Closing the Gender Gap? How Altmetrics Influence Citation Counts for Political Science Journal Articles

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Abstract:
Gendered citation patterns in political science resemble those in many other disciplines (e.g., economics, sociology, linguistics, ecology) and show a tendency for male/mixed author teams to cite research by female scholars less frequently than female authors. This citation behavior generates a citation gender gap for traditional citation metrics (e.g., citation counts, h-index). These dynamics contributed to the development of Altmetrics, one measure that captures the quantity and quality of online attention to research in multiple outlets such as news coverage, blog posts, and social media. These non-academic venues enable scholars to promote their work more actively to broad audiences. Given that female scholars are as active on social media as male scholars, Altmetrics may display fewer gender gaps. However, whether these new measures translate into better research impact using traditional citation metrics remains unclear. Our paper analyzes the relationship between Altmetrics scores (and Tweet counts) in 2017 and citations in 2021 for 8,493 articles in 21 political science journals while controlling for authors' gender. Consistent with previous literature, we find that higher online attention scores significantly increase articles' citation counts. We also find that solo authored pieces show the strongest marginal effects, and that solo authored women and female author teams accrue more citations as Altmetrics scores increase. Our results suggest that online promotion of political science research will help to shrink the gender citation gap.

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Unlike early days of blogs, when political scientists were warned not to blog or engage in public discourse about research (Jaschik 2005), universities now actively encourage their faculty to engage online. Political scientists frequently use Twitter to discuss and share their research (Klar et al. 2020; Bisbee, Larson, and Munger 2020).[1] Nevertheless, most universities' promotion and tenure policies still emphasize traditional impact metrics, such as citation counts (e.g., Web of Science, Google Scholar) and citation metrics (e.g., h-index). Furthermore, these citation metrics are often gendered with women's research being cited less often by men and less central in citation networks (e.g., Dion, Sumner, and Mitchell 2018). Because women's research is cited less often and included in fewer syllabi (Colgan 2017) and because women cite their own work less often than men (King et al 2017), gender citation gaps persist in political science. Yet analyses show that the gender citation gap has been shrinking over time (Peterson 2018). It could be that the increasing presence of women on social media platforms helped to reduce the gap because women have been very active on Twitter and other platforms and because female networks like Women Also Know Stuff (WAKS)[2] promote research by women online.[3]

Greater social media attention for research can translate into more traditional citations of that work, as research in multiple disciplines have shown. Scholars often use the Altmetrics score of an article to gauge online attention for that research. Altmetrics is a London based company that measures online activity for scholarly articles (since 2011) on a variety of platforms such as Twitter, Facebook, Google+, Mendeley, blogs, and mainstream media.[4] A large number of studies find a positive and significant correlation between Altmetrics and citations across fields (Costas et al 2015; Paul-Hus et al 2015; Akella et al 2021) and in specific disciplines like communications studies (Repiso et al 2019; Wasike 2021), ecology (Peoples et al 2019), medicine (Eysenbach 2012; Thelwall et al 2013), and physics (Brody et al 2006). Articles reviewed in blog posts also have significantly higher citation counts (Shema et al 2014). In short, online engagement is beneficial for increasing scholarly impact.

However, a key question is whether online engagement with research exacerbates or mitigates gender bias in academic citations. Female scholars might tweet less often about research than male peers or accrue fewer citations from tweets (Dehdarirad 2020). An analysis of political scientist use of Twitter to share research suggests that the practice is gendered in that men are more likely to share research by men (than by women), while women do not seem to favor research by one gender (Bisbee, Larson, and Munger 2020). Another study finds few gender differences in article tweets in political science, although articles by solo authored women are more likely to be tweeted than articles by solo authored men (Klar et al. 2020).[5] Analytically,

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[1] Social scientists are the most frequent users of Twitter among all academics (Haustein et al 2015).
[2] A group of female political scientists formed WAKS in February 2016 to encourage journalists to seek out the expertise of women in the profession. The group also promotes women's research with the Twitter hashtag #WAKS. See https://www.womenalsoknowstuff.com/.
[3] Appendix figures A1 and A2 show an increasing average number of Altmetric attention scores in political science over time. A study of articles published in several prominent science journals found little to no gender gap in article tweets: "Women, who are underrepresented in terms of citation, are nearly at parity with their male colleagues in terms of the ratio between tweets and citations." (ACS Editorial 2017: 675) Similar patterns are obtained in analyses of political science Twitter data (Klar et al 2020).
[4] See https://www.altmetric.com/
[5] Hu, Kearney, and Frisby (2021) find that while the overall level of engagement in political topics on Twitter is similar between men and women, the patterns for tweeting are distinct. Women are much more likely to retweet

these studies of citations and Twitter focus on whether the association between author gender(s) and academic citations becomes less substantively and statistically significant when controls for Tweet counts are added. We build on this prior research by assembling a larger sample of political science and international relations journal articles, allowing for a longer lag between online engagement and subsequent citations (five years rather than one), using the Altmetric Attention score in addition to Tweet counts, and explicitly modelling whether the association between online engagement varies systematically by author gender. We find that higher Altmetric scores and tweet counts lead to higher citation counts for all authors in political science, but that the greatest benefits accrue to solo authors (female and male) and all female author teams. Our findings suggest that universities should pay more attention to Altmetrics in tenure and promotion cases as their efforts for public engagement have an added benefit of mitigating gender gaps that arise with traditional citation metrics.

