

Title

Funding Thin Air: Research Collaboration and Geography of Excellence and Productivity in Finnish research 1995-2009

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Introduction

What type of research collaboration fosters excellence in knowledge creation? This remains a central challenge for sociology of science as well as research policy. By developing novel method of assessing credit for authorship and excellence with Finnish data for 1995-2009, this paper argues that conventional bibliometric assessments lead to misguided conclusions about how best research is created, and what type policies may promote research excellence. At the heart of our argument is the observation that conventional bibliometric measures fail to recognize at article level for the geographic locations of co-authorship, or to relate papers' received citations to number of authors and thus to productivity in terms of excellence. Consequently, much of research indicators focus on *papers*, instead of actual researchers and research communities, undermining the credibility and effectiveness of policy incentives for research excellence.

Although teams increasingly author most and the best papers (Jones et al 2008), and although much of Finnish (alike other) policy makers (e.g. Treudthardt and Nuutinen 2012, pp. 86) and analysts (e.g. Muhonen et al 2012) believe that international co-authorship equals higher citation impact, there are growing concerns of not seeing the forest for trees. Ionnadis (2008) argued that fractional count of citations received reveals that mega-authored papers are less efficient in attracting citations than smaller teams. Lee and Bozeman (2005) demonstrated that collaboration is not a good predictor of publishing productivity or high citation rates, and identified the nature of collaboration relationship as more significant factor than author team size. Indeed, although it appears that the conventional wisdom still holds that international collaboration increases citation impact, there is number of scholars who have cautioned of making too far-reaching conclusion on the basis of too stylized bibliometric assessments of research collaboration. (e.g. Katz and Hicks 1997; Persson et al 2004; Glänzel and Schubert 2004).

This paper demonstrates the amount of "noise" included in conventional bibliometric measures by contrasting at article level the international and national perspective, count of citations per author, and geographic location of authorship. Besides of providing accurate and more realistic description of co-authorship, our basic policy concern is whether policy efforts to boost excellence through internationalism is really viable, and we place our paper in the context of recent doubts on existing funding award criterias (Nicholson and Ioannidis 2012).

Data and Methods

We use Web of Science data for Finland from 1995 to 2009, provided in XML format on article level by Thomson Reuters in August 2012, including all WOS indexed fields. For this research, we have restricted data to types Article, Proceedings paper, Meeting abstracts, and Reviews, totaling 141 554 papers. For each year, we have also received all papers awarding citations to Finnish publications (totaling approximately two

million records). Using this latter set, we estimated how many times each Finnish publication published between 1995-2009 was cited during a 4-year citation window stretching from one year before the publishing year to two full years after.

By using the research address field, we calculated for each article the share of domestic and foreign authors, allowing us to re-calculate Finnish share of (institutional) authorship, and, more importantly, the Finnish share of citations received for each article. This follows in the CN_{CC} measure (Gauffriau et al. 2007) where $1/m$ score is given each country and m is the number of countries, and citations divided by the proportion given by the $1/m$ score. To rank articles annually according to citations received, we created two data sets. *Finnish* ranks articles in order of citations received by Finnish institutional authors, whereas the other one, *Absolute*, ranks articles in order of absolute citations received. This essentially allows us to credit citations received to different geographic locales. The method is in full described in Toivanen (2012a) and in the full paper.

We have divided these two sets of annual publications 1995-2009 in three echelons of research: First, the best and most visible research, or “*hot papers*” or the “*research front*”, defined here as the most cited 10% of publications that receive citations within the citation window. Second, the “*other cited papers*” that receive citations less than the “*hot papers*” within citation window, and, third, the “*non-cited papers*”.

Results

The results are summarized in Figures 1. to 3. Figure 1. shows the average number of authors and the average share of Finnish authors in the publications as a time series from 1995 to 2009. The average number authors, excluding the “*other cited papers*” is fairly constant. Similarly, with the “*hot papers*” and “*non-cited papers*” the average share of Finnish authors has remained high – “*hot papers*” and “*non-cited papers*” remaining significantly Finnish. The “*other cited papers*” group shows a more challenging trend, with significant variance in the average number of authors, suggesting structural system-level transitions in the structure or focus of research, such as annual variation in participation to international big science. Importantly, author teams for “*other cited papers*” are on average significantly larger and more international than those of “*hot papers*”.

