

2-15-2018

## Gender Disparity in Law Review Citation Rates

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# William & Mary Law Review

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VOLUME 59

No. 3, 2018

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## GENDER DISPARITY IN LAW REVIEW CITATION RATES

CHRISTOPHER A. COTROPIA\* & LEE PETHERBRIDGE\*\*

### ABSTRACT

*Gender disparity in scholarly influence—measured in terms of differential citation to academic work—has been widely documented. The weight of the evidence is that, in many fields of academic inquiry, papers authored by women receive fewer citations than papers authored by men. To investigate whether a similar gender disparity in scholarly influence exists in legal studies, we analyze the impact of gender on citation to articles published in top 100 law reviews between 1990 and 2010. We find evidence of gender disparity in citation rates, but in surprising contrast to observations made in other disciplines, we observe that articles authored by women receive significantly more citations than articles authored by men.*

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## INTRODUCTION

Although there is some debate over the merits of using the number of citations that academic research receives as a measure of its quality and professional recognition,<sup>1</sup> citation counts are commonly used for this purpose,<sup>2</sup> and studies have provided considerable evidence that citation rates correlate with research quality.<sup>3</sup> Citation to research also serves the purpose of fitting the research into the broader structure of the relevant field of study.<sup>4</sup> Thus, when a researcher publishes findings that are never cited, it can be said that the researcher has failed to make a significant contribution to any field of study.<sup>5</sup> Moreover, regardless of the genuine merits of using citation rates to measure the quality and professional recognition of scholarship, citation rates are commonly considered in the

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1. Kathryn B. Ward et al., *Visibility and Dissemination of Women's and Men's Sociological Scholarship*, 39 SOC. PROBS. 291, 291 (1992).

2. See, e.g., Theodore Eisenberg & Martin T. Wells, *Inbreeding in Law School Hiring: Assessing the Performance of Faculty Hired from Within*, 29 J. LEGAL STUD. 369 (2000); Fred R. Shapiro, *The Most-Cited Legal Scholars*, 29 J. LEGAL STUD. 409 (2000); Stefan Wuchty et al., *The Increasing Dominance of Teams in Production of Knowledge*, 316 SCIENCE 1036 (2007).

3. See, e.g., Dag W. Aksnes, *Citation Rates and Perceptions of Scientific Contribution*, 57 J. AM. SOC'Y FOR INFO. SCI. & TECH. 169, 173-74, 182 (2006) (finding correspondence between, and scientist/author's perception of, the scientific contribution of an article and the number of citations the article receives); Dag W. Aksnes & Randi Elizabeth Taxt, *Peer Reviews and Bibliometric Indicators: A Comparative Study at a Norwegian University*, 13 RES. EVALUATION 33, 40 (2004) (finding correlation between peer assessments and citation); Jonathan Cole & Stephen Cole, *Measuring the Quality of Sociological Research: Problems in the Use of the Science Citation Index*, 6 AM. SOCIOLOGIST 23, 28 (1971) (finding correlation between peer assessments of the significance of a researcher's contribution and citation to a researcher's papers, and concluding that "[t]he data available indicate that straight citation counts are highly correlated with virtually every refined measure of quality"); Stephen M. Lawani & Alan E. Bayer, *Validity of Citation Criteria for Assessing the Influence of Scientific Publications: New Evidence with Peer Assessment*, 34 J. AM. SOC'Y FOR INFO. SCI. 59, 65-66 (1983) (reporting that peer assessments of papers and citation rates are highly correlated); Manuel Trajtenberg, *A Penny for Your Quotes: Patent Citations and the Value of Innovations*, 21 RAND J. ECONOMICS 172, 180, 184 (1990) (finding that citations to patents correlate with independent measures of value of associated innovation).

4. See S. Nazim Ali et al., *Determining the Quality of Publications and Research for Tenure or Promotion Decisions: A Preliminary Checklist to Assist*, 45 LIBR. REV. 39 (1996).

5. Carolyn A. Copenheaver et al., *Lack of Gender Bias in Citation Rates of Publications by Dendrochronologists: What Is Unique About This Discipline?*, 66 TREE-RING RES. 127, 128 (2010).

contexts of hiring and tenuring, as well as in the context of allocating research funds.<sup>6</sup>

The question of whether gender disparity in citation rates occurs within a discipline is therefore one of importance. If, for example, research by women accumulates fewer citations than research by men, that fact might impact the hiring and professional advancement of women researchers, and, by extension, could more broadly impact the likelihood of women researchers participating in and contributing to a field of study.<sup>7</sup> For at least this reason, the question of whether gender disparity in citation rates exists has garnered considerable interest.<sup>8</sup> In addition, if gender disparity in citation rates does occur, it would naturally be very interesting to understand why it exists.

Although some fields have observed gender disparity in citation rates, few have looked to see whether noticeable differences exist within legal scholarship.<sup>9</sup> Although we have found no articles specifically focused on the issue, a report by Ian Ayres and Fredrick Vars in 2000 focused on a small universe of legal journals (three to be exact),<sup>10</sup> and another by Deborah Merritt, in the same year, tracked a specific cohort of law professors.<sup>11</sup> Both studies provide some relevant information. Both studies, however, occurred over fifteen years ago and focused on citations in the 1980s and 1990s.<sup>12</sup> And notably, the results of these studies point in different directions, with Ayres and Vars finding that female authors are cited more than male authors,<sup>13</sup> and Merritt finding the opposite.<sup>14</sup>

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6. See, e.g., Ali et al., *supra* note 4; Ward et al., *supra* note 1, at 297.

7. Copenheaver et al., *supra* note 5, at 128.

8. See, e.g., *id.* at 127.

9. See Ian Ayres & Fredrick E. Vars, *Determinants of Citations to Articles in Elite Law Reviews*, 29 J. LEGAL STUD. 427, 427-29 (2000); Deborah Jones Merritt, *Scholarly Influence in a Diverse Legal Academy: Race, Sex, and Citation Counts*, 29 J. LEGAL STUD. 345, 346-47 (2000).

10. Ayres & Vars, *supra* note 9, at 429 (studying these three journals, including 979 nonstudent articles published from 1980 to 1995).

11. Merritt, *supra* note 9, at 347 (studying 815 law professors who began their careers between 1986 and 1991 and remained tenure-track in fall 1998).

12. Ayres & Vars, *supra* note 9, at 429; Merritt, *supra* note 9, at 346.

13. Ayres & Vars, *supra* note 9, at 427 (“[A]rticles by young, female, or minority authors are more heavily cited.”).

14. Merritt, *supra* note 9, at 347 (“The analyses reported below show that female and minority scholars still lag somewhat behind white men in average citation counts. The

Given the interest in the topic, the importance of the topic, and the conflicting earlier results, we decided to embark on a larger, more current study to investigate whether legal scholarship exhibits a gender disparity in scholarly influence. We report here an analysis of the impact of author gender on citation to articles published in top 100 law reviews between 1990 and 2010. In this process, we coded for a variety of possible determinants of citation rates with the hope that we might be able to develop some useful, if nascent, insights into the relationship between author gender and citation rate in the field of legal studies.

We find evidence of gender disparity in citation rates. In surprising contrast to observations made in most other disciplines,<sup>15</sup> we observe that female-authored articles are generally cited more often than male-authored articles, and that the difference is statistically noticeable, although not overwhelming.<sup>16</sup> This observation holds true, moreover, even after statistically controlling for other plausible determinants of citation rates.<sup>17</sup> Female authors appear at least somewhat disproportionately responsible for higher impact articles.<sup>18</sup>

This Article reports and analyzes these results as follows. Part I describes previous research done on gender disparity and citation rates, both in research areas outside of law and law itself. Part II describes the methods of our study. Part III details and discusses the results found, exploring some possible mechanisms for the gender disparity in citation rates that favors female-authored articles.

## I. PREVIOUS RESEARCH ON GENDER DISPARITY AND CITATION RATES

### A. *Studies Outside of Law*

Most of the previous studies on gender disparity in citation rates have focused on areas other than legal scholarship. Even these

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differences, however, are small—especially when compared to other variations in citation rates, including those associated with subject matter specialties or religious background.”).

15. *See infra* Part I.A.

16. *See infra* Part III.A.

17. *See infra* Part III.D.

18. *See infra* Part III.C.

studies produced mixed results, with some disciplines exhibiting a higher citation rate for male authors, some higher citation rates for female authors, and some observing no statistically significant difference.

