

Dutch research funding, gender bias and Simpson's paradox

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Based on, amongst others, three consecutive years of grant applications to the "VENI programme" of the Netherlands Organisation for Scientific Research (NWO), Van der Lee and Ellemers (3) conclude that these data "provide compelling evidence of gender bias in personal grant applications to obtain research funding". One of the main results this claim is based upon is that out of the 1635 applications by males, 17.7% was successful, whereas out of the 1188 applications by females, only 14.4% was successful. When applying the χ^2 -test to the data, the authors find a p -value of .045. This conclusion is based on the application of an inappropriate statistical procedure and therefore questionable, due to the so-called Simpson's paradox.

Simpson's paradox dates back to Simpson (4) and gained familiarity after Bickel, Hammel and O'Connell (2). In essence, Simpson's paradox states that an apparently significant relation between two variables in a contingency table, can be due to a joint dependency on a third variable.

In Table S1 (Van der Lee and Ellemers, 3), a breakdown of grant applications per research discipline is presented. The proportion of female applicants varies from 11.8% (physics) to 51.4% (health sciences), and the total success rate varies from 13.4% (social sciences) to 26.3% (chemical sciences). Figure 1 visualised these data and immediately shows a clear negative relation between the proportion of female applicants and the total success rate. It turns out that women tend to apply more often to competitive disciplines such as health sciences and social sciences, whereas men apply more often to less-competitive disciplines such as physics and chemical sciences. In four out of the nine disciplines, women have a higher success rate than men, and in five out of nine, men have a higher success rate than women. When taking into account that multiple comparisons are performed, for none of the disciplines the gender bias is significant (at the $\alpha = .05$ level). Thus, when taking into account the spurious correlation, the statistical significance of the relation is vanishes.

As a consequence, Van der Lee and Ellemers' conclusion could be severely influenced by this issue – at least for the (large) part where this claim is based on the supposed p -value of 0.045. The authors perform other tests on various aspects of the proposal review process, but the data provided in the paper is insufficient to check whether these tests suffer from

Simpson's paradox as well. Since these tests study related issues, it is not unlikely that this is indeed the case.

Further scrutiny of NWO-data is needed to assess whether gender bias indeed affects Dutch science funding. This includes studying data from other years and programmes. Interestingly, on the aggregate level, men received relatively more grants than women in 8 out of the 14 VENI-calls. This, again, is no statistical significant indication of gender bias (Albers, 1).

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Figure 1. Proportion of applications submitted by females versus the (overall) proportion of accepted proposals, per NWO discipline. The size of the markers is proportional to the number of applications.

References

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