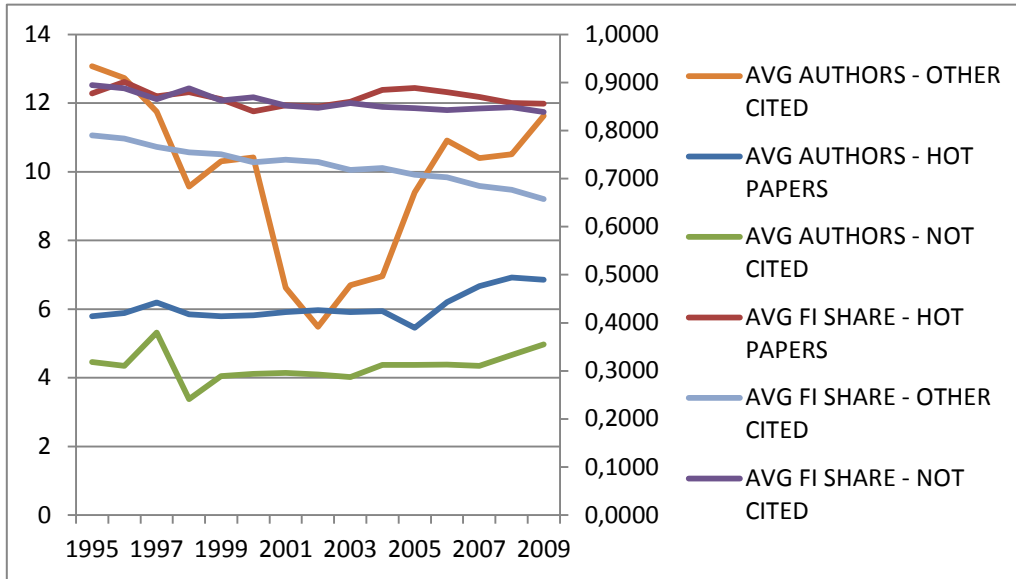


Figure 1. Average number of authors and the average share of Finnish authors in the publications in the three groups (Hot papers, Other cited papers and Non-cited papers) during 1995 to 2009.

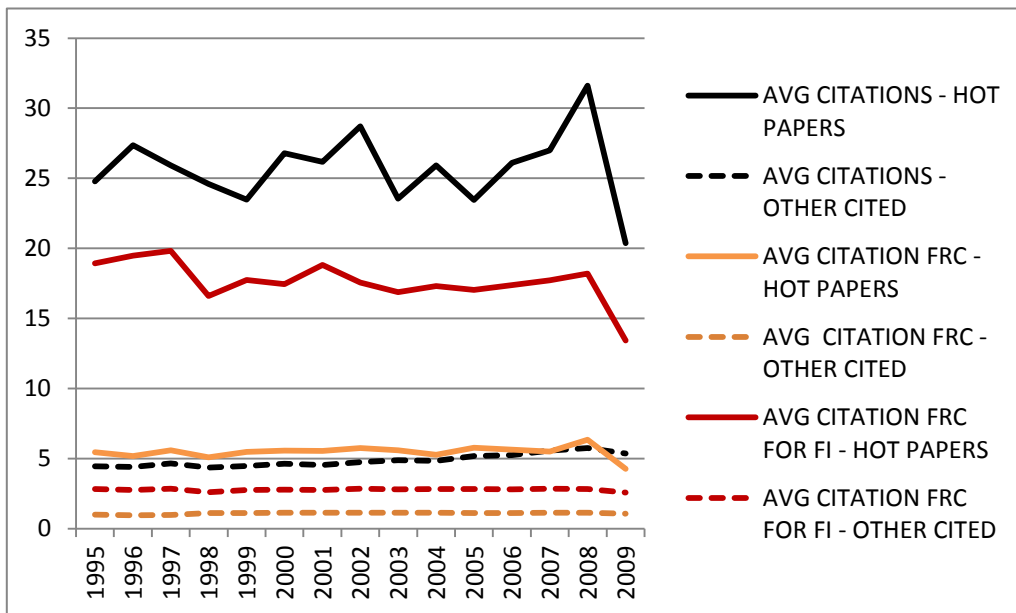


Figure 2. Average number of citations (AVG CITATIONS), average share of an author from citations (AVG CITATION FRC) and average share of Finnish authors from citations (AVG CITATION FRC FOR FI) within the two citation groups (Hot papers and Other cited papers).