A number of studies spanning the natural and social sciences have indicated that women researchers receive fewer citations than their male counterparts.<sup>19</sup> In the natural sciences, researchers have found that women scientists both publish less than men and are cited less.<sup>20</sup> Researchers in the social sciences, such as sociology<sup>21</sup> and international relations, have made similar findings.<sup>22</sup> These findings hold true for papers authored by teams.<sup>23</sup> Articles with a woman in the dominant author position (first or last author) receive fewer citations than papers authored by men or which have men in the dominant author position.<sup>24</sup>

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19. See Elisabeth Davenport & Herbert Snyder, Research Brief, *Who Cites Women? Whom Do Women Cite?: An Exploration of Gender and Scholarly Citation in Sociology*, 51 *J. DOCUMENTATION* 404, 408 (1995); Daniel Maliniak et al., Research Note, *The Gender Citation Gap in International Relations*, 67 *INT'L ORG.* 889, 892 (2013); Harriet Zuckerman & Jonathan R. Cole, *Women in American Science*, 13 *MINERVA* 82, 93 (1975); see also Marianne A. Ferber, *Citations: Are They an Objective Measure of Scholarly Merit?*, 11 *SIGNS* 381, 388-89 (1986) (observing "that researchers tend to cite a larger proportion of authors of their own sex than they do those of the opposite sex" and that such imbalances could have substantial consequences in fields in which men constitute a large majority).

20. See, e.g., Dag W. Aksnes et al., *Are Female Researchers Less Cited? A Large-Scale Study of Norwegian Scientists*, 62 *J. AM. SOC'Y FOR INFO. SCI. & TECH.* 628, 628 (2011) ("Based on a large-scale study of 8,500 Norwegian researchers and more than 37,000 publications covering all areas of knowledge, we conclude that the publications of female researchers are less cited than are those of men, although the differences are not large."); Elissa Z. Cameron et al., *Solving the Productivity and Impact Puzzle: Do Men Outperform Women, or Are Metrics Biased?*, 66 *BIOSCIENCE* 245, 245, 247 (2016) (observing higher h-index scores for men); Zuckerman & Cole, *supra* note 19, at 93 ("Differences in the frequency of citation to the publications of men as compared to those of women scientists are considerable .... Women scientists publish less than men and what they do publish appears to have less impact on their field.").

21. See, e.g., Davenport & Snyder, *supra* note 19, at 408 ("Women are undercited in proportion to their relative numbers in the population as a whole and in the population of sociology researchers.").

22. See, e.g., Maliniak et al., *supra* note 19, at 889 ("Using data from the Teaching, Research, and International Policy project on peer-reviewed publications between 1980 and 2006, we show that women are systematically cited less than men after controlling for a large number of variables including year of publication, venue of publication, substantive focus, theoretical perspective, methodology, tenure status, and institutional affiliation.").

23. See Cassidy R. Sugimoto et al., *Global Gender Disparities in Science*, 504 *NATURE* 211, 212 (2013).

24. See *id.* ("We find that in the most productive countries, all articles with women in dominant author positions receive fewer citations than those with men in the same posi-

Not all studies outside of the law, however, point in the same direction. Studies in the areas of ecology,<sup>25</sup> dendrochronology,<sup>26</sup> information sciences,<sup>27</sup> and criminal justice<sup>28</sup> suggest that papers authored by female researchers are cited at rates statistically indistinguishable from papers authored by male researchers. One study in the area of ecology and evolutionary biology found that, once one controls for the lower rates of female researcher productivity, female researchers receive more citations than male researchers.<sup>29</sup>

The variation in observations across disciplines led Carolyn Copenheaver and colleagues to conclude: “Gender differences in citation rate appear to be discipline specific, so identifying whether a difference exists within a discipline is an important factor for making fair and equitable decisions regarding the evaluation and promotion of female and male researchers.”<sup>30</sup>

Other factors relevant to gender disparities in citation rates have also been studied. For example, the ratio of female to male researchers varies greatly in many disciplines, with most exhibiting far fewer females.<sup>31</sup> Furthermore, research on gender’s influence on productivity has demonstrated that female researchers are more likely to publish at slower rates and have shorter research careers.<sup>32</sup>

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tions.”); *see also* Maliniak et al., *supra* note 19, at 894.

25. *See, e.g.*, Roosa Leimu & Julia Koricheva, *What Determines the Citation Frequency of Ecological Papers?*, 20 *TRENDS IN ECOLOGY & EVOLUTION* 28, 30 (2005).

26. *See* R.M. Borsuk et al., *The Influence of Author Gender, National Language and Number of Authors on Citation Rate in Ecology*, 2 *OPEN ECOLOGY J.* 25, 26-28 (2009); Copenheaver et al., *supra* note 5, at 128.

27. *See, e.g.*, Celia Sánchez Peñas & Peter Willett, *Brief Communication: Gender Differences in Publication and Citation Counts in Librarianship and Information Science Research*, 32 *J. INFO. SCI.* 480, 484 (2006) (“There are, however, no significant differences in the numbers of citations to published papers by male and by female LIS academics.”).

28. *See, e.g.*, Steven Stack, *Gender and Scholarly Productivity: The Case of Criminal Justice*, 30 *J. CRIM. JUST.* 175, 180-81 (2002).

29. *See, e.g.*, Matthew R.E. Symonds et al., *Gender Differences in Publication Output: Towards an Unbiased Metric of Research Performance*, *PLoS ONE*, Dec. 2006, at 1, 2 (concluding that in the fields of evolutionary biology and ecology, once one controls for the lower rates of female researcher productivity, female researchers receive more cites than male researchers).

30. Copenheaver et al., *supra* note 5, at 128.

31. *See, e.g.*, Maliniak et al., *supra* note 19, at 918-19.

32. *See, e.g.*, Aksnes et al., *supra* note 20, at 628 (“The gender differences in citation rates can be attributed to differences in productivity. There is a cumulative advantage effect of increasing publication output on citation rates. Since the women in our study publish



Researchers have also studied the acceptance rates of female-authored articles at top journals in comparison to male-authored articles, finding a higher acceptance rate for male-authored articles.<sup>33</sup> Others have found that females have a hard time finding coauthors,<sup>34</sup> but that women, while engaging in fewer collaborations, are more open to teaming with new coauthors.<sup>35</sup> Data also supports that men are more likely to cite their own papers than women,<sup>36</sup> and that men are more likely to cite other men.<sup>37</sup>

### *B. Studies on Legal Scholarship*

With regard to legal scholarship, gender disparity in scholarly influence has received very little attention. Two studies, done in the early 2000s, use two very different methodologies and arrive at different results: one finding female authors cited more than men,<sup>38</sup> and the other finding the opposite.<sup>39</sup>

Ayres and Vars, in a study not particularly directed to the question of women's scholarly influence, did observe that female-authored papers receive significantly more citations than papers authored by men.<sup>40</sup> Ayres and Vars analyzed the citations for articles published from 1980 to 1995 in three law reviews: *Harvard Law Review*, *Stanford Law Review*, and *Yale Law Journal*.<sup>41</sup> In

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significantly fewer publications than do men, they benefit less from this effect.”); Cameron et al., *supra* note 20, at 245-47 (finding more career absences and non-research active years for women); Peñas & Willett, *supra* note 27, at 484 (“Statistical analysis of the resulting data shows that the male LIS academics do publish significantly more papers on average than do female LIS academics: this situation mirrors that observed in other disciplines, despite the high proportion of women working in the area as professionals and academics.”); Xiao Han T. Zeng et al., *Differences in Collaboration Patterns Across Discipline, Career Stage, and Gender*, PLOS BIOLOGY, Nov. 2016, at 1, 3.

33. See, e.g., Marianne A. Ferber & Michelle Teiman, *Are Women Economists at a Disadvantage in Publishing Journal Articles?*, 6 EASTERN ECON. J. 189, 193 (1980) (finding that women economists are at a “disadvantage ... in having their manuscripts accepted”).

34. See, e.g., *id.*

35. See, e.g., Zeng et al., *supra* note 32, at 4, 9.

36. Maliniak et al., *supra* note 19, at 889 (finding “women tend to cite themselves less than men”).

37. *Id.* (observing that “men ... tend to cite men more than women”).

