

Quantity does matter as citation impact increases with productivity



*Many scholars are encouraged to focus on the quality not the quantity of their publications, the rationale being that becoming too focused on productivity risks reducing the quality of one's work. But is this, in fact, the case? **Peter van den Besselaar** and **Ulf Sandström** have studied a large sample of researchers and found that, while results vary by field, there is a positive and stronger than linear relationship between productivity and quality (in terms of the top cited papers). This same pattern appears to apply to institutions as well as individual researchers.*

It seems obvious that science is about quality, not quantity. As a consequence evaluation processes do not take productivity into account, with there now being a trend to limit the number of publications per researcher under consideration. This way a panel can assess quality without being confronted with huge publication lists that would be impractical to evaluate. So, scholars may be encouraged to focus on quality, not quantity. Indeed, from this perspective, quality and quantity are opposite characteristics of research activity, and focusing on quantity is not only a mistake but will even have perverse effects as it will reduce quality of the work. However, these ideas might be misguided. Our understanding, developed in a recent [PLoS ONE paper](#), is that there is a positive and stronger than linear relationship between productivity and quality (in terms of the top cited papers).

Figure 1 shows the various possible relationships between “quality” and “quantity” that may exist: (i) there may be an “impact ceiling”, meaning that after a certain number of papers the number of highly cited papers stabilises; there could be (ii) diminishing; (iii) constant; or even (iv) increasing “impact returns” from productivity; and finally (v) “small may be beautiful” in the sense that the number of high-impact papers decreases when authors become too productive, trading quality for quantity. The good thing is that this can be investigated empirically.

