normal part of many researchers' career (transitory mobility), and the less common migration (permanent moves to another country) is important because science policy wants to encourage the first but to prevent the second. However, the empirical operationalisation of this conceptual distinction is extremely difficult. The two-year threshold applied by the authors for assuming migratory mobility appears to be too short. My own recent studies of academic careers show that it is common for postdocs to stay abroad for two years; and that even longer stays in a foreign lab - three or even four years - occur too frequently to be negligible. For future research I suggest experiments with varying thresholds of two, three, four, and five years."

The UK brain circulation map looks at researcher productivity and seniority over the entire 15-year span of the analysis, which offers an overview of the stocks and flows of human capital in that period but ignores the temporal dynamics of this complex system. On the basis of a detailed temporal analysis of the career trajectories of 20 individual scientists, Laudel made two very important observations: i) current elites recruit future elites; ii) it is not necessarily the current elite that migrate, but those who will go on to become the elite later in their careers - a country needs strategies to attract potential elite'. It would be of great interest to see how these observations on a handful of individuals in selected specialties scales to the active researcher population of the UK: can these findings be confirmed, or can they be even further refined?

Finally, Laudel suggests that more sophisticated metrics to describe the researchers comprising each of the mobility groups shown on the UK map could be devised: "While this information is very interesting, the relative productivity is very likely to be read as a proxy for quality, which is unfortunate. It is of course very important for science policy to know, for example, about the performance levels of researchers 'gained' and 'lost'. However, this requires better indicators than those which are not intended to represent quality but will inevitably be interpreted that way."

The brain circulation map presented in the ['International Comparative Performance of the UK Research Base: 2011'](#) report offers empirical progress on an important but difficult question. As Laudel concludes: "...the map provides not only interesting information, but also many suggestions for further research. Hopefully those will be taken up."

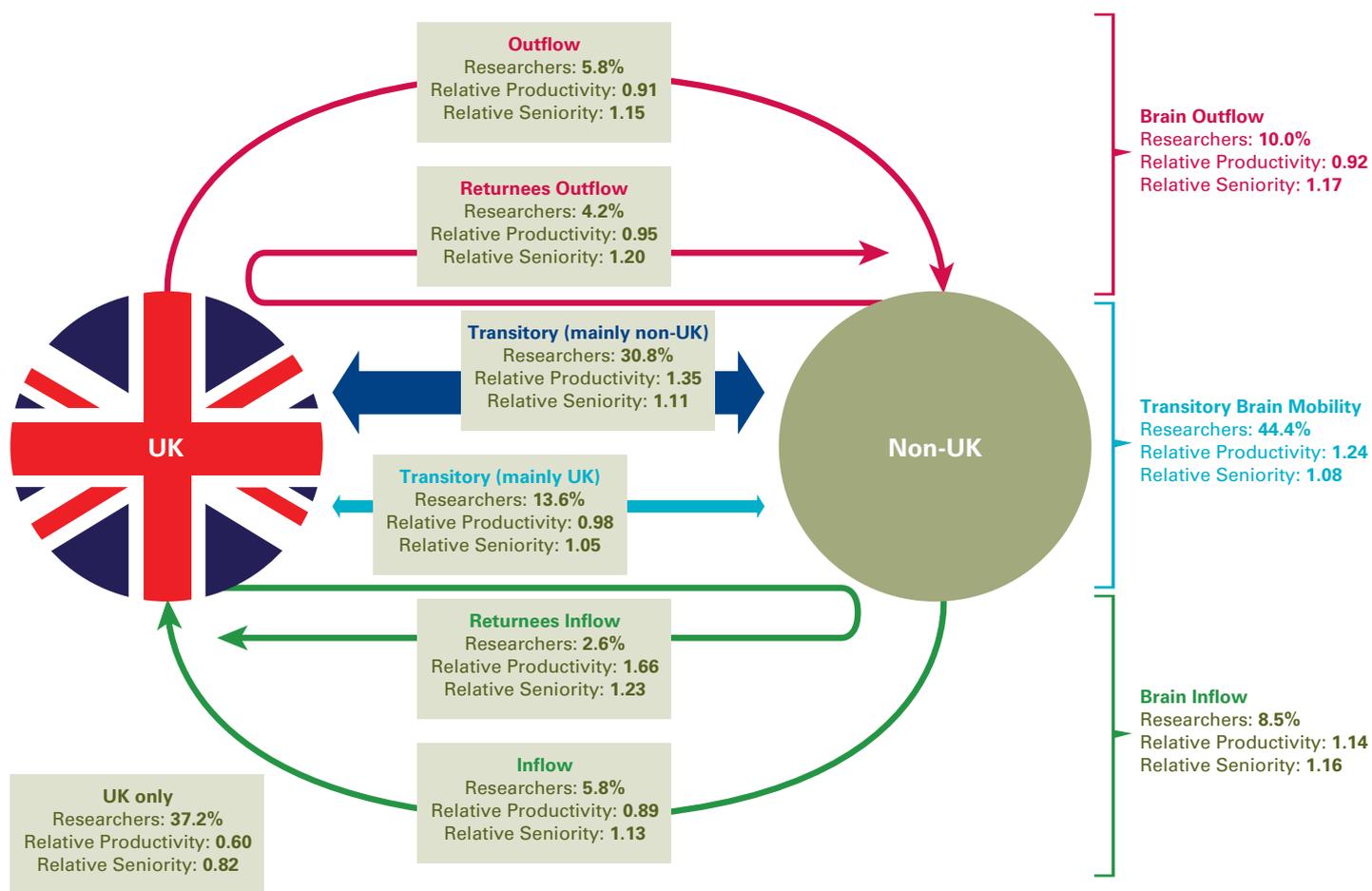


Figure 1 – International mobility of UK researchers, 1996–2010. See article text for further details. The original figure (Figure 3.3, pg. 21) appeared in the 'International Comparative Performance of the UK Research Base: 2011' report.

References:

1. Laudel, G. (2005) "Migration currents among the scientific elite", *Minerva*, Vol. 43, pp. 377-395.