38. Ayres & Vars, *supra* note 9, at 439.

39. Merritt, *supra* note 9, at 353.

40. Ayres & Vars, *supra* note 9, at 438 tbl.3.

41. *Id.* at 429.

addition to date and journal of publication, they examined fifty other article attributes, including demographic data regarding the author's gender.<sup>42</sup>

Based on this data, Ayres and Vars found that “[w]hite female authors received 57 percent more citations than white men” and that “[a]rticles by minority women were the most heavily cited, with 164 percent more citations than articles by white men.”<sup>43</sup> The authors thought that the editors at the top three journals caused this finding by “setting a higher quality threshold for their acceptance” of female-authored articles as compared to male-authored articles.<sup>44</sup> The finding could also be that the articles by female authors “were of higher average quality.”<sup>45</sup> Ayres and Vars further noted that the difference could be based in some nonquality related bias to citing female authors; however, data suggested that citation, in general, is based on quality of the cited article.<sup>46</sup>

Merritt performed a study looking at the relationship of gender and race on scholarly impact.<sup>47</sup> Merritt found that white men averaged significantly more citations than did women or minorities.<sup>48</sup> Merritt's study made this finding based on a model of a specially selected cohort of law professors.<sup>49</sup> Merritt examined citation counts for all 815 professors who began tenure-track positions at accredited U.S. law schools between 1986 and 1991, and who remained on the tenure track in fall 1998.<sup>50</sup> In addition to

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42. *Id.* at 438 tbl.3 (detailing these variables).

43. *Id.* at 439.

44. *Id.* at 444.

45. *Id.*

46. Ayres & Vars make this observation by looking at which articles are listed first when the articles are arranged nonalphabetically. *Id.*

47. *See generally* Merritt, *supra* note 9.

48. *Id.* at 353 (“White men averaged 107.9 citations; women of color, 90.7; white women, 78.8; and men of color, 73.1.”).

49. Those who “began teaching between 1986 and 1991, when law schools proclaimed a strong commitment to affirmative action and hired a substantial number of female and minority scholars” and who remained in tenure track positions as of the fall of 1998 when measurement was taken. *Id.* at 346-48. Notably, this means that Merritt's study does not track those who started teaching but were no longer teaching in the fall of 1998, meaning that she fails to track those who, for whatever reason, decided to leave the academy.

50. *Id.* at 346-47.

citation count, Merritt identified the race and gender of each of the professors in the dataset, as well as other author characteristics.<sup>51</sup>

Merritt found a difference in citation rates along gender lines.<sup>52</sup> Notably, this difference was “particularly small when compared with other variations in academic citation rates.”<sup>53</sup> Furthermore, Merritt explained that, after controlling for many of the other non-gender author characteristics, the variance in citation rates were “a minute 0.4 percent.”<sup>54</sup> Merritt concluded that, while the study’s results support gender as one explanation for why female authors receive fewer citations than men, the power of this factor to explain such differences was declining.<sup>55</sup>

Many other studies have focused on alternative aspects of female-authored legal scholarship. Studies document the lower number of female law professors in comparison to male law professors.<sup>56</sup> Studies have also noted the higher proportion of male-authored articles placed in top law reviews.<sup>57</sup> The dearth of female law review editors has also been chronicled.<sup>58</sup>

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51. *Id.* at 352-53 tbls.1-2 (identifying these independent variables).

52. *Id.* at 355-58 (reporting results in detail in Table 3 and Table 4). Notably, Merritt’s citation count is not by article, but a total for all of a specific author’s articles. *Id.* at 348-49.

53. *Id.* at 363-64.

54. *Id.*

55. *Id.* at 367-68.

56. See JASON HAWKINS, ROUNDTABLE ON INCREASING AUTHOR DIVERSITY IN LEGAL SCHOLARSHIP: PROGRAM AND BIBLIOGRAPHY 8 (2015); Edward S. Adams & Samuel P. Engel, *Gender Diversity and Disparity in the Legal Profession: An Empirical Analysis of the Gender Profile in National Law Firms and Law Schools*, 63 *BUFF. L. REV.* 1211 (2015); Hannah Brenner, *Expanding the Pathways to Gender Equality in the Legal Profession*, 17 *LEGAL ETHICS* 261 (2014); Marjorie E. Kornhauser, *Rooms of Their Own: An Empirical Study of Occupational Segregation by Gender Among Law Professors*, 73 *UMKC L. REV.* 293 (2004); Nancy Leong, *Discursive Disparities*, 8 *FIU L. REV.* 369 (2013); Paula A. Monopoli, *Gender and the Crisis in Legal Education: Remaking the Academy in Our Image*, 2012 *MICH. ST. L. REV.* 1745.

57. See Minna J. Kotkin, *Of Authorship and Audacity: An Empirical Study of Gender Disparity and Privilege in the “Top Ten” Law Reviews*, 31 *WOMEN’S RTS. L. REP.* 385, 386-87, 396-99 (2010); Jason P. Nance & Dylan J. Steinberg, *The Law Review Article Selection Process: Results from a National Study*, 71 *ALB. L. REV.* 565, 583, 587 (2008); Christine Hurt, *More on Gender, Scholarship, and HLR*, *CONGLOMERATE* (May 19, 2005), [http://www.theconglomerate.org/2005/05/more\\_on\\_gender\\_.html](http://www.theconglomerate.org/2005/05/more_on_gender_.html) [<https://perma.cc/R5SJ-KYFT>]; Laura Spitz, *Where Are the Women? Another Post About Gender Disparities at Elite Law Journals* (Apr. 30, 2009), <http://www.feministlawprofessors.com/2009/04/where-are-the-women-another-post-about-gender-disparities-at-elite-law-journals/> [<https://perma.cc/2Z7L-WVSK>].

58. *E.g.*, Lynne N. Kolodinsky, *The Law Review Divide: A Study of Gender Diversity on the Top Twenty Law Reviews* (2014) (unpublished student note) (on file with Cornell Law

## II. METHODS

To explore the impact of gender on citation rates in the area of legal studies, we examined 19,257 law review articles from the HeinOnline Law Journal Library.<sup>59</sup> The database of articles comprises all articles—excluding student notes and commentaries<sup>60</sup>—published across a twenty-year period (1990 to 2010), by a randomly selected one-half of top 100 law reviews.<sup>61</sup>

For the retrieved articles, we collected the following information via computer script: article title, number of words in title, publishing law review, article citation, publication year, article page length, author names, the listing position of the author, and the number of citations of the article in other HeinOnline Law Library law reviews. We collected the citation information for all articles as of the same date: November 25, 2012.

For all collected articles, each listed author's gender was human coded. Coding was initially based on the author's first name.<sup>62</sup> If the coder considered the name to be commonly associated with a particular gender, then the author's gender was coded as such.<sup>63</sup> However, if the coder had any question about the author's gender, the coder did a search for the individual's law school, or other employment web page. If the coder found such a page, the coder read the text of the page to identify the author's gender. If the web page did not use a pronoun, the coder used the photograph of the

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Library), <http://scholarship.law.cornell.edu/cllsrp/8/> [<https://perma.cc/E97S-FGRE>].

59. See Fred R. Shapiro & Michelle Pearse, *The Most-Cited Law Review Articles of All Time*, 110 MICH. L. REV. 1483, 1486 (2012) (noting that HeinOnline's Law Journal Library "includes the vast majority of the entire United States law review literature from the nineteenth and twentieth centuries").

60. We used HeinOnline's Law Library search options to filter out student-authored articles.

61. Washington and Lee School of Law Law Library's law journal rankings were used to determine the top 100 law reviews. *Law Journals: Submissions and Ranking, 2009-2016*, WASH. & LEE U. SCH. L., <http://lawlib.wlu.edu/LJ/index.aspx> [<https://perma.cc/N7Y7-JRC9>].

62. Ferber, *supra* note 19, at 383; Maliniak et al., *supra* note 19, at 897; Jevin D. West et al., *The Role of Gender in Scholarly Authorship*, PLOS ONE, July 2013, at 1, 2-3. The implication is that the study cannot categorize transgender scholars, or other scholars that would not fit within binary male or female gender identification. *See id.*

63. Examples of such names are David and Jeffrey being coded as "male," and Jennifer and Mary being coded as "female."

individual to identify the author's gender. If no photograph was available, the coder performed further web searches to see if any other pages used pronouns to identify the author's gender. In cases when the coder could not find information associating the name with a gender, we left the gender of the author as missing data.<sup>64</sup>

To improve our understanding of the effect of female authorship on citation rates, and to address some concerns about possible distorting influences from other independent variables, we employed a multiple regression analysis. We gathered the data used as follows. From the collected articles described above, we took a sample of 6981 articles published during the period spanning and including the years 2000 and 2010. We coded the articles for the presence of an abstract and table of contents, number of footnotes, subject matter,<sup>65</sup> whether the first author was a law professor,<sup>66</sup> and the first author's institution.<sup>67</sup>

### III. RESULTS AND DISCUSSION

#### A. Overall

Articles having at least one female author comprised just over a quarter (26.94 percent) of the law review articles published in top 100 law reviews from 1990 to 2010.<sup>68</sup>

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64. A sample of the coding was coded by a second coder. Intercoder reliability (Cohen's kappa) is 0.957, indicating that reliability of coding is quite strong. Matthew Lombard et al., *Practical Resources for Assessing and Reporting Intercoder Reliability in Content Analysis Research Projects*, <https://www.merlot.org/merlot/viewMaterial.htm?id=86697> [<https://perma.cc/HYG2-VAF5>].