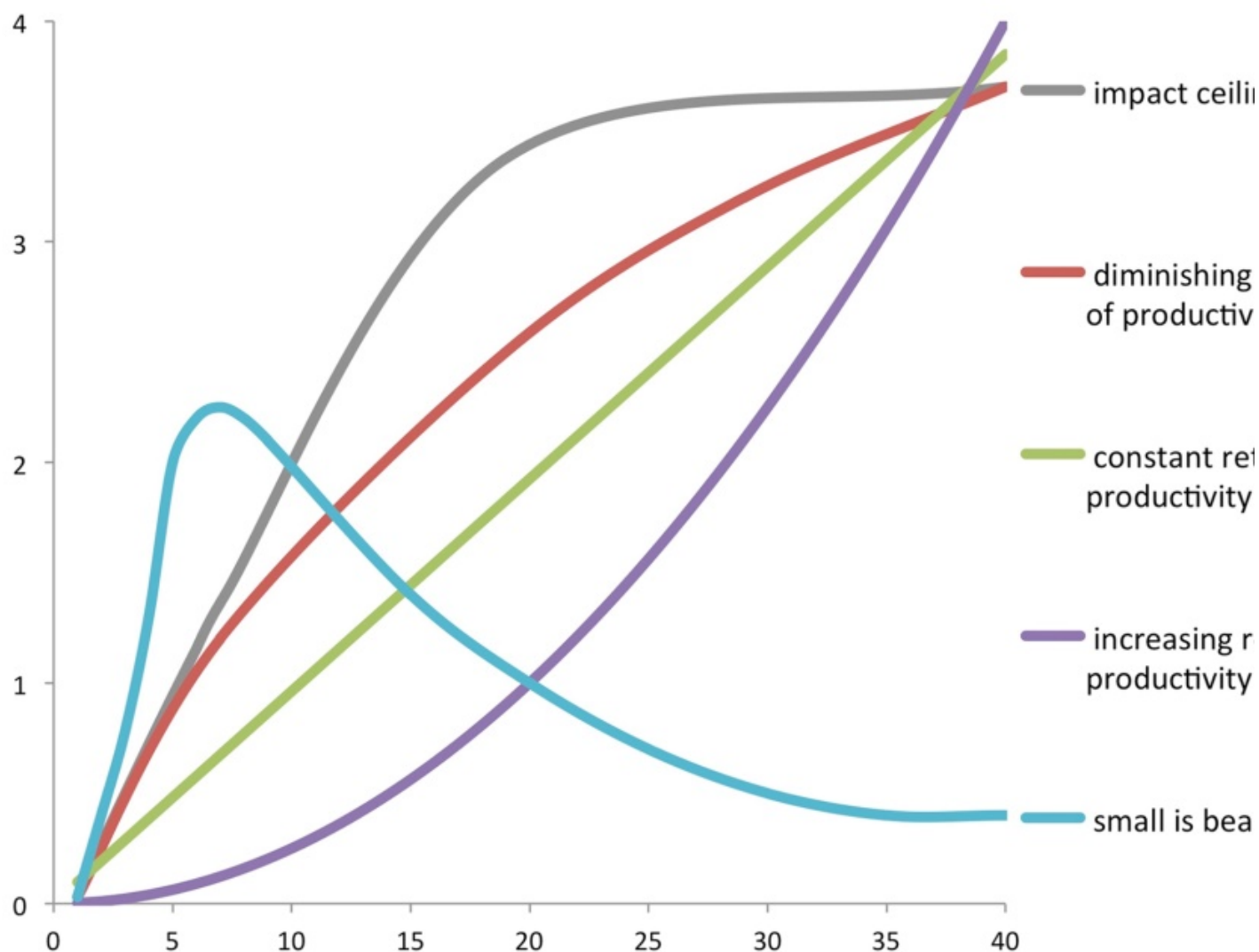


Figure 1: Possible views on the relationship between quantity and quality. Note: x-axis=#papers; y-axis=citation impact. Click to enlarge.

We show our findings by field, presented in the same way as the possible relationships above. We used a disambiguated dataset of more than 40,000 Swedish researchers (2008-2011). For each researcher we calculated the (field-normalised and fractionally counted) total number of publications and also the number of those publications that figure in the (2.5%) highest cited papers. Figure 2 shows the results: in the natural sciences & engineering, in the life & medical sciences, and in psychology & education, we find the “increasing returns” pattern. In agriculture, biology, environmental studies & geography, the “constant” pattern dominates. In the social sciences, the (slightly) “diminishing returns” pattern seems to dominate; whereas the “impact ceiling” pattern was found for computer science & mathematics and for the humanities.