Research design and data

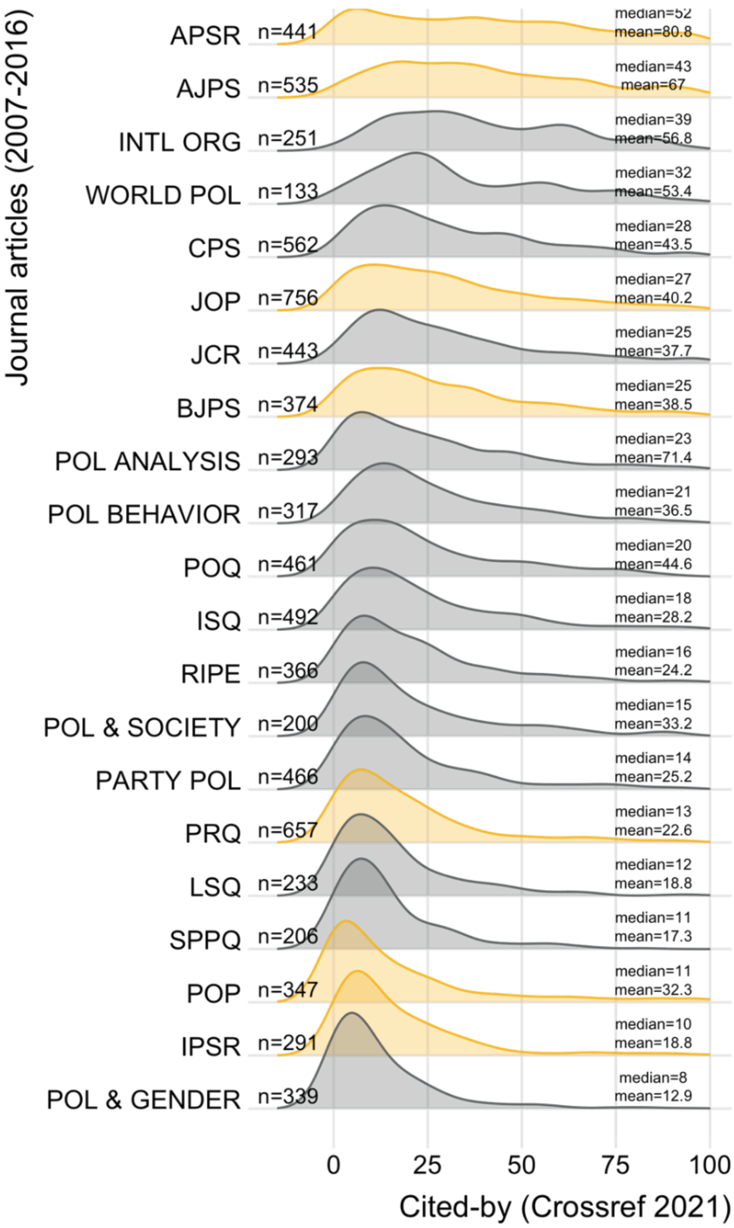
To understand these relationships, we model the count of *academic citations* in 2021 as a function of Altmetric scores and tweet counts in 2017, controlling for author(s) gender(s). Our sample includes 8,493 research articles published in 21 political science and international relations journals between 2007 and 2016.[6] These journals include a mix of general journals that publish research in all fields of political science and specialty journals that publish research focused on one (or more) subfields (e.g., *International Studies Quarterly*) or a topical focus spanning fields (e.g., *Party Politics* or *Politics & Gender*). Figure 1 illustrates the distribution of academic impact, our outcome of interest, which is measured using the June 2021 Crossref Cited-by indicator (Crossref 2021; 2020a), a count of citations in their database of academic books, articles, datasets, preprints, and similar scholarly output.[7]

content by men related to politics, while men are more likely to post original content. Additionally, men are much less likely than women to retweet content by women tweeters. This suggests that network connections could influence the dynamics of Altmetrics and create gendered differences.

[6] We include article corrections, introductions to thematic article collections, and other types of academic exchange (e.g., replies, responses, and letters to the editor). In June 2017, we identified our population using the Web of Science, searching by journal ISSN for all items published between 2007 and 2016. We excluded book reviews and items that do not include scholarly content (e.g., editor's notes, contents), resulting in 8,721 items, of which 228 were excluded from analysis due to missing DOIs. The missing DOIs are limited to 1-3 articles per journal and year with a handful of exceptions. The sample is missing DOIs for: a) all but four years of *Comparative Politics*, b) half of the articles in *World Politics* in 2010; and all articles in the *Journal of Politics* in 2007 (see Appendix Tables A1 & A2). The sample excludes all articles from *Perspectives on Politics* and *Politics & Gender* in 2007 because they were not yet indexed in the Web of Science. Their first issues were published in 2003 and 2005, respectively.

[7] In June 2021, we used the DOIs to collect the item Cited-by counts from the Crossref API (2020b). We also downloaded Web of Science Times Cited in 2021(Web of Science 2018) as another measure of academic citations for each article and include figures and results for this alternative outcome measure in the Appendix.

Figure 1: Distribution of Cited-by in 2021 for articles published 2007-2016 in 21 political science journals



Note: Darker distributions are specialized journals with a subfield or topical focus, while the lighter shaded journals publish across all subfields of political science.

We measure *online engagement* using the summer 2017 Altmetric Attention score and Twitter citation counts.[8] Altmetric Attention scores are proprietary, weighted scores that may

[8] Using the DOIs, we queried the Altmetric API (2015) to retrieve item Altmetric Attention scores and Tweet counts in July 2017. Altmetric API returns records only for those items with positive Altmetric Attention scores (the minimum in our sample was 0.25), and therefore items with valid DOIs but missing Altmetric Attention scores or Tweet counts were recoded from missing to zero (n = 3659). We also excluded two articles (Gilens and Page 2014; Levin 2016) that are outliers. Both articles have Cook's D scores greater than two in a least squares regression of Cited-by on Altmetric Attention score interacted with author(s) gender(s), centered age of article, and a set of

increase or decrease over time and measure online engagement across a number of platforms at the time of data collection (Priem, Groth, and Taraborelli 2012; "The Donut and Altmetric Attention Score" 2015). The mean Attention score in 2017 is 6.53 with a range of 0 to 539.82. We also use the count of Tweets (or Twitter mentions) as a secondary measure of online engagement from the same source.[9] In our sample in 2017, the mean number of Tweets was 3.15 per article (range of 0 to 555), more than 14 times the mean number of mentions in the next most popular online source (mainstream media) tracked by Altmetric at the time (see Appendix, Table A3). Our sample roughly parallels the first decade of Twitter's existence as well as the rapid expansion of Twitter use among academics, including political scientists. See Table 1 for descriptive statistics for these measures of academic citations and online engagement.

