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Strength in diversity

Richard B. Freeman and **Wei Huang** reflect on a link between a team's ethnic mix and highly cited papers.

Sticking with co-authors with similar surnames to yours might dent the impact of your work. The reason is unclear, but bibliometrics suggest that teams with greater ethnic diversity generate papers that make more of a splash in the scientific literature.

We analysed[1] 2.5 million research papers in which all of the authors had US addresses. Our study showed that US-based authors with English surnames were more likely have co-authors with English surnames than would occur by chance; those with Chinese names were more likely to have co-authors with Chinese names, and so on. The trend held for seven other groups, including Russian and Korean populations, between 1985 and 2008 in 11 scientific fields, including biomedicine, physics and geosciences.

The results hint that scientific research is much like the rest of social life. Studies of social networks find that people eat with, work with and generally connect with others similar to themselves, a tendency that some sociologists call homophily.

To the extent that surnames can be a proxy for ethnicity, homophily in scientific collaborations also seems to be related to a work's reception in the scientific community. After controlling for numbers of authors and for factors such as an ethnic groups' population density, we find that greater ethnic homogeneity among authors is associated with a paper's publication in lower-impact journals. It also predicts fewer citations. Papers with four or five authors of multiple ethnicities have, on average, one to two more citations than those written by authors all of the same ethnicity. This effect represents a 5–10% difference in the mean number of citations for a given publication.

What might explain this observation? Scientists with lacklustre or fewer papers may have a narrower pool of potential collaborators. Homophily is greater for authors with weaker publication records. But even when we compare work from authors with similar publication histories, homophily is still associated with lower-impact papers.

NETWORK EFFECTS

Teasing out the implications of these findings is difficult. Teams with members from diverse ethnic backgrounds may benefit from a greater variety of perspectives. Researchers have been shown to think differently when they work in diverse groups because they expect greater challenges to their ideas, or because small group dynamics are altered[2]. Given that communication can be hampered by linguistic or cultural differences[3], perhaps researchers make an extra effort to work through these challenges on research questions that are likely to have particular impact.

Network effects offer a different sort of explanation. A paper generated by a more diverse research group could tap into different networks and thus attract greater attention and citations, an effect observed in patents studies[4], and in inter-institution and international collaborations[5]. And although using journal impact factors to infer the quality of individual papers is controversial, that relationship, too, indicates that diverse teams publish stronger papers.

In other words, greater diversity of authorship might boost either the quality of the paper or the number of people who notice it, or both. One way to distinguish between the two would be to examine the terms, techniques and references in papers. If ethnic diversity contributes to productivity by widening ideas, papers from more-diverse collaborations should contain a wider range of scientific terms, use more varied equipment, procedures, or data and reference a wider range of previous work than papers from homogenous groups. In the biomedical sciences, the medical subject heading, or MeSH, terms would provide a natural measure, as might automated text analysis.

Another approach would be to model the probable impact of network effects on citations and then estimate the effect of co-authors in differently sized ethnic networks. This type of analysis could also be used to determine the mechanism by which inter-institutional or international collaborations often have greater impact than collaborations written at a single address.

Finally, we are studying the ethnic mix of collaborators who met at scientific meetings, and the impact of resulting papers. This would control for variation in the opportunity to meet people of different ethnicity, and could isolate people's preference for homophily or diversity.

These are questions worth pursuing. We need to work out what makes the most creative and effective scientific teams. ■

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