65. The subject matter categories used included: Business Law, Constitutional Law, Criminal Law, International Law, Procedure, Discrimination, Feminism or Critical Legal Studies, Economics, Common Law, Jurisprudence, and Other. We attempted to mimic the categories used by Ayres and Vars in their citation study. See Ayres & Vars, *supra* note 9, at 438 tbl.3. Like Ayres and Vars we found that some categories were difficult to code with consistency (Common Law, for example), while others were much easier to identify (Constitutional Law, for example).

66. Whether the first author was a "law professor" was determined initially by the self-identification by the author in the dagger footnote. "Visiting" law professors are included in the category of "law professor."

67. Just as with "law professor," institution was initially determined by the description in the dagger footnote. If the author identified more than one institutional affiliation, we recorded them all.

68. See *infra* Table 1.

Table 1. The Frequency of Female Authorship in Top 100 Law Reviews Between 1990 and 2010

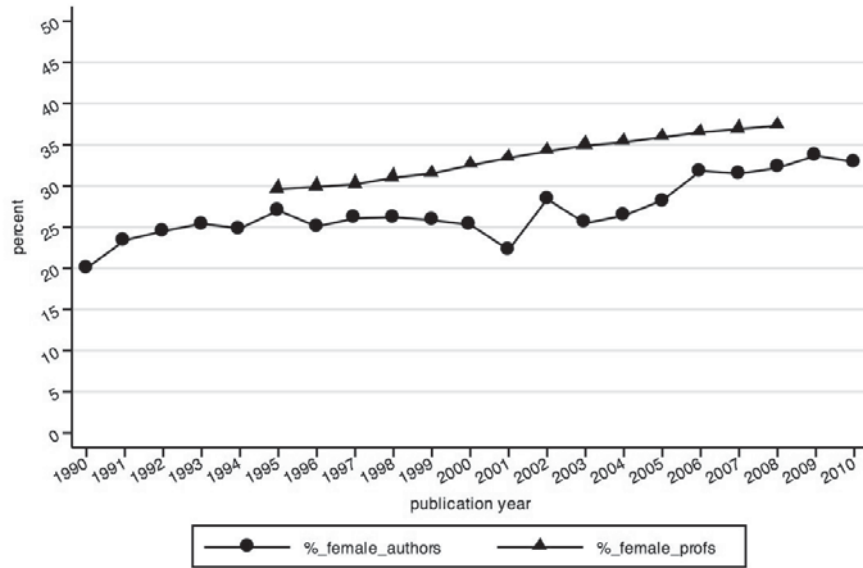
Author's Gender	Frequency	Percentage
Male	14,069	73.06
Female	5188	26.94
All	19,257	100

The fraction of female authorship in the data set is slightly below the fraction of female participation in the legal academy during a similar period, 2007 through 2009, according to data provided by the American Association of Law Schools.<sup>69</sup>

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69. PATI ABDULLINA, ASS'N OF AM. LAW SCHS., STATISTICAL REPORT ON LAW FACULTY 10 (2007-2008).

Figure 1. Percent Articles in Top 100 Law Reviews with Female Authors Compared to Percent Female Law Professors, 1990-2010



From 1990 to 2010, the mean number of top 100 law review articles having at least one female author trended upward ( $r = 0.839$ ;  $p < .001$ ), as did the mean number of female law professors ( $r = 0.994$ ;  $p < .001$ ).<sup>70</sup> Regressing mean female-authored articles on publication year, and mean female law professors on publication year, yields similarly positive slope coefficients with overlapping confidence intervals.<sup>71</sup> This suggests correspondence between more females entering the legal academy and more female-authored law review articles. The correlation coefficient between the yearly mean of articles with at least one female author and the yearly mean of female law professors ( $r = 0.652$ ;  $p < 0.020$ ) further supports a positive relationship between the number of female law professors

70. See *supra* Table 1.

71. See *supra* Figure 1.

available and the number of female-authored articles in top 100 law reviews.<sup>72</sup>

Based on evidence from studies in other disciplines, we expected female-authored articles to be cited less often than articles with exclusively male authors.<sup>73</sup> This is not what we observed.

Taking all of the data as a cross section, we found that the average number of citations received by articles with at least one female author is 23.390, while the average number of citations received by articles without a female author is 22.286.<sup>74</sup> These differences are statistically significant ( $p = 0.009$ ) (rank sum).<sup>75</sup>

The distribution of the number of citations received by the articles in our dataset is substantially right tailed.<sup>76</sup> In such instances the median may be a better indicator of central measure than the mean.<sup>77</sup> An examination of the median number of citations received by female- and male-authored articles does not indicate that female-authored articles average fewer citations than male-authored articles.<sup>78</sup> To the contrary, it confirms what the observation of the means suggests. In articles published in top 100 law reviews between 1990 and 2010, those with at least one female author exhibited a median of no fewer citations (12) than articles with male authors (12).<sup>79</sup>

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72. See *supra* Figure 1.

73. See *supra* Part I.A.

74. See *infra* Table 2.

75. The “rank sum” test is an alternative to the “*t*-test,” which determines the difference between independent population means for two samples. See generally Clay Ford, *The Wilcoxon Rank Sum Test*, U. VA. LIBR. (Jan. 5, 2017), <http://data.library.virginia.edu/the-wilcoxon-rank-sum-test/> [<https://perma.cc/9URB-XG3L>].

76. See *infra* Table 2.

77. See *Skewed Distributions: Definition, Examples*, STATISTICS HOW TO, <http://www.statisticshowto.com/probability-and-statistics/skewed-distribution/> [<https://perma.cc/WCC5-JAGV>].

78. See *infra* Table 2.

79. Another statistical means of addressing the right-tailedness of the data is to transform the independent variable so that it takes on parametric characteristics. The “number of cites” variable is amenable to such a transformation. When that is done, and a *t*-test performed, there is statistical evidence ( $t = 2.17$ ,  $p = 0.03$ ) that articles with at least one female author garner *more* citations than articles authored by men.



Table 2. Number of Citations to Female- and Male-Authored Articles in Top 100 Law Reviews Between 1990 and 2010

	Mean	Median	Standard Deviation
Male-Authored	22.286	12	35.509
Female-Authored	23.390**	12	41.695

\*\* $p < 0.01$

The distribution of citation to female- and male-authored articles across citation percentiles exhibits a similar pattern.<sup>80</sup> Articles with at least one female author showed the same number of citations as articles without female authors at the 5th, 10th, 25th, 50th, and 75th percentiles.<sup>81</sup> Consistent with the observed higher mean for articles with at least one female author, such articles showed higher rates of citation at the 90th, 95th, and 99th percentiles.<sup>82</sup> Taken together, these data suggest that the distribution of citation by gender is similar. The observation that female-authored papers have higher citation rates at very high percentiles further suggests the possibility that women might be somewhat disproportionately responsible for higher impact research. An examination of the minimum and maximum number of citations observed for each gender indicates that the most heavily cited paper (by far) in our data is authored by a woman.<sup>83</sup>

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80. See *infra* Table 3.

81. See *infra* Table 3.

82. See *infra* Table 3.

83. Angela P. Harris's article, *Race and Essentialism in Feminist Legal Theory*, 42 STAN. L. REV. 581 (1990), received the 1264 citations, with the next highest cited female-authored article being Christine Jolls, Cass R. Sunstein, and Richard Thaler's article, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471 (1998), with 784 citations—close to the highest cited male-authored article, with 746 citations, is William N. Eskridge, Jr., *The New Textualism*, 37 UCLA L. REV. 621 (1990).

Table 3. Citations by Percentile for Male- and Female-Authored Articles in Top 100 Law Reviews Between 1990 and 2010

Percentile	5	10	25	50	75	90	95	99	Min	Max
Male-Authored	1	2	5	12	26	52	77	168	0	746
Female-Authored	1	2	5	12	26	53	78	176	0	1264

### B. Investigating the Impact of the Opportunity to Be Cited

To this point, we have analyzed the citation data in cross section. One important limitation to such analysis is that it fails to take into account the opportunity an article has had to be cited. Perhaps the most important aspect of opportunity to be cited is time. The older an article is, the longer it has been available to cite. The prediction is straightforward: articles published in earlier years should have more citations than articles published in more recent years. Our data had this characteristic ( $r = -0.9630$ ;  $p < 0.001$ ).<sup>84</sup>

To address the possible distorting effect of time, we standardized citation rates by comparing female- and male-authored articles within a given publication year. We calculated a ratio for each year's published articles (the relative gender impact (RGI)).<sup>85</sup> We calculated RGI by dividing the median number of citations received by female-authored work over the median number of citations received by male-authored work. Thus, when RGI equals 1, the rate of citation to female- and male-authored papers was the same. When RGI is greater than 1, the rate of citation to female-authored papers was greater than male-authored papers. When RGI was less than 1, the rate of citation to female-authored papers was less than male-authored papers.

