

Response to Dr. Zigerell's Blog Post on "Small-Sample Effects in Quillian et al. 2017 PNAS"

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(Referring to Lincoln Quillian, Devah Pager, Ole Hexel, Arnfinn Midtbøen. "Meta-analysis of field experiments shows no change in racial discrimination in hiring over time." *Proceedings of the National Academy of Sciences of the United States of America*. Online before print, September 12, 2017. Available here: <http://www.pnas.org/content/early/2017/09/11/1706255114.abstract>).

In his blog post, Dr. Zigerell argues that tests that look for a symmetric funnel of effects show asymmetry for our data on discrimination against African-Americans, 1989-2015. He suggests this may indicate publication bias – that studies that found little evidence of discrimination against African-Americans were less likely to be published, with the result that our results would overstate the level of discrimination against African-Americans. The main reason to be concerned about funnel-plot asymmetry is the possibility it indicates publication bias.

We agree with Dr. Zigerell that any meta-analysis should consider the issue of publication bias. Correspondingly, our original paper included an extensive discussion of publication bias (On page 5 of the manuscript and section 5 of the Supplementary Information Appendix). As we discussed, we took efforts to find unpublished studies of discrimination and include them in our analysis by conducting an author survey and including unpublished papers in our analysis. We also performed our own test of publication bias in our paper, and included discussion of the issue.

Strangely, Dr. Zigerell's comment ignores the discussion of publication bias present in the text of our article. Dr. Zigerell instead applies a test of funnel-plot symmetry that is well-known in the meta-analysis literature. However, as we discussed in SI Appendix 5 of our original paper, we believe the test of funnel-plot symmetry is inferior to the test in our paper. In what follows, we expand on the discussion in our original text and explain why we think this and other evidence suggests publication bias is not a problem for our results.

**1. Tests using the substantive focus of papers show no evidence of publication bias:** In our paper, we discuss publication bias in supplementary information appendix section 5. The test we employ is simple, but is not a test like funnel-plot asymmetry that can be applied mechanically to any meta-analysis dataset.

One variable we were able to code from our analysis is a measure of whether a study is primarily focused on race/ethnicity or whether it is primarily focused on another factor influencing hiring (e.g. credentials or a criminal record) but, because it used racially diverse application profiles, can be used to estimate discrimination. We include a variable measuring substantive focus on race/ethnicity or another attribute as a predictor of the discrimination ratio. If publication bias is a serious issue, then studies that focus on factors other than race/ethnic discrimination should show lower discrimination

than studies focused primarily on race/ethnicity, because for the latter studies (but not the former) publication should be difficult for studies that do not find significant evidence of racial discrimination.

The results of using this predictor in our meta-regression are shown in the SI Appendix table S7 of our original study. Not only is there no statistically significant difference between studies with and without a race focus, we find that the direction of association is inconsistent with publication bias. Studies not focused on race/ethnicity show slightly higher discrimination ratios than those primarily about race/ethnicity. This is contrary to a claim of substantial publication bias, in which studies focused on race/ethnicity that show substantial discrimination are more likely to be published.

As we discuss in the next section, a major appeal of this test is the lack of assumptions it requires. By contrast, the tests Dr. Zigerell suggests for publication bias require strong assumptions that there is reason to believe don't hold in our data, as we discuss in our next point.<sup>1</sup>

## **2. Tests based on funnel plot asymmetry often generate false positives as indicators of publication bias.**

As the *Handbook of Meta-Analysis* summarizes: "It is important to appreciate that funnel plot asymmetry may not be related to publication bias at all. Any factor associated with both study size and effect size may potentially confound the relationship" (Sutton 2009). Correlations between study sample size and other study characteristics, measured or unmeasured, can lead to funnel plot asymmetry without any publication bias.

Are there characteristics of studies that tend to differ between small-n and large-n studies in our analysis? The answer is clearly yes for several of the covariates we include in our meta-regressions. Perhaps most clearly, in-person audits tend to have much smaller sample sizes than resume audits, because the cost of additional cases is greater for in person audits than resume audits. Smaller studies also more often have limited geographic samples of one city or area (rather than multiple cities) and more often cover a small set of occupations (e.g. Bendick 2010 just looked at waiters in restaurants). Correlation of these variables with rates of discrimination could produce funnel plot asymmetry without any publication bias. As we discuss in the next section, our results suggest that in person versus resume audit likely acts as a confounding variable that produces funnel asymmetry without publication bias.

The ambiguous reasons for funnel-plot asymmetry makes us prefer the substantive test we previously discussed for determining publication bias. It does not require the strong assumptions found in Dr. Zigerell's funnel plot asymmetry tests that there are no study characteristics that are correlated with discrimination levels and study size.