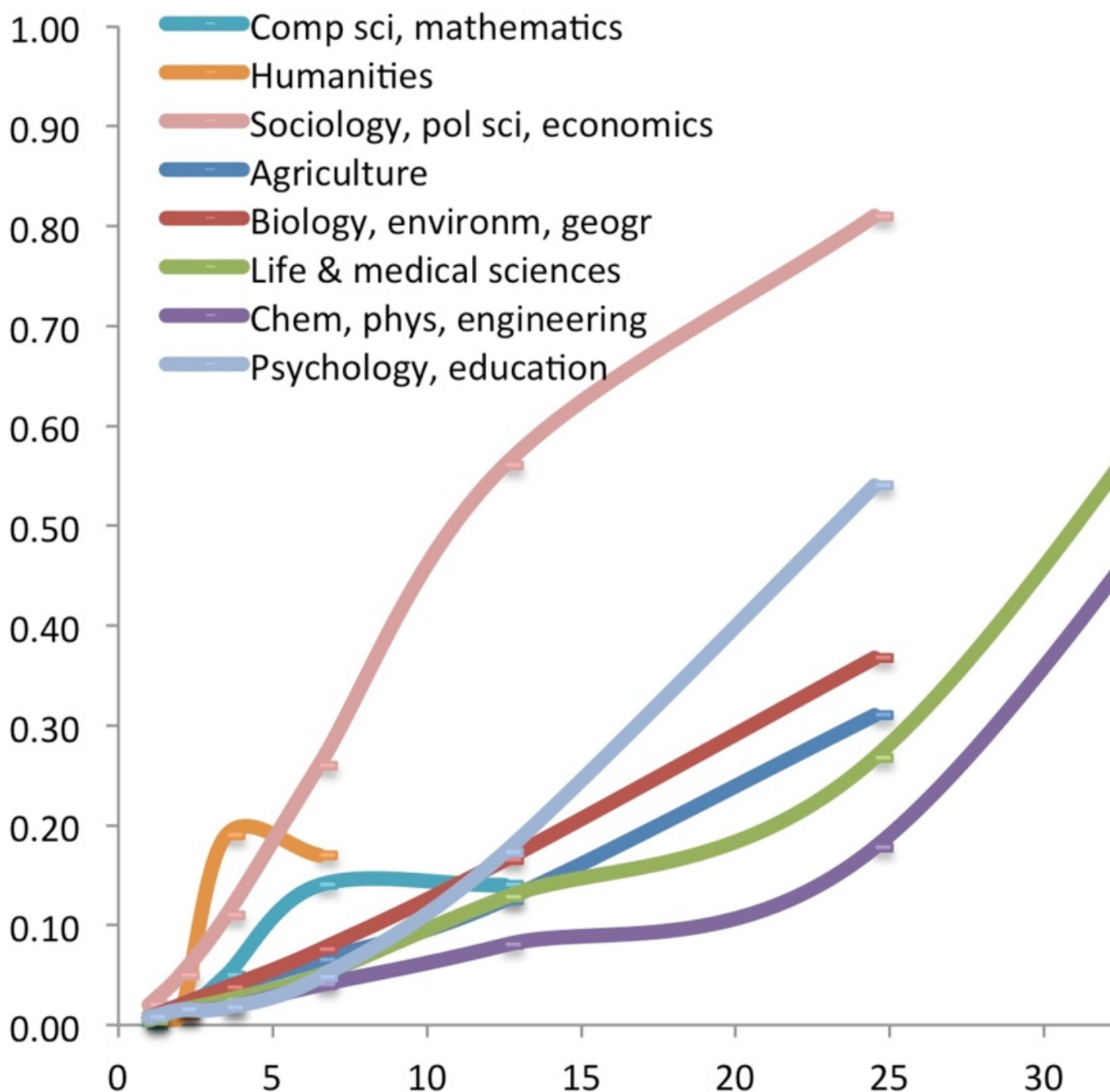


Figure 2: Actual relationship between quantity and quality based on Swedish data 2008-2011 per discipline area. Note: x-axis=#papers; y-axis=citation impact (left axis – natural and medical sciences; right axis – human and social sciences). Source: Web of Science Online. Click to enlarge.

Interestingly, the “small is beautiful” pattern does not occur. The question remains as to why the pattern in the computer sciences and the humanities is so different from other fields. This is probably related to the nature of these fields, which, more than elsewhere, have several audiences other than their scientific peers. We would suggest that prolific authors in the computer sciences and humanities move towards writing more for stakeholders other than the peer audience once their scholarly output is above a (reasonably high) threshold. However, to sort this out would need further research.

How can we explain the patterns we find? First of all, research shows that scholars are generally highly motivated and committed, so there is no good reason to expect that they would try to maximise output at the expense of quality. Secondly, theories of scientific creativity suggest the opposite: the more creative someone is, the more new ideas someone generates, the more potential and (as our results suggest) realised papers the researcher has. Of course, not all ideas are good ideas, but [the more ideas one has, the higher the probability](#) that some are good. It is all about trying, experimenting, learning: the more one does, the better one becomes, on average.

This size effect also holds at organisational level, something we did not address in the [PLoS ONE paper](#) but tested after a reviewer claimed the opposite: “the CWTS Leiden Ranking, for example, does not show such a linear relationship as the authors claim between the number of papers produced by a university and the percentage of highly cited papers produced by that university”. We tested this using the [Leiden Ranking 2014](#), which details the number of papers and the number of papers belonging to the top 10% highly cited papers for all universities included. As Figure 3 shows, the relationship between quantity and quality/impact also follows the “positive returns” pattern at the level of universities and public research organisations.

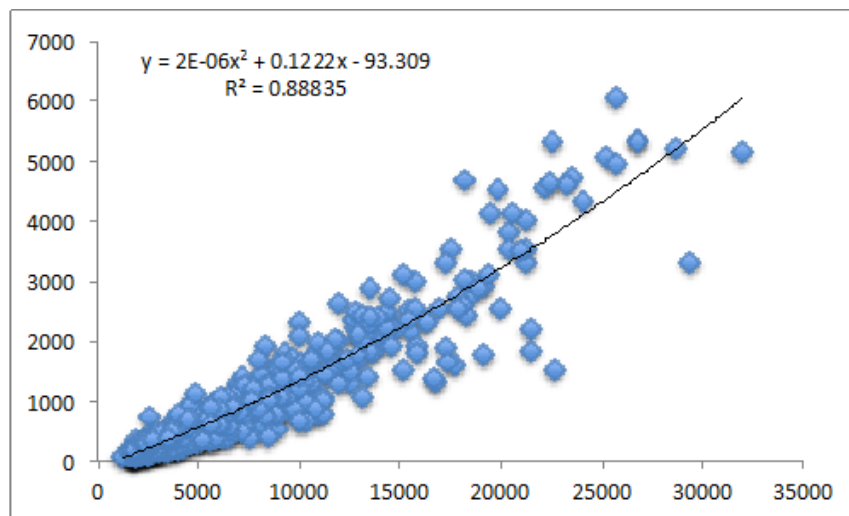


Figure 3: Relationship between number of papers per university and impact in terms of Top10% papers. Source: The Leiden ranking 2014.

In conclusion, what we have seen is that, overall, there is a positive quality return from increased productivity. Higher numbers of papers do result in even higher numbers of top cited papers. In other words, stimulating output matters, and would seem to be a positive and not a negative incentive for researchers. This being the case, output levels should be taken into account in the evaluation of researchers and organisations. This, of course, does not imply that output is the only relevant evaluation criterion; but that it is relevant seems indisputable.

This blog post is based on the authors' article, "[Quantity and/or Quality? The Importance of Publishing Many Papers](#)", published in PLoS ONE (DOI: [10.1371/journal.pone.0166149](#)).

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