When comparing the averages of the “*hot papers*”, and “*other cited papers*” further, there is a clear difference between the two groups. The average citation values of the “*hot papers*”, as expected, are significantly higher. In addition, the ratio of average citations and the share of Finnish authors remain higher for the “*hot papers*” within the time period. It is noteworthy, that although the average number of authors in “*other cited papers*” experiences a U-shaped curve the average citation values remain as a constant throughout the period.

Finally, we compare the average citation values against the by absolute values times cited highest publications. We see that while the average citation share of an author remains the same, the impact of Finnish contributors becomes smaller. Seen in Figure 3, average citations of the by absolute values times cited highest publications is higher than that of the Finnish "hot papers". In addition, the absolute value "hot papers" have a lower fractional share of Finnish contributors.

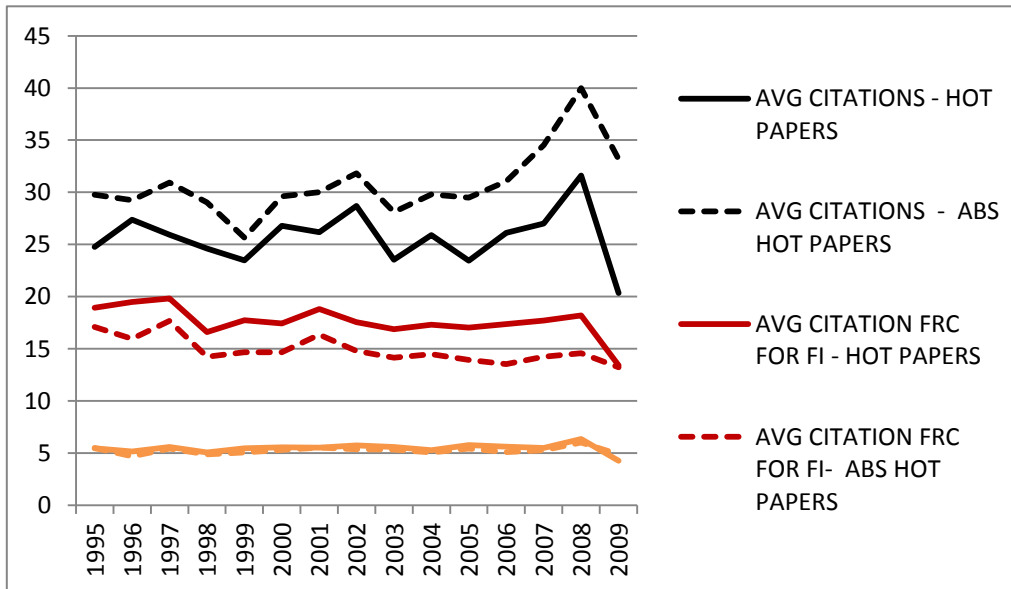


Figure 3. Comparison of citation profile between the "hot papers" in the two data sets, *Finnish* and *Absolute*. Values used are Average number of citations (AVG CITATIONS), average share of an author from citations (AVG CITATION FRC) and average share of Finnish authors from citations (AVG CITATION FRC FOR FI)

Discussion

By exploring the nature of Finnish research 1995-2009, we have demonstrated that the nature of the *Finnish "hot papers"* or *research frontiers* doesn't correspond with the idealized vision of "high quality research". It is created by relatively small author teams (on average 6 co-authors) and is highly national (on average 85% of authors are Finnish), and that as such it resembles closely research with no impact, i.e. the *non-cited papers* (4 authors; 86% Finnish, respectively). These two groups differ dramatically from the "other cited papers" (10 authors, 73% Finnish, respectively). This result alone gives rise to the suspicion that conventional (Finnish) policy efforts to foster research excellence target the middle-tier papers, and target poorly the best papers that resemble closely the worst ones, but is compounded when we show that the *Absolute "hot papers"* – the assumed cr me of Finnish science - has less than half of Finnish institutional authorship.

As such, our results have immediate bearing upon public policies and institutional strategies trying to foster excellence in science, up to the point of suggesting that many of the existing approaches may be wrong-headed and target wrong (mediocre)

researcher populations. This especially, if they are underpinned by simplistic assumptions that large and international author teams lead to scientific excellence, or are based on assessments of research that are blind to geographic sources of authorship. While our results may be a Finnish idiosyncry, the bibliometric assessment method and some literature (Toivanen 2012b) suggests otherwise, as the fractional accounting of geographic locations shows great variance in the share of domestic authorship. Naturally more comparative work is needed, and our full paper will expand this discussion fully, as well as develop further policy implications.

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