Table 1: Descriptive statistics for academic citations & online engagement

Indicator	Min	P25	Median	P75	Max	Mean	SD	N
Cited-by (2021)	0.00	9.00	20.00	44.00	2027.00	38.80	68.69	8163
Times Cited (2021)	0.00	9.00	20.00	43.00	1921.00	37.67	65.56	7568
Attention score (2017)	0.00	0.00	1.00	5.61	539.82	6.53	18.03	8491
Tweet count (2017)	0.00	0.00	0.00	3.00	555.00	3.15	11.19	8491

To determine the probable binary gender of article authors, we used the first five authors' first and second names to query the Genderize.io API (Genderize 2018), which others have found has an error rate of less than 2% (Teele and Thelen 2017, 444 fn. 10). The API returns a probable binary (male/female) gender based on social media display or real names combined with profile gender information.[10] If an author's first [or when authors use a first initial, the second] name generated a predicted binary gender with an estimated probability equal to or greater than 0.7, the author was assigned that binary gender. Any remaining author names without a gender yet assigned were coded as the predicted binary gender only if both the first and second names predicted the same gender (where both probabilities are greater than 0.5 and less than 0.7). Once the first five author names were coded, we coded the article author(s) gender into five categories: solo male, solo female, all male teams, all female teams, and mixed gender teams (see Table 2).[11] We were not able to code the probable gender of authors of 472 articles. Overall, in our sample of 8,493 records for which we had a DOI to collect academic citations and online engagement, 328 articles are missing Cited-by counts, 472 are missing author gender coding, and only 19 articles are missing both indicators.

dummies for journal. Unlike most articles in the sample, these two have exceptionally high Altmetric Attention scores, in part due to engagement beyond academia including atypical engagement in public partisan political debates combined with relatively modest or typical academic citation counts.

[9] Twitter debuted its service in March 2006 and was in widespread use less than two years later. In early 2008, the first discussion of Twitter for teaching or networking appeared in *The Chronicle of Higher Education* (Young 2008a; 2008b), and both major party candidates used Twitter in the 2008 United States presidential election.

[10] We describe this variable as gender rather than sex because the algorithm is based on users' expressed or chosen gender on social media cites, rather than their sex. Many, though not all people who identify as non-binary or transgender choose or use names that reflect or align with societal gender norms, often choosing names that may be gender ambiguous or convey a particular gender when used by people who identify as cisgender.

[11] Teams with at least one male and one female author were coded as mixed gender, even if all other team member genders were not coded.

Table 2: Frequencies of author genders

Author gender(s)	N	Proportion
Women team	309	0.04
Men team	2273	0.27
Mixed gender team	1685	0.20
Solo woman	1126	0.13
Solo man	2628	0.31
Solo uncoded	152	0.02
Uncoded team	320	0.04
Total	8493	1.00

Analysis & results

Our outcome of interest, the count of academic citations in 2021 for each article, is not normally distributed (see Figure 1 and Appendix Figure 1). In addition, academic citations of articles are nested within journals, which are likely to vary in their average academic citations. Therefore, we estimate negative binomial mixed effects models that regress academic citations on online engagement (either Altmetric Attention score or Tweet count divided by 100)[12], author gender(s), and an indicator for difference between 2017 (the year online engagement is measured) and publication year with varying intercepts (random effects) by journal.[13] To test whether the association between academic citations and online engagement varies by author gender, we also estimate the model allowing the association to vary by author team.

Consistent with previous literature, we find a positive and significant relationship between Altmetric Attention scores and Crossref citation counts (Table 3). On average, each 100-point increase in the Altmetrics Attention score in 2017 is associated with over 9 times higher Crossref citation rates in 2021. We observe similar patterns when using Twitter mentions as the online engagement measure (Table 4); 100 tweets about an article in 2017 are associated with 26 times higher citation rates in 2021. Online engagement is a net positive for scholars looking to increase attention and scholarly impact of their research.

To evaluate if there are gendered differences in these relationships, we add the author(s) gender variables in Model 1 and interact them with Altmetrics Attention scores in Model 2. Figure 2 compares the marginal effects of Altmetrics for each gender configuration using the results from Model 2. We find that solo authored articles accrue more citations from Altmetrics and that articles authored by solo females have the largest effect (3.4 more citations for each 100-point increase in Altmetrics). We also show that all female teams have the next highest marginal effect after solo authored articles. However, mixed gender author teams have the weakest relationship between Altmetric scores and citations. Analyses of Twitter mentions (Table 4 and Figure 3) show similar results, with solo female authors gaining 7 times more traditional citations for each 100 additional tweets about their article. Models estimated with Web of Science citation data for the dependent variable produce similar findings too (Appendix Table A4). These results suggest that while all articles benefit from higher online attention, the benefits are strongest for solo female authors.[14]

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[12] We divide the Altmetric/Twitter scores by 100 to help keep our variables on a similar scale for the model.

[13] We also estimated Poisson mixed effects regression models of Crossref Cited-by regressed on either the Altmetric Attention score or Tweet count, followed by tests confirming that the outcomes are over dispersed ($p < 0.001$).

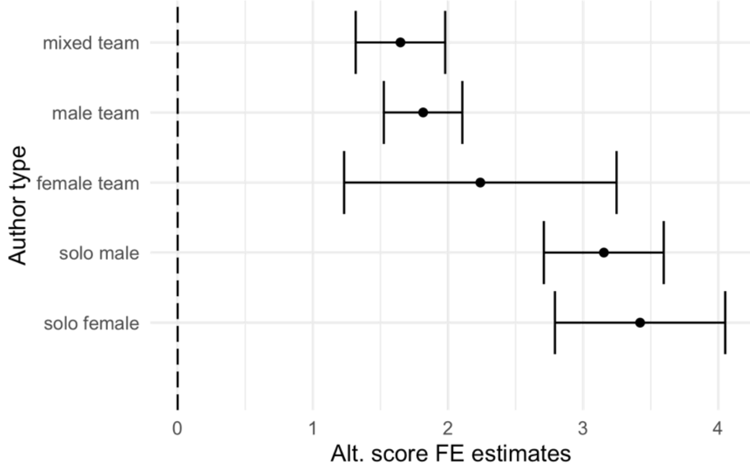
[14] Klar et al (2020) found that solo authored female articles had significantly more tweets than solo authored male articles, while there were no gendered differences for multi-author teams. Whether the marginal differences we

Table 3: Negative binomial mixed effects regression of academic citations (Altmetric Attention Score)

	Crossref Cited-by (1)			Crossref Cited-by (2)		
	Coef.	**SE**	**IRR**	**Coef.**	**SE**	**IRR**
Altmetric Score/100	2.223	0.1	9.236	3.153	0.226	23.4
Solo female	0.094	0.037	1.099	0.079	0.042	1.082
Mixed team	0.338	0.032	1.402	0.437	0.037	1.548
Female team	0.462	0.061	1.587	0.509	0.07	1.664
Male team	0.364	0.029	1.439	0.449	0.034	1.568
Alt. X Solo female				0.268	0.39	1.308
Alt. X Mixed team				−1.505	0.28	0.222
Alt. X Female team				−0.913	0.559	0.401
Alt. X Male team				−1.337	0.267	0.263
2017-Publication year	0.138	0.004	1.148	0.139	0.004	1.15
Intercept	2.513	0.092	12.339	2.456	0.092	11.661
Varying intercepts (sd)	0.4			0.397		
Num.Obs.	7710			7710		
AIC	68943.7			68898.9		
BIC	69006.2			68989.3		
Log.Lik.	−34462.8			−34436.5		
Conditional R^2	0.405			0.399		
Marginal R^2	0.263			0.257		
N journals	21			21		

observe are driven by overall frequency differences between author gender groups is something we can explore more in future research.