Not accounting for time effects, the overall data has an RGI of 1: the median number of citations for both female- and male-authored articles was 12.<sup>86</sup> Standardizing for time, however, we observed that for most publication years, articles with at least one female author

84. Correlating publication year to average number of citations for articles in a year.

85. See generally Wuchty et al., *supra* note 2.

86. See *supra* Table 2.

exhibited greater impact than articles without a female author.<sup>87</sup> The distribution of RGI across the period from 1990 to 2010 appeared to move from relatively lower RGIs, for articles published in earlier years, to more strikingly higher RGIs, for articles published in the more recent decade.<sup>88</sup> The observed correlation coefficient between publication year and RGI is positive ( $r = 0.451$ ) and statistically significant ( $p < 0.050$ ), indicating that the extent to which female-authored articles are more impactful than male-authored articles has trended upward. That is, the impact of female authorship is more pronounced for recently published top 100 law review articles.

Figure 2. Relative Gender Impact (RGI), 1990-2010

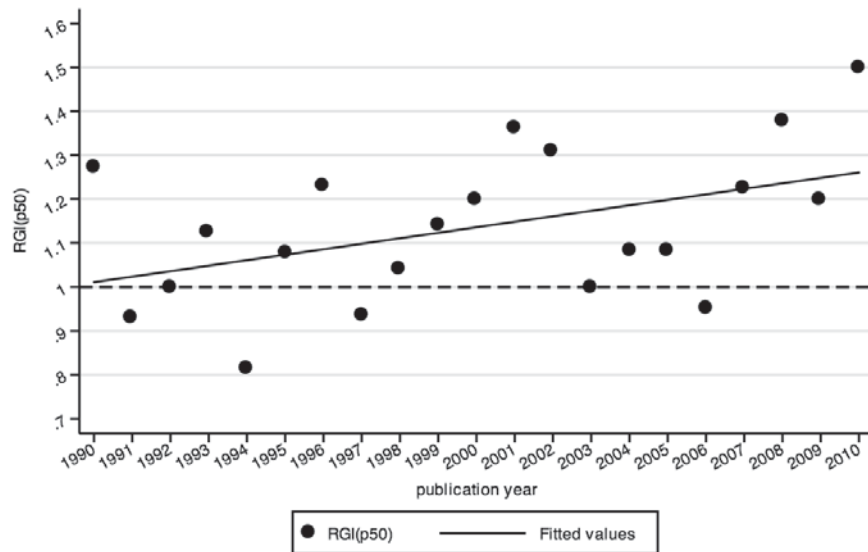


Fig. 2. Articles with female authors exhibit greater impact than articles with male authors. RGI(p50) is the relative gender impact measured as the quotient of the median number of citations garnered by female-authored over nonfemale-authored articles.

Taken together, the data to this point uniformly rejected the idea that articles with a female author have lower citation rates than articles without a female author. The evidence has two aspects.

87. See *infra* Figure 2.

88. See *infra* Figure 2.

First, female-authored articles are either no different than male-authored articles at the central measures or, depending on the statistical arguments employed, enjoyed a statistically noticeable advantage. Second, female-authored articles might disproportionately comprise the higher impact (that is, the more highly cited) category. In terms of gender disparity in citation rates to articles published in top 100 law reviews, the evidence, on net, demonstrates that female-authored articles enjoy an advantage in impact over male-authored articles.

### *C. Considering High Impact Articles*

To better understand the extent to which female-authored papers disproportionately comprise the higher impact category, we examined the rate of female authorship of articles with different levels of citation.<sup>89</sup>

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89. *See infra* Figure 3.

Figure 3. Mean Female Authorship and Article Impact, 1990-2009

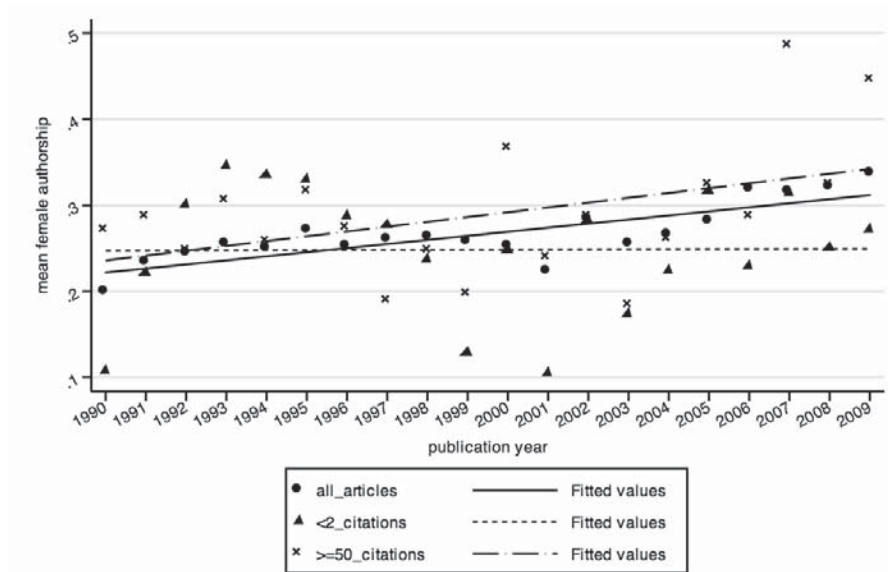


Fig. 3. Mean female authorship is higher in more highly impactful articles, an effect that appears to trend positively relative to publication year, 1990-2009.

From 1990 to 2010, women authored about one quarter of all articles published in top 100 law reviews that received less than two citations.<sup>90</sup> The data showed no indication of a trend in women's authorship of low impact articles across publication year ( $r = 0.008$ ;  $p = 0.972$ ).<sup>91</sup> By contrast, mean female authorship of all articles in the dataset trended upward across publication year ( $r = 0.813$ ;  $p < 0.001$ ).<sup>92</sup>

Consistent with the idea that women are disproportionately responsible for higher impact articles, the mean female authorship of articles with fifty or more citations was higher than that for all articles.<sup>93</sup> Mean female authorship for such articles exhibited an upward trend across publication year ( $r = 0.434$ ;  $p = 0.056$ ) that

90. See *supra* Figure 3.

91. See *supra* Figure 3.

92. See *supra* Figure 3.

93. See *supra* Figure 3.

apparently paralleled the upward trend in female authorship across the same period.<sup>94</sup> This suggests the possibility that the propensity of women to author high impact law review articles corresponds reasonably well to the entry of more women into the legal academy. If so, it could indicate that the disparity in scholarly impact favoring female-authored articles might be fairly broad based—that is, our observations are perhaps less likely explained by a relatively small number of female superstars.

To improve our understanding of how the disparity in citation rates that favors female-authored articles related to article age, we distributed the RGI across percentiles of citation for articles published in the oldest five years of the data, 1990 to 1994, and articles published in the most recent five years of the data, 2006 to 2010.<sup>95</sup>

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94. *See supra* Figure 3.

95. *See infra* Figure 4. We determined an RGI from 1990 to 1994 by summing all the citations received by female-authored articles at a given percentile (for example, 25th) for the five-year period, and then dividing that by the sum of all the citations received by male-authored papers for the same five-year period at the same percentile. We did the same for the 2006 to 2010 period. *Cf.* Wuchty et al., *supra* note 2, at 1037.