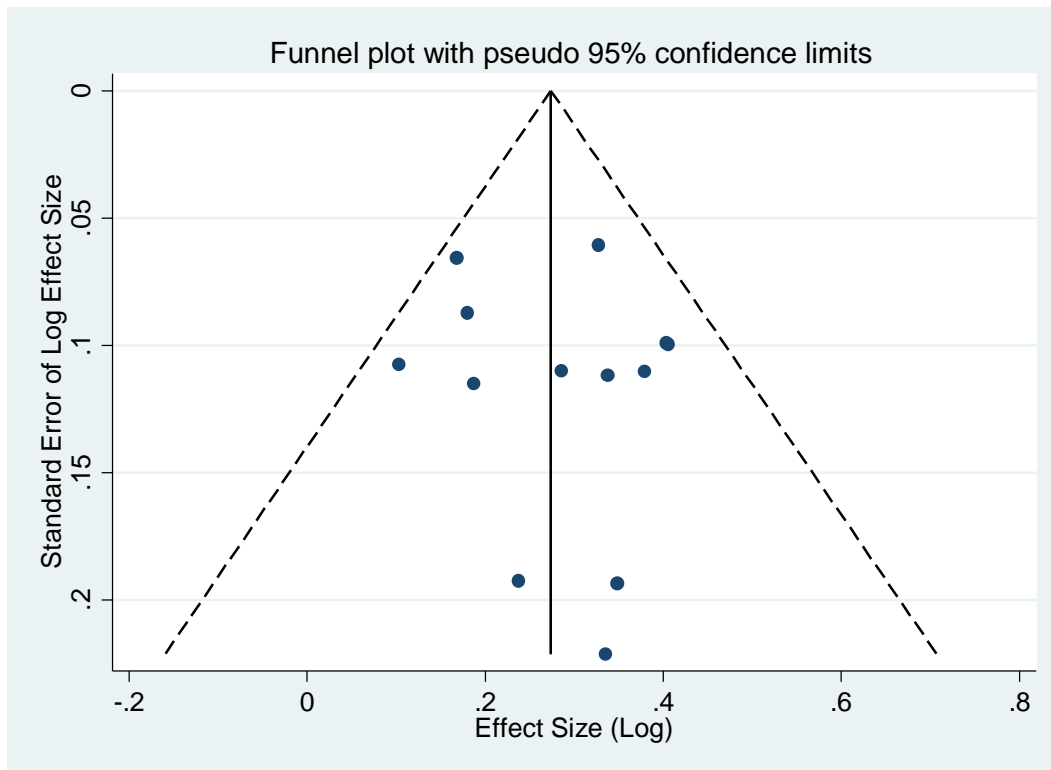
## **3. There is no funnel plot asymmetry just using resume audit studies, and our results hold just as well only using these studies.**

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<sup>1</sup> We note we are not the first to use this type of test, for instance see Taylor et al. 2014. Our statistical consultant Larry Hedges also approved use of this test for this purpose.

One study characteristic that is strongly associated with the sample size of a study is whether the study is a resume audit or in-person audit. Resume audits have larger sample sizes because it is much less difficult to send out a resume than to conduct a face-to-face audit. Tests of publication bias that account for study characteristics (covariates) are still being developed. As a second-best approach, we will consider the results just using resume audits, a typical approach suggested in discussions of publication bias (e.g. Sutton 2009).

A funnel plot for only resume audit studies (n=13) is below:



This plot shows no evidence of funnel asymmetry, and correspondingly Egger's test fails to reject ( $p=.647$ ). Using only resume audits to analyze change over time gives no trend (the linear slope is  $-.002$ , almost perfectly flat, shown in figure 3 in our original paper, and the weighted-average discrimination ratio is 1.32, only slightly below the ratio of all studies of 1.36). Overall, then, we get the same results just using the universe of resume audits, and funnel plot symmetry is clear for these studies.

#### **4. Taken at face value as indicating publication bias Dr. Zigerell's tests don't suggest any effect on the time trend.**

Dr. Zigerell argues there is publication bias in the African-American discrimination results. Our main finding is that we find stability, rather than decline, in the rate of discrimination against African-Americans. For this finding to be undercut, it would need to be the case that not only is there publication bias, but the extent of publication bias changes over time.

Dr. Zigerell provides some evidence on this point in his graphs that break down results by decade. His summary is “both graphs [by year groups] are at least suggestive of the same type of small study effects.” If we accept his suggestion these indicate publication bias, this suggests a constant bias over time, and one that should not alter the trend. His results then provide no reason to revise our main conclusion even if we were to accept his tests as valid measures of publication bias.

**Conclusion: Not much evidence of publication bias, and even less reason to think it occurs in a way that makes any difference for our results.** Studies that do not focus on race find slightly higher discrimination than studies that are primarily focused on race, a fact highly inconsistent with publication bias. Dr. Zigerell’s tests are well-known to generate false positives of publication bias, and we find evidence that the difference between in person versus resume audit may create false positives for this test. Using just resume audits produces very similar findings to our base findings, but no evidence of publication bias. Overall, we find there to be much more evidence against strong publication bias in the field experimental literature on discrimination than in favor of it. We find even less evidence this bias would alter our major findings.

Some readers may find the result of no publication bias on this topic to be surprising. Isn’t it intuitive that it would be easier to publish studies that show bias than those that do not? However, we think that in a literature where past studies have found bias, it may be as easy (or easier) to publish studies that do not find bias. In fact, one reviewer of our manuscript objected to our paper on the grounds that “everyone knows there is a lot of discrimination and discrimination has persisted.” While we disagree with this statement especially as it applies to trend, it illustrates how a finding of no-discrimination may be more novel than a finding of discrimination to many scholars, and therefore more publishable.

## References

Sutton, Alex J. 2009. “Publication Bias”, Chapter 23 in Cooper, Harris, Larry V. Hedges, and Jeff C. Valentine, eds., *The Handbook of Research Synthesis and Meta-Analysis*. New York: Russell Sage Foundation.

Taylor, Gemma et al. 2014. “Change in mental health after smoking cessation: Systematic review and meta-analysis.” *British Medical Journal* 348:g1151 doi: 10.1136/bmj.g1151.