Figure 2: Marginal effects of Altmetric Attention score by author gender(s)



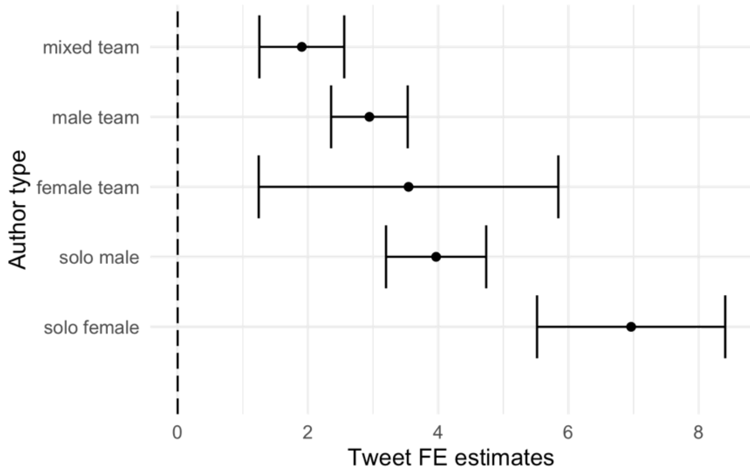
Author type	Alt. score FE estimates	SE	5% LCI	95% UCI
mixed team	1.648	0.169	1.317	1.979
male team	1.816	0.148	1.525	2.106
female team	2.239	0.514	1.231	3.247
solo male	3.153	0.226	2.709	3.596
solo female	3.421	0.322	2.791	4.051

Note: Based on estimates from Table 3, Model 2.

Table 4: Negative binomial mixed effects regression of academic citations, Tweet counts

	Crossref Cited-by (1)			Crossref Cited-by (2)		
	Coef.	**SE**	**IRR**	**Coef.**	**SE**	**IRR**
Tweets/100	3.266	0.204	26.207	3.968	0.392	52.879
Solo female	0.112	0.038	1.119	0.032	0.043	1.032
Mixed team	0.38	0.032	1.462	0.45	0.036	1.569
Female team	0.487	0.062	1.628	0.495	0.071	1.64
Male team	0.397	0.03	1.487	0.431	0.034	1.538
Tweets X Solo female				2.995	0.818	19.98
Tweets X Mixed team				−2.062	0.503	0.127
Tweets X Female team				−0.424	1.223	0.655
Tweets X Male team				−1.024	0.48	0.359
2017-Publication year	0.144	0.005	1.155	0.145	0.005	1.157
Intercept	2.531	0.097	12.563	2.505	0.097	12.24
Varying intercepts (sd)	0.421			0.418		
Num.Obs.	7710			7710		
AIC	69326			69284.6		
BIC	69388.5			69374.9		
Log.Lik.	−34653.979			−34629.297		
Conditional R^2	0.397			0.387		
Marginal R^2	0.242			0.231		
N journals	21			21		

Figure 3: Marginal effects of Tweet counts by author gender(s)



Author type	Tweet FE estimates	SE	5% LCI	95% UCI
mixed team	1.906	0.332	1.254	2.557
male team	2.944	0.300	2.356	3.532
female team	3.545	1.174	1.244	5.845
solo male	3.968	0.392	3.199	4.737
solo female	6.963	0.737	5.518	8.408

Note: Based on estimates from Table 4, Model 2.

Conclusion

Gendered citation patterns in political science resemble those in many other disciplines (e.g., economics, sociology, linguistics, ecology) and show a tendency for male/mixed author teams to cite research by female scholars less frequently than female authors. This citation behavior generates a citation gender gap for traditional citation metrics (e.g., citation counts, h-index). These dynamics contributed to the development of Altmetrics or measures that capture the quantity and quality of online attention to research in multiple outlets such as news coverage, blog posts, and social media. Given that female scholars are as active on social media as male scholars, Altmetrics may display fewer gender gaps. However, whether these new measures translate into better research impact in political science using traditional citation metrics remains unclear. Our paper analyzes the relationship between Altmetrics scores (and Tweet counts) in 2017 and citations in 2021 for 8,493 articles in 21 political science journals while controlling for authors' gender. Consistent with previous literature, we find that higher online attention scores significantly increase articles' citation counts. We also find that solo authored pieces show the strongest marginal effects, and that solo authored women and female author teams accrue more citations as Altmetrics scores increase. Our results suggest that online promotion of political science research will help to further shrink the gender citation gap.

References

Akella, Akhil Pandey, Hamed Alhoori, Pavan Ravikanth Kondamudi, Cole Freeman, and Haiming Zhou. 2021. "Early Indicators of Scientific Impact: Predicting Citations with Altmetrics." *Journal of Informetrics* 15 (2): 101128. https://doi.org/10.1016/j.joi.2020.101128.

Altmetrics. 2015. "Altmetric Details Page API." *Altmetric* (blog). July 9, 2015. https://www.altmetric.com/products/altmetric-api/.

Bisbee, James, Jennifer Larson, and Kevin Munger. 2020. "#polisci Twitter: A Descriptive Analysis of How Political Scientists Use Twitter in 2019." *Perspectives on Politics*, December, 1–22. https://doi.org/10.1017/S1537592720003643.

Brody, Tim, Stevan Harnad, and Leslie Carr. 2006. "Earlier Web Usage Statistics as Predictors of Later Citation Impact." *Journal of the American Society for Information Science and Technology* 57 (8): 1060–72. https://doi.org/10.1002/asi.20373.

Colgan, Jeff. 2017. "Gender Bias in International Relations Graduate Education? New Evidence from Syllabi." *PS: Political Science & Politics* 50(2): 456-460.