Figure 4. Relative Gender Impact (RGI) Across Citation Percentiles

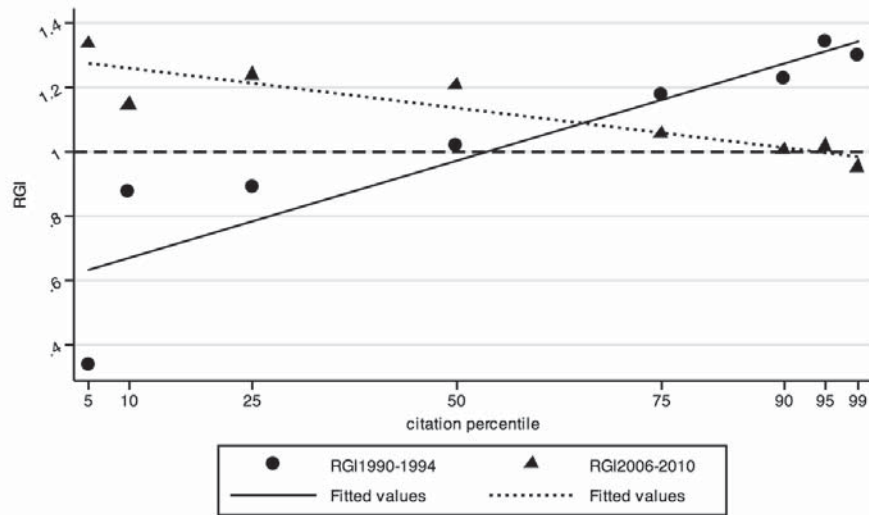


Fig. 4. Relative gender impact across citation percentiles measured as the quotient of the number of citations garnered by female-authored and nonfemale-authored articles at the relevant percentile. Comparing the first five years of data, 1990-1994, to the most recent five years of data 2006-2010. Articles having female authors exhibit a relatively greater impact with older articles appearing especially impactful.

For older articles, those published between 1990 and 1994, the relative impact of female authorship is striking for higher impact articles.<sup>96</sup> RGI easily exceeded 1 for the 75th, 90th, 95th, and 99th percentiles of citation. Standing in contrast to the disproportionate impact of female-authored articles at the high end of the citation distribution was the observation that male authorship seemed to dominate the publication of lower impact articles during this time period.<sup>97</sup>

Female-authored articles also appeared to dominate in impact over male-authored articles in the most recently published articles in the data, as in nearly all percentiles RGI exceeds 1.<sup>98</sup> However, the data pattern was clearly different. The range of percentiles across which RGI exceeded 1 broadened, and when it comes to the

96. See *supra* Figure 4.

97. See *supra* Figure 4.

98. See *supra* Figure 4.

most highly impactful articles, those comprising the 90th, 95th, and 99th percentiles, RGI was very close to 1.<sup>99</sup> This observation suggests a degree of gender parity for the most highly impactful, recently published articles.

#### *D. Investigating Other Possible Determinants of Citation Rates*

We now turn to multiple regression to improve our understanding of the effect of female authorship on citation rates. This approach allows us to statistically control for factors that might mask, or otherwise distort, the observation that female-authored articles are on average cited as much as, or more than, male-authored articles.<sup>100</sup> Moreover, this approach should provide something of a fuller explanation of citation rates to articles in top 100 law reviews because it seems obvious that citation rates to a law review article are not solely the product of the gender of an author.<sup>101</sup> What we observed, ultimately, was that the impact of author gender was robust across models that included a number of factors impacting citation rates and explained a very respectable amount of variance.

The main variable of interest in the regression analysis was female authorship. Because all authors are presumed to contribute equally to articles reporting their research, female authorship (fem\_ authorship) was coded to equal 1 when the observed article had at least one female author.<sup>102</sup>

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99. See *supra* Figure 4.

100. See *supra* Table 2.

101. See, e.g., Ayres & Vars, *supra* note 9, at 442 (noting “the effects of various article and author attributes” on the citations the article received per year).

102. Another choice would have been to count female authorship only in situations where articles evinced sole female authorship, or a woman is listed as the first and/or last author. See, e.g., Sugimoto et al., *supra* note 23, at 211-13 (investigating the impact of the “lead-author” in various fields of study). We decided to present the data as described for the reasons provided in the text, and because of a lack of evidence that law review and journal articles observe the conventions of research-based fields. We have, however, examined the data when female authorship is counted only in situations where articles evinced sole female authorship, or a woman is listed as the first author. The observations are similar to those reported in the text.



The regression analysis relied on several models of the data.<sup>103</sup> To address the tailedness of the dependent variable (number of citations), we transformed the data by the square root function<sup>104</sup> (we will continue in the text to refer to just “number of citations” for ease of reading). The mean number of citations in the data was 3.549.<sup>105</sup>

Our first and most general model, Model (1), regressed the number of citations<sup>106</sup> of female authorship.<sup>107</sup> It showed a significant effect ( $\beta = 0.173$ )—amounting to an increase in citation rates for female-authored articles of 10.133 percent<sup>108</sup> (or 1.241 citations) over male-authored articles.

As noted earlier, the older an article is, the longer it has been available to cite.<sup>109</sup> We addressed that problem by comparing citations within given years using the RGI measure.<sup>110</sup> Here, Model (2) statistically controls for the opportunity to be cited using indicator variables for publication year (`pub_year`).<sup>111</sup> The partial coefficient for female authorship was positive ( $\beta = 0.246$ ) and statistically significant, supporting the idea that the advantage in citation rates that female-authored articles enjoy is not a phenomenon controlled by just one or a few years’ observations.

Because this Article follows the convention of correlating scholarly influence, or impact to rate of citation,<sup>112</sup> once one accounts for time, it may be unimportant which law review or journal published an article. However, it seems plausible that the law review or journal of publication could affect citation rates in ways that do not correlate with research quality.<sup>113</sup> In addition, it is clear that there was

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103. Recall that the data used in these models is based on a 6981-article sample taken from the overall dataset representing articles published from 2000 to 2010, for which additional variables were coded.

104. Another approach is to use a negative binomial model. We did this and we observed a similar pattern of results. *See infra* Appendix, Table A1.

105. *See infra* Table 4 (depicting models).

106. Specifically, the square root of the number of citations.

107. *See infra* Table 4.

108. Arrived at by backtransforming and comparing the predicted number of citations with and without female authorship. *See infra* Table 4.

109. *See supra* Part III.B.

110. *See supra* Figure 4.

111. *See infra* Table 4.

112. *See supra* Introduction.

113. *See Ayres & Vars, supra* note 9, at 431-32.

significant variation in our data across law reviews with respect to female authorship.

To address these concerns, Model (3) statistically controlled not only for publication year but also for law review of publication (*law\_rev*).<sup>114</sup> As we discuss below, however, the use of this control presented something of an identification problem<sup>115</sup> because it was difficult to conceptualize the significance of any observed effects.<sup>116</sup> In particular, whether the control helped address variations in an article's opportunity for citation, or whether it was unreasonably applying a higher standard to articles appearing in more widely circulated or highly regarded law reviews.<sup>117</sup>

On one view, the law review of publication seemed to clearly relate opportunity for citation. For example, law reviews have varying degrees of circulation,<sup>118</sup> and it is easy to imagine that articles published in more widely circulated law reviews are more heavily cited for that reason alone.<sup>119</sup> In addition, scholars may have a preference for reading certain journals and for citing articles that come from certain law reviews "in the hopes that it will lend more weight to their own writings."<sup>120</sup> Moreover, in deciding to accept articles for publication, it seems possible that law reviews might consider factors such as the author's reputation, home institution, and, perhaps, gender.<sup>121</sup> When articles are published in more widely circulated or highly regarded law reviews for these sorts of reasons, it seems most correct to conclude that the law review of publication variable is another variable that controls the opportunity for citation. From this perspective, the law review of publication control helps to clarify the scholarly impact of female-authored articles by addressing factors that should not correlate as well to scholarly impact as, say, research quality.

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114. *See infra* Table 4.

115. *See* Ayres & Vars, *supra* note 9, at 443-44.

116. *See id.*

117. *See id.* at 434.

118. *See id.*

119. *See id.*

120. Lee Petherbridge & Christopher A. Cotropia, *Should Your Law Review Article Have an Abstract and Table of Contents?: An Empirical Analysis*, 85 *MISS. L.J.* 295, 315 (2016).

121. *See generally* Nance & Steinberg, *supra*, note 57 (discussing the factors considered in the law review article selection process).

From another view, however, law review of publication could perhaps correlate with articles that “deserve” more citations, because they make greater contributions. That is, “better” articles are published in more highly regarded and more widely circulated law reviews, because those law reviews have the power to acquire and publish such articles. Thus, while articles published in widely circulated or highly regarded law reviews might receive some citations merely from being published by such law reviews,<sup>122</sup> they might also receive some citations because they are likely to make more significant contributions than articles published in other law reviews. If one views the matter from this perspective, including the law review of publication variable might unreasonably diminish the scholarly impact of articles published in certain law reviews.