Costas, Rodrigo, Zohreh Zahedi, and Paul Wouters. 2015. "Do 'Altmetrics' Correlate With Citations?" *Journal of the Association for Information Science and Technology* 66(10): 2003-2019.

Crossref. 2020a. "Introduction to Content Types." Website. Crossref. April 2020. https://www.crossref.org/documentation/content-registration/content-types-intro/.

———. 2020b. "REST API." Website. Crossref. April 8, 2020. https://www.crossref.org/documentation/retrieve-metadata/rest-api/.

———. 2021. "Cited-By." Website. Crossref. February 2021. https://www.crossref.org/documentation/cited-by/.

Dehdarirad, Tahereh. 2020. "Could Early Tweet Counts Predict Later Citation Counts? A Gender Study in Life Sciences and Biomedicine (2014–2016)." *PLOS ONE* 15 (11): e0241723. https://doi.org/10.1371/journal.pone.0241723.

Dion, Michelle L., Jane Lawrence Sumner, and Sara McLaughlin Mitchell. 2018. "Gendered Citation Patterns across Political Science and Social Science Methodology Fields." *Political Analysis* 26 (3): 312–27. https://doi.org/10.1017/pan.2018.12.

Eysenbach, Gunther. 2012. "Can Tweets Predict Citations? Metrics of Social Impact Based on Twitter and Correlation with Traditional Metrics of Scientific Impact. *Journal of Medical Internet Research 13*(4), e123.

Genderize. 2018. "Genderize." 2018. https://genderize.io/.

Gilens, Martin, and Benjamin I. Page. 2014. "Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens." *Perspectives on Politics* 12 (3): 564–81. https://doi.org/10.1017/S1537592714001595.

Haustein Stefanie, Rodrigo Costas, and Vincent Larivière. 2015. "Characterizing Social Media Metrics of Scholarly Papers: The Effect of Document Properties and Collaboration Patterns." PLoS ONE 10(3): e0120495. https://doi.org/10.1371/journal.pone.0120495

Hu, Lingshu, Michael W. Kearney & Cynthia M. Frisby. 2021. "Tweeting and Retweeting: Gender Discrepancies in Discursive Political Engagement and Influence on Twitter." *Journal of Gender Studies,* DOI: 10.1080/09589236.2021.1995340

Lingshu Hu, Michael W. Kearney & Cynthia M. Frisby. 2021. “Tweeting and Retweeting: Gender Discrepancies in Discursive Political Engagement and Influence on Twitter.” *Journal of Gender Studies*, DOI: 10.1080/09589236.2021.1995340

Jaschik, Scott. 2005. “Too Much Information?” Inside Higher Ed. October 11, 2005. https://www.insidehighered.com/news/2005/10/11/too-much-information.

King, M. M., Bergstrom, C. T., Correll, S. J., Jacquet, J., & West, J. D. 2017. “Men Set Their Own Cites High: Gender and Self-citation across Fields and over Time." *Socius 3:* 1–22. https://doi.org/10.1177/2378023117738903.

Klar, Samara, Yanna Krupnikov, John Barry Ryan, Kathleen Searles, and Yotam Shmargad. 2020. “Using Social Media to Promote Academic Research: Identifying the Benefits of Twitter for Sharing Academic Work.” *PLOS ONE* 15 (4): e0229446. https://doi.org/10.1371/journal.pone.0229446.

Levin, Dov H. 2016. “When the Great Power Gets a Vote: The Effects of Great Power Electoral Interventions on Election Results.” *International Studies Quarterly* 60 (2): 189–202. https://doi.org/10.1093/isq/sqv016.

Paul-Hus, Adele, Cassidy R. Sugimoto, and Vincent Larivière, 2015. “Is there a Gender Gap in Social Media Metrics?” In *Proceedings of the 15th International Society of Scientometrics and Informetrics Conference*, pp. 37–45.

Peoples, Brandon K., Stephen R. Midway, Dana Sackett, Abigail Lynch, and Patrick B. Cooney. 2016. “Twitter Predicts Citation Rates of Ecological Research.” *PLoS ONE* 11(11): e0166570.

Peterson, David A.M. 2018. "Historical Disparities and Gendered Citation Patterns." *Political Analysis* 26(3): 338-344.

Priem, Jason, Paul Groth, and Dario Taraborelli. 2012. “The Altmetrics Collection.” *PLOS ONE* 7 (11): e48753. https://doi.org/10.1371/journal.pone.0048753.

Repiso, Rafael, Antonio Castillo-Esparcia, and Daniel Torres-Salinas. 2019. “Altmetrics, Alternative Indicators for Web of Science Communication Studies Journals.” *Scientometrics* 119(2): 941–958.

Shema, Hadas, Judit Bar-Ilan, and Mike Thelwall. 2014. “Do Blog Citations Correlate with a Higher Number of Future Citations? Research Blogs as a Potential Source for Alternative Metrics.” *Journal of the Association for Information Science and Technology 65*(5): 1018–1027.

Teele, Dawn Langan, and Kathleen Thelen. 2017. “Gender in the Journals: Publication Patterns in Political Science.” *PS: Political Science & Politics* 50 (2): 433–47. https://doi.org/10.1017/S1049096516002985.

“The Donut and Altmetric Attention Score.” 2015. *Altmetric* (blog). July 9, 2015. https://www.altmetric.com/about-our-data/the-donut-and-score/.

Thelwall, Mike, Stefanie Haustein, Vincent Larivière, and Cassidy R. Sugimoto. 2013. “Do Altmetrics Work? Twitter and Ten Other Social Web Services.” *PLOS ONE* 8 (5): e64841. https://doi.org/10.1371/journal.pone.0064841.

Wasike, Ben. 2021. “Citations Gone #Social: Examining the Effect of Altmetrics on Citations and Readership in Communication Research.” *Social Science Computer Review* 39(3): 416–433.

Web of Science. 2018. “All Times Cited Counts.” Web of Science All Databases Help. October 9, 2018.

https://images.webofknowledge.com/WOKRS523_2R2/help/WOK/hp_times_cited_count.html.

Young, Jeffrey R. 2008a. "A Professor's Tips for Using Twitter in the Classroom." *The Chronicle of Higher Education* (blog). January 28, 2008. https://www.chronicle.com/blogs/wiredcampus/a-professors-tips-for-using-twitter-in-the-classroom.

———. 2008b. "Forget E-Mail: New Messaging Service Has Students and Professors Atwitter." *The Chronicle of Higher Education* (blog). February 29, 2008. http://www.chronicle.com/article/forget-e-mail-new-messaging-service-has-students-and-professors-atwitter/.

Appendix

Table A1: Frequencies of articles by journal and publication year

Journal	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
AMERICAN JOURNAL OF POLITICAL SCIENCE	59	57	60	59	64	65	64	69	66	70	633
AMERICAN POLITICAL SCIENCE REVIEW	50	34	33	44	45	45	51	53	53	55	463
BRITISH JOURNAL OF POLITICAL SCIENCE	35	31	33	44	39	40	38	38	32	47	377
COMPARATIVE POLITICAL STUDIES	59	52	52	55	57	53	57	70	57	59	571
COMPARATIVE POLITICS	0	0	0	0	5	19	21	6	0	0	51
INTERNATIONAL ORGANIZATION	27	25	19	23	24	25	28	32	32	24	259
INTERNATIONAL POLITICAL SCIENCE REVIEW	19	20	21	27	30	28	29	34	36	47	291
INTERNATIONAL STUDIES QUARTERLY	40	31	47	51	52	61	65	67	62	66	542
JOURNAL OF CONFLICT RESOLUTION	37	40	38	37	41	43	43	57	57	54	447
JOURNAL OF POLITICS	58	79	96	83	89	79	79	75	81	85	804
LEGISLATIVE STUDIES QUARTERLY	25	23	22	21	21	22	21	21	24	34	234
PARTY POLITICS	32	33	33	34	37	46	46	74	66	65	466
PERSPECTIVES ON POLITICS	0	36	41	52	22	28	37	36	39	57	348
POLITICAL ANALYSIS	25	26	25	26	32	28	31	28	35	39	295
POLITICAL BEHAVIOR	22	24	25	28	30	32	36	39	41	40	317
POLITICAL RESEARCH QUARTERLY	59	66	62	69	70	68	68	74	63	67	666
POLITICS & GENDER	0	33	30	33	40	39	43	38	46	38	340
POLITICS & SOCIETY	14	19	16	24	20	23	22	21	22	24	205
PUBLIC OPINION QUARTERLY	41	52	50	41	52	43	50	51	41	42	463
REVIEW OF INTERNATIONAL POLITICAL ECONOMY	31	28	39	36	30	36	43	46	41	36	366
STATE POLITICS & POLICY QUARTERLY	21	22	17	15	21	22	25	22	22	19	206
WORLD POLITICS	9	7	15	18	17	10	14	18	20	21	149

Table A2: Frequencies of missing DOIs by journal and publication year

Journal	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
AMERICAN JOURNAL OF POLITICAL SCIENCE	1	0	0	0	0	0	0	0	0	0	1
AMERICAN POLITICAL SCIENCE REVIEW	1	0	0	0	0	0	0	0	0	0	1
BRITISH JOURNAL OF POLITICAL SCIENCE	0	0	0	0	0	0	0	0	0	1	1
COMPARATIVE POLITICAL STUDIES	0	0	0	0	0	0	0	0	0	0	0
COMPARATIVE POLITICS	20	20	21	24	16	1	1	16	24	27	170
INTERNATIONAL ORGANIZATION	0	0	0	0	0	0	0	0	0	0	0
INTERNATIONAL POLITICAL SCIENCE REVIEW	0	0	0	0	0	0	0	0	0	0	0
INTERNATIONAL STUDIES QUARTERLY	1	0	2	0	0	0	0	0	0	0	3
JOURNAL OF CONFLICT RESOLUTION	0	0	0	0	0	0	0	0	0	0	0
JOURNAL OF POLITICS	19	0	0	0	0	0	1	0	0	0	20
LEGISLATIVE STUDIES QUARTERLY	0	1	0	0	0	0	0	0	0	0	1
PARTY POLITICS	0	0	0	0	0	0	0	0	0	0	0
PERSPECTIVES ON POLITICS	0	0	0	1	0	0	0	0	0	0	1
POLITICAL ANALYSIS	0	0	0	0	0	0	0	0	0	1	1
POLITICAL BEHAVIOR	0	0	0	0	0	0	0	0	0	0	0
POLITICAL RESEARCH QUARTERLY	0	0	0	0	0	0	0	0	0	0	0
POLITICS & GENDER	0	0	0	1	0	0	0	0	0	0	1
POLITICS & SOCIETY	0	0	0	0	0	0	0	0	0	0	0
PUBLIC OPINION QUARTERLY	0	0	0	0	0	0	0	0	0	0	0
REVIEW OF INTERNATIONAL POLITICAL ECONOMY	0	0	0	0	0	0	0	0	0	0	0
STATE POLITICS & POLICY QUARTERLY	0	0	1	6	0	0	0	0	0	0	7

Journal	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Total**
WORLD POLITICS	3	4	0	0	0	10	4	0	0	0	21

Table A3: Altmetric Attention score and online engagement descriptive statistics (2017)

	Min	**Max**	**Mean**	**Median**	**SD**	**N**
Altmetric Attention score	0.00	539.82	6.53	1.00	18.03	8491
Tweets	0.00	555.00	3.15	0.00	11.19	8491
News outlets	0.00	41.00	0.22	0.00	1.09	8491
Blogs	0.00	24.00	0.24	0.00	0.71	8491
Peer reviewed sites	0.00	1.00	0.00	0.00	0.02	8491
Facebook public	0.00	19.00	0.13	0.00	0.54	8491
Google Plus	0.00	14.00	0.01	0.00	0.19	8491
Reddit	0.00	4.00	0.01	0.00	0.13	8491
Q&A fora (e.g., Stack Exchange)	0.00	1.00	0.00	0.00	0.03	8491

Figure A1: Altmetric score distributions (2007-2016)