The bottom line is, perhaps, that if two different law reviews published the identical article, the article might, for a number of plausible reasons, receive different numbers of citations. Because it is possible that female or male authors might disproportionately end up in a more highly or lowly cited journal, we statistically controlled for law review of publication in Model (3), acknowledging the identification difficulties just discussed.<sup>123</sup> Once statistical controls for law review of publication were added, female authorship remained a somewhat more positive ( $\beta = 0.270$ ) and strongly statistically significant determinant of the number of citations an article received.<sup>124</sup>

The scholarly impact of an article is known to be sensitive to its characteristics, such as the number of footnotes or whether it contains an abstract or table of contents.<sup>125</sup> Model (4) includes the variables of Models (2) and (3), and adds additional statistical controls to address paper characteristics, such as number of words in title (`title_words`), presence of an abstract (`abstract`), presence of a table of contents (`toc`), number of footnotes (`no_footnotes`),<sup>126</sup>

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122. Petherbridge & Cotropia, *supra* note 120, at 315.

123. *See infra* Table 4.

124. *See infra* Table 4.

125. Ayres & Vars, *supra* note 9, at 439, 444; Petherbridge & Cotropia, *supra* note 120, at 304-05.

126. Square root transformed.

number of pages (*no\_pages*),<sup>127</sup> and subject matter (*sm\_conlaw*).<sup>128</sup> The coefficient for female authorship remains positive and strongly statistically significant.

Model (5) adds to the opportunity variables of Models (2) and (3), variables concerning author characteristics, such as whether the author's home institution is a top fifteen law school (*auth\_inst\_t\_15*),<sup>129</sup> whether the author is a law professor (*law\_prof*), and whether the paper is team authored (*solo\_author*).<sup>130</sup> It leaves out the variables concerning paper characteristics. Female authorship is robust to the addition of author characteristic variables (0.219).<sup>131</sup>

Finally, female authorship retained a statistically significant impact on citation rates when we considered all opportunity variables, paper characteristics variables, and author characteristics variables are considered in Model (6).<sup>132</sup>

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127. Square root transformed.

128. Binary for whether the subject matter of the article was constitutional law. *See infra* Table 4.

129. We coded the author's home institution's prestige by using the *U.S. News & World Report* law school rankings. *See Best Law Schools*, U.S. NEWS & WORLD REP. (2017), <http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-law-schools/law-rankings?int=992008> [<https://perma.cc/V4RS-4J38>].

130. Binary for whether the article has one or more authors, a factor shown to increase the scholarly impact of law review and law journal articles. *See generally* Christopher A. Cotropia & Lee Petherbridge, *The Dominance of Teams in the Production of Legal Knowledge*, 124 *YALE L.J. F.* 18 (2014).

131. *See infra* Table 4.

132. *See infra* Table 4.

Table 4. Models Addressing Opportunity to Be Cited and Other Determinants of Citation

	(1)	(2)	(3)	(4)	(5)	(6)
<b>VARIABLES</b>						
fem_authorship	0.173	0.246	0.270	0.181	0.219	0.151
	(0.058)**	(0.056)***	(0.049)***	(0.044)***	(0.048)***	(0.043)***
pub_year		X	X	X	X	X
law_rev			X	X	X	X
title_words				-0.017		-0.013
				(0.004)***		(0.004)***
abstract				0.155		0.130
				(0.061)*		(0.060)*
toc				-0.130		-0.105
				(0.063)*		(0.062)
no_footnotes				0.014		0.022
				(0.011)		(0.010)*
no_pages				0.414		0.374
				(0.027)***		(0.027)***
sm_conlaw				0.010		0.015
				(0.057)		(0.056)
solo_author					-0.448	-0.319
					(0.064)***	(0.058)***
law_prof					0.979	0.580
					(0.049)***	(0.044)***
auth_inst_t_15					0.207	0.392
					(0.056)***	(0.050)***
n	6981	6981	6981	6978	6981	6978
R2	0.001	0.067	0.307	0.456	0.345	0.475
p	0.003	<0.000	<0.000	<0.000	<0.000	<0.000

*Note:* The dependent variable is the square root of the number of citations. As discussed in more detail in the text, Model (1) is female authorship alone; Model (2) is opportunity to be cited; Model (3) is the law review of publication; Model (4) is the paper characteristics; Model (5) is the author characteristics; and Model (6) is all of the variables combined. Robust standard errors are reported in parentheses.

\* $p < 0.05$

\*\* $p < 0.01$

\*\*\* $p < 0.001$

In deciding how to present the data, we opted for the conventional approach of transforming our dependent variable to take on parametric characteristics. A drawback to this approach was that it was somewhat more difficult to understand the practical significance of the models. To help address this interpretive limitation, we offered the following information about models identical to those just described. But this information predicts an untransformed number of citations variable. This is in the spirit of providing something of a more practical sense of the size of effect. In all instances under this approach, female authorship produced a positive and significant coefficient.<sup>133</sup>

For example, the mean number of cites for female-authored papers was 18.288 compared to a mean of 16.963 for male-authored papers ( $t = 2.141$ ;  $p = 0.032$ ).<sup>134</sup> Generally speaking, the models indicate that, after controlling for the effect of other theoretically plausible determinants of citation in the data, female authorship was worth between roughly 1.3 to 2.4 citations.<sup>135</sup>

#### *E. What Is Different About Female-Authored Articles?*

The observation that female-authored articles appear generally to be more cited than male-authored articles in the field of legal studies, even if not overwhelmingly so, sets legal studies apart from some other disciplines and stimulates the question: What explains the observed gender disparity?

The answer to such a question is surely complex and lies well beyond the data collected here and well beyond the ambitions of this study, which are only to investigate by measurement whether the field of legal studies exhibits the same disparity in citation rates observed in other fields. With that in mind, these data do permit us to describe some features of female-authored papers that might be relevant to their surprising comparative rate of citation (when compared to some other fields). We offer what follows, therefore, in the hope that it might be information that supports useful speculation that helps lead to future research.

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133. See *supra* Table 4.

134. See *supra* Table 2.

135. Another approach, backtransforming, yields a similar number of cites.

Our approach in this Section is straightforward. We regress female authorship on variables that may relate to citation rate hoping that we might discover factors that noticeably distinguish female authorship. As a moment's reflection will reveal, however, determining factors that influence female authorship of law review articles does not, on its own, tell us that those factors are statistically responsible for the advantage in citation that female-authored articles seem to have over male-authored articles. At best, it provides information that might be useful for future research into the subject.

With that important limitation in mind, female authorship is a binary variable, and so we turn to logistic regression to explore what factors determine female authorship.

### *1. Team Authorship*

Model (1) considered the author characteristics of whether the author was part of a team, the author's home institution was a top fifteen law school, and the author is a law professor. The solo author variable—set to “1” for solo-authored articles—was statistically significant and indicated that female authors were more likely to be part of an author team than male authors in our data.<sup>136</sup> This observation was notable for two reasons. First, a recent study showed that, in the field of legal studies, research conducted by teams is noticeably more impactful than research conducted by only one investigator.<sup>137</sup> Second, this finding runs counter to findings suggesting women have a harder time finding coauthors.<sup>138</sup> It is therefore plausible that part of an explanation for the observation that female-authored articles receive more citations than male-authored articles could result from women more often collaborating on legal scholarship research projects.

That said, this likely provides only a partial explanation, as other evidence developed from these data indicate that female authorship and collaborative research offer distinct explanations for variation

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136. See *infra* Table 6.

137. Cotropia & Petherbridge, *supra* note 130, at 22.

138. See, e.g., Ferber & Teiman, *supra* note 33, at 193.

in scholarly impact.<sup>139</sup> Table 4, for example, indicates that female authorship remained a significant determinant of scholarly impact even when collaborative work was statistically taken into account.<sup>140</sup> Furthermore, although team authorship was increasing,<sup>141</sup> if one analyzed the data looking only at solo-authored pieces, the gender disparity favoring articles with female authors, generally speaking, was even more pronounced.<sup>142</sup>

Model (1) further indicated that female authors of law review articles were more likely to be law professors than not.<sup>143</sup> It was something of a surprise, however, to observe that female authors of articles published in top 100 law reviews have significantly lower odds of being employed at a top fifteen institution.<sup>144</sup> If one supposes that being at a top fifteen institution provides a citation advantage, the female authors in our data have lower odds than male authors of realizing it.

When we controlled for opportunity to be cited, using both publication year and law review of publication, little changed.<sup>145</sup> When we added paper characteristics, we observed that female-authored papers were more likely to have more words in their titles and more footnotes than male-authored papers.<sup>146</sup> They were also more likely to have fewer pages and less likely to have constitutional law as their subject matter.<sup>147</sup>

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139. *See supra* Table 4.

140. Specifically, Models (5) and (6). *See supra* Table 4.

141. *See* Cotropia & Petherbridge, *supra* note 130, at 27.

142. *See infra* Appendix, Table A2.

143. *See infra* Table 5.

144. *See infra* Table 5.

145. *See infra* Table 5.

146. *See infra* Table 5.

147. *See infra* Table 5.