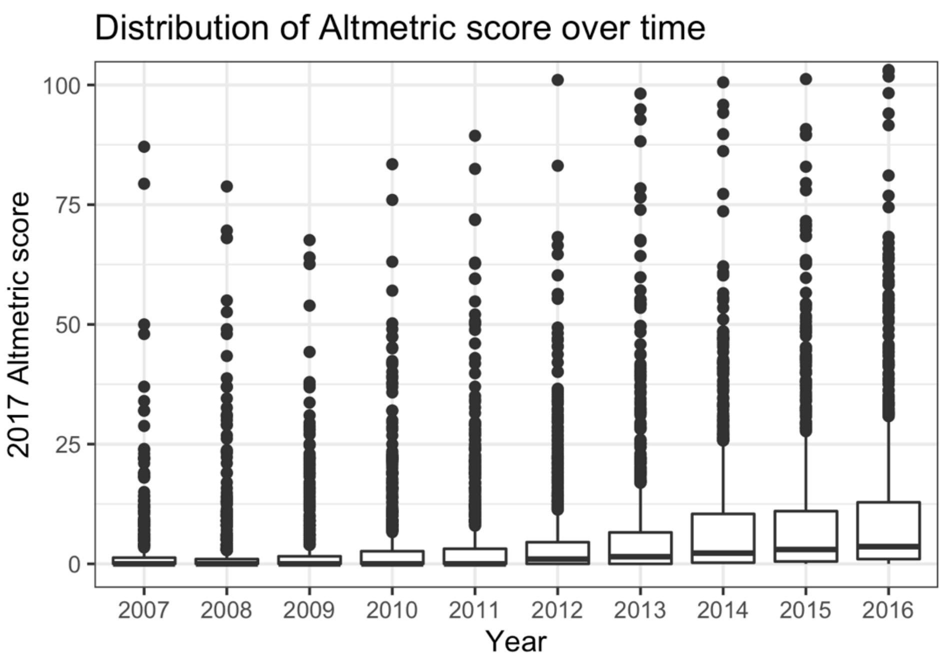


Figure A2: Altmetric Tweet count distributions (2007-2016)

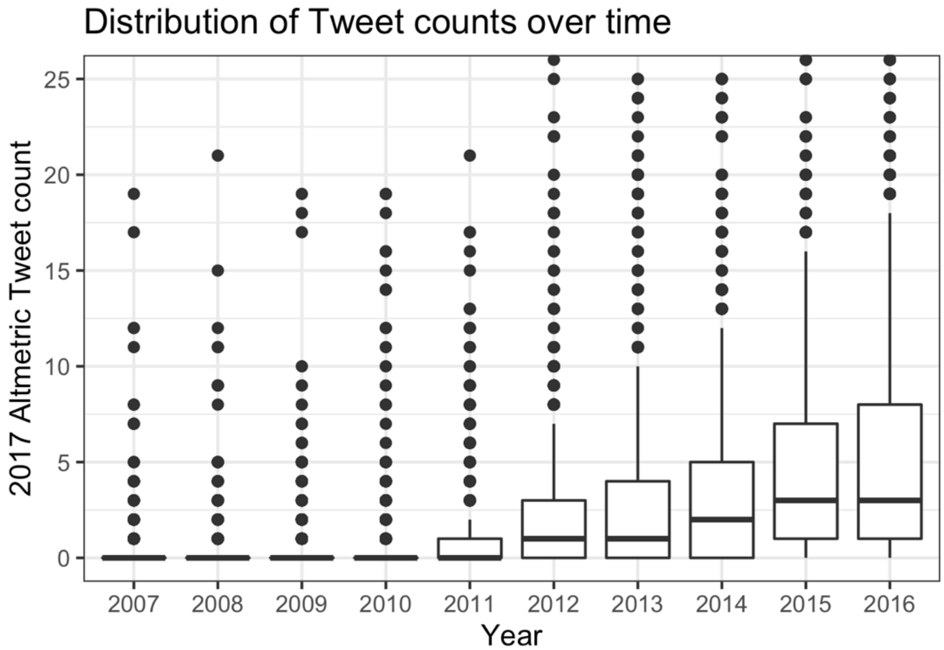
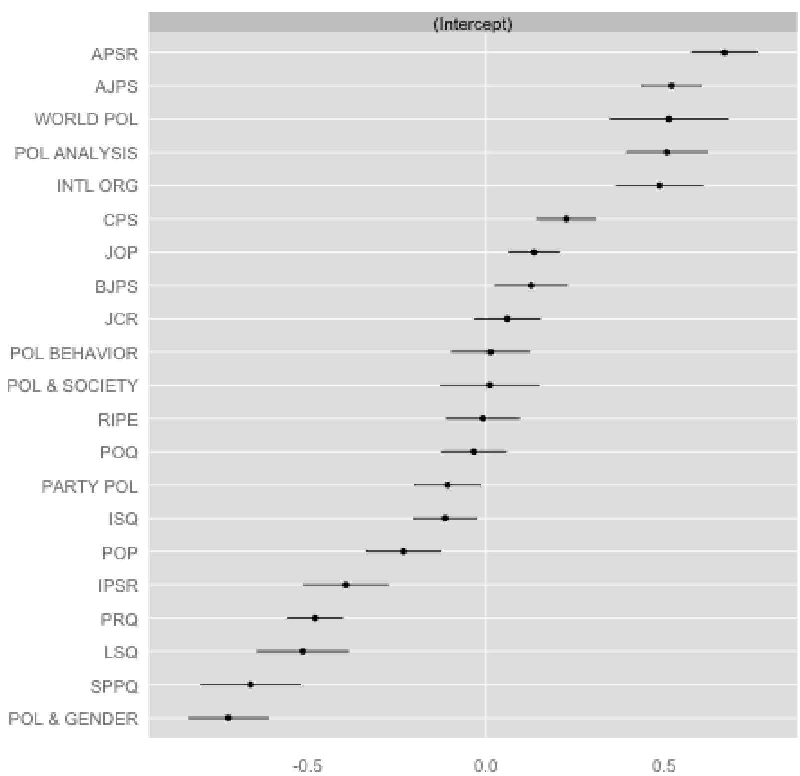
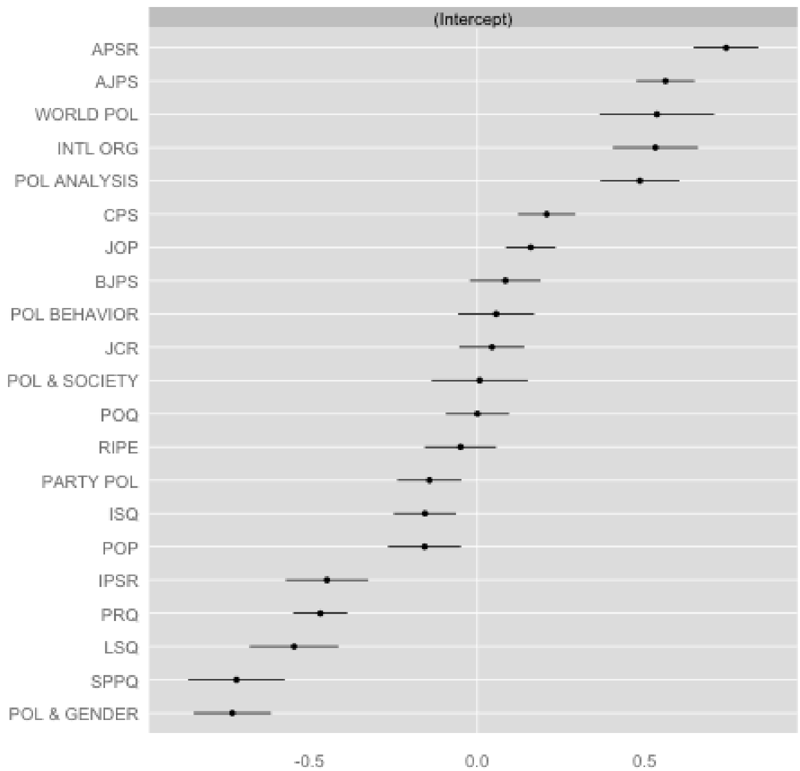


Figure A3: Random effects by journal, Altmetric Attention score



Note: Based on Model 2 in Table 3.

Figure A4: Random effects by journal, Tweets



Note: Based on Model 3 in Table 3.

Table A4: Negative binomial mixed effects models of Web of Science Times Cited

	Web of Science Times Cited (1)			Web of Science Times Cited (2)		
	Coef.	**SE**	**IRR**	**Coef.**	**SE**	**IRR**
Altmetric Score/100	2.945	0.215	19.011			
Solo female	0.121	0.042	1.129	0.085	0.043	1.089
Mixed team	0.396	0.036	1.485	0.398	0.036	1.49
Female team	0.504	0.07	1.655	0.451	0.073	1.57
Male team	0.408	0.033	1.504	0.38	0.033	1.462
Alt. X Solo female	0.091	0.367	1.096			
Alt. X Mixed team	−1.406	0.264	0.245			
Alt. X Female team	−1.249	0.511	0.287			
Alt. X Male team	−1.243	0.252	0.289			
Tweet count/100				3.563	0.364	35.263
Tweets X Solo female				2.295	0.77	9.927
Tweets X Mixed team				−1.728	0.469	0.178

Tweets X Female team				−0.366	1.181	0.693
Tweets X Male team				−0.745	0.448	0.475
2017-Publication year	0.153	0.004	1.165	0.158	0.004	1.172
Intercept	2.395	0.083	10.971	2.449	0.087	11.583
Varying intercepts (sd)	0.362			0.382		
Num.Obs.	7143			7143		
AIC	63321.6			63701.2		
BIC	63411			63790.6		
Log.Lik.	−31647.8			−31837.6		
Conditional R2	0.408			0.395		
Marginal R2	0.283			0.257		
N journals	22			22		

Table A5:

Author type	**Attention Score/100 FE**	**SE**	**5% LCI**	**95% UCI**
solo male	2.945	0.215	2.523	3.367
female team	1.696	0.467	0.779	2.612
male team	1.702	0.137	1.433	1.971
mixed team	1.539	0.157	1.232	1.846
solo female	3.036	0.302	2.445	3.628

Note: Based on Appendix Table 4, Model 1

Author type	**Tweets/100 FE**	**SE**	**5% LCI**	**95% UCI**
solo male	3.563	0.364	2.848	4.277
female team	3.197	1.134	0.974	5.419
male team	2.818	0.280	2.268	3.367
mixed team	1.835	0.311	1.226	2.444
solo female	5.858	0.695	4.497	7.219

Note: Based on Appendix Table 4, Model 2

Table A6: Negative binomial mixed effects models of Crossref Cited-by with 2017 academic citation control

	Crossref Cited-by (1)			**Crossref Cited-by (2)**		
	Coef.	**SE**	**IRR**	**Coef.**	**SE**	**IRR**
Altmetric Score/100	1.002	0.13	2.723			
Tweet count/100				1.288	0.222	3.627
Solo female	0.086	0.029	1.09	0.062	0.029	1.064
Mixed team	0.248	0.024	1.282	0.237	0.024	1.268
Female team	0.256	0.05	1.292	0.241	0.048	1.273
Male team	0.207	0.023	1.23	0.19	0.022	1.21
Alt. X Solo female	0.195	0.232	1.215			

Alt. X Mixed team	−0.659	0.152	0.517			
Alt. X Female team	0.013	0.421	1.013			
Alt. X Male team	−0.714	0.152	0.49			
Tweets X Solo female				1.393	0.47	4.026
Tweets X Mixed team				−0.780	0.262	0.458
Tweets X Female team				0.582	0.753	1.789
Tweets X Male team				−0.783	0.266	0.457
2017-Publication year	−0.012	0.003	0.988	−0.012	0.003	0.988
Cited-by 2017	0.032	0.000	1.033	0.033	0	1.034
Intercept	2.396	0.049	10.982	2.406	0.049	11.08 5
Varying intercepts (sd)	0.202			0.2		
Num.Obs.	7348			7348		
AIC	59545.3			59571.2		
BIC	59641.9			59667.8		
Log.Lik.	−29758.6			−29771.6		
Conditional R2	0.746			0.387		
Marginal R2	0.717			0.231		
N journals	21			21		

Table A7: Marginal fixed effects of Attention scores controlling for 2017 academic citations

Author type	Altmetric Attention score/100 FE	SE	5% LCI	95% UCI
solo male	1.002	0.130	0.748	1.256
female team	1.014	0.403	0.224	1.804
male team	0.288	0.085	0.121	0.454
mixed team	0.342	0.084	0.178	0.507
solo female	1.197	0.198	0.809	1.585

Note: Based on Appendix Table A6, Model 1

Table A8: Marginal fixed effects of Attention scores controlling for 2017 academic citations

Author type	Tweet count/100 FE	SE	5% LCI	95% UCI
solo male	1.288	0.222	0.853	1.724
female team	1.870	0.725	0.450	3.290
male team	0.505	0.159	0.193	0.817
mixed team	0.508	0.148	0.218	0.798
solo female	2.681	0.424	1.849	3.513

Note: Based on Appendix Table A6, Model 2