Table 5. Models Addressing Determinants of Female-Authored Legal Scholarship

	(1)	(2)	(3)	(4)
<b>VARIABLES</b>				
solo_author	0.456 (0.032)***	0.467 (0.033)***	0.464 (0.034)***	0.466 (0.034)***
law_prof	1.235 (0.079)***	1.203 (0.078)**	1.204 (0.083)**	1.145 (0.081)*
auth_inst_t_15	0.820 (.052)**	0.824 (0.054)**	0.881 (0.061)	.968 (0.068)
pub_year		X	X	X
Law_rev			X	X
title_words				1.018 (0.005)***
abstract				1.117 (0.096)
toc				0.884 (0.075)
no_footnotes				1.091 (0.014)***
no_pages				0.867 (0.029)***
sm_conlaw				0.653 (0.057)***
n	6981	6981	6981	6978
pseudo R2	0.015	0.020	0.039	0.051
p	<0.002	<0.002	<0.001	<0.001

*Note:* The dependent variable is female authorship. Values reported are odds ratios. As discussed in more detail in the text, Model (1) is the author characteristics; Model (2) is the opportunity to be cited; Model (3) is the law review of publication; and Model (4) is the variables from Models (1)-(3) and paper characteristics. Robust standard errors are reported in parentheses.

\* $p < 0.05$

\*\* $p < 0.01$

\*\*\* $p < 0.001$

Collaboration had the largest and most significant positive impact on the odds of female authorship.<sup>148</sup> In view of this, and given that the literature has established that team scholarship received significantly more citations on average than solo scholarship,<sup>149</sup> we decided to further examine the impact of gender and collaboration on citation rates. To begin with, we examined the gender composition of the individuals and teams authoring the articles in our data.

Table 6. Solo and Team Authorship Composition by Gender

# Authors	Author Gender	Frequency
1	Solo Male	12,521
	Solo Female	4122
2	Male Only Team	1371
	Female Only Team	161
	Mixed Team	636
3	Male Only Team	152
	Female Only Team	14
	Mixed Team	166
4	Male Only Team	25
	Female Only Team	1
	Mixed Team	88

Overall, women participated in 1066 instances of team authorship, which, expressed as a percentage of solo female authorship, is 25.837 percent.<sup>150</sup> Men participated in 2438 instances of team authorship, or a lower 19.471 percent, when expressed as a percentage

148. See Zeng et al., *supra* note 32, at 9.

149. Cotropia & Petherbridge, *supra* note 130, at 23.

150. See *supra* Table 6.

of solo male authorship.<sup>151</sup> When coauthoring, women coauthor with men at a much higher rate, comprising 83.396 percent of all female coauthorship, than men coauthor with women, comprising 36.464 percent of all male coauthorship.

To further understand the connection between team authorship, gender, and scholarly impact, we regressed the number of citations<sup>152</sup> on teams of varying composition.<sup>153</sup>

The reference category was solo female authorship; the other categories included solo male authorship (*solo\_male\_author*); teams of equal gender composition (*team\_m\_equals\_f*); disproportionately male mixed gender teams (*team\_m\_gt\_f*); disproportionately female mixed gender teams (*team\_f\_gt\_m*); all-female teams (*all\_fem\_team*); and all-male teams (*all\_male\_team*).<sup>154</sup> Model (1) was the most general, while Models (2) and (3) statistically addressed opportunity for citation using publication year and law review of publication, as discussed earlier.

The models indicated that solo female-authored articles enjoyed a significant citation advantage over solo male-authored articles,<sup>155</sup> the difference being worth between roughly 1.6 and 2.0 citations.<sup>156</sup> Solo female authorship was otherwise as impactful as all but two other collaborative relationships.<sup>157</sup> Mixed gender teams that were predominantly female produced articles with significantly fewer citations,<sup>158</sup> and all-male teams produced articles with significantly more citations.<sup>159</sup> These patterns reproduced even after we controlled for publication year and law review of publication. However, the all-male team advantage lost some significance of its effect once we controlled for law review of publication. This offers the possibility that all-male teams might benefit from placements, despite the

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151. Again, this finding falls in line with literature from other disciplines—females are more likely to coauthor. *See, e.g.,* Zeng et al., *supra* note 32.

152. Specifically, the square root of the number of citations.

153. *See infra* Table 7. For this analysis we are able to use our larger dataset, also used in Part II.

154. *See infra* Table 7.

155. *See infra* Appendix, Table A2.

156. In the transformed data, it is 1.620 citations. When the number of citations is not transformed, the difference is 1.967 citations. *See infra* Appendix, Table A2.

157. *See infra* Table 7.

158. *See infra* Table 7.

159. *See infra* Table 7.

fact that, as noted earlier, the identification of the impact of law review of publication is unclear.<sup>160</sup>

Table 7. Models Addressing Team Authorship and Gender

	(1)	(2)	(3)
<b>VARIABLES</b>			
solo_male_author	-0.206 (0.047)***	-0.294 (0.046)***	-0.257 (0.041)***
team_m_equals_f	-0.159 (0.114)	-0.0150 (0.112)	0.002 (0.093)
team_m_gt_f	-0.308 (0.291)	-0.219 (0.290)	-0.006 (0.231)
team_f_gt_m	-1.179 (0.234)***	-1.196 (0.240)***	-0.633 (0.198)***
all_fem_team	-0.106 (0.247)	-0.020 (0.244)	0.108 (0.203)
all_male_team	0.361 (0.087)***	0.343 (0.085)***	0.125 (0.071)+
pub_year		X	X
law_rev			X
n	19257	19257	19257
R2	0.004	0.051	0.300
p	<0.000	<0.000	<0.000

*Note:* The dependent variable is the square root of the number of citations. As discussed in more detail in the text, Model (1) is the solo or team composition; Model (2) is the opportunity to be cited; and Model (3) is the law review of publication. The reference category is solo female authorship. Robust standard errors are reported in parentheses.

\* $p < 0.05$

\*\* $p < 0.01$

\*\*\* $p < 0.001$

The picture of gender disparity in law review citation rates, thus far painted, is consequently a complex one. While teams produced

160. See *supra* Table 4.

more impactful scholarship than individuals,<sup>161</sup> it seemed the individuals that suffered the largest negative differences were solo male authors.<sup>162</sup> The rate of citation to solo female-authored articles was not statistically distinct from that of most teams, with the exception that it was noticeably higher than mixed teams that have more women than men<sup>163</sup> and noticeably lower than all-male teams. However, in that instance, law review of publication could play an as yet undetermined role.

## 2. *Citation Behavior*

We noted two additional topics highlighted in the literature from other fields pertaining to gender bias in citation rates but which scholars have largely ignored. To begin with, while a gender bias in citation rates favoring female-authored legal scholarship was unusual in that it contrasted with evidence from other fields, the finding is potentially even more remarkable when we account for the citation behaviors of men and women observed in other fields. For example, evidence from other fields demonstrates that men are more likely to cite other men, and women are more likely to cite other women.<sup>164</sup> If male legal scholars engaged in the same citation practices, male-authored articles should enjoy a comparative citation advantage given that 73.06 percent of the law review articles in our study were exclusively male-authored works.<sup>165</sup> This potential comparative advantage suggested the possibility that the gender disparity favoring female authors that we observed may be of greater magnitude than we reported.

Evidence from other disciplines also shows that male authors are more likely to self-cite than female authors.<sup>166</sup> In addition, a single self-citation can stimulate several additional citations for an

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161. *Accord* Cotropia & Petherbridge, *supra* note 130, at 22.

162. *See supra* Table 7.

163. *See supra* Table 7.

164. Ferber, *supra* note 19, at 384; Maliniak et al., *supra* note 19, at 917.

165. *See* Ferber, *supra* note 19, at 388-89.

166. Maliniak et al., *supra* note 19, at 915.

article.<sup>167</sup> If legal scholarship follows a similar pattern<sup>168</sup>—that is, male authors self-citing more often than female authors—male authors should enjoy a comparative citation rate advantage.<sup>169</sup> The advantage may or may not be legitimate, as there are clearly valid reasons for citing one’s own work.<sup>170</sup> But if male legal scholars self-cite more than female legal scholars—and if at least some self-citations might be removed from consideration on theoretical grounds—the observed gender bias in citation rates favoring female-authored articles might again be higher than we reported.

### 3. *Article Production and Frequency*

Another important topic, although in this case one not addressed in legal studies or any other field so far as we know, is the topic of what the theoretically correct “expected” number of citations for female-authored research should be, and whether it should be similar across all fields. There may be good reasons for the absence of such work from existing literature. For instance, it may be too unreasonable to try to theorize given the existing state of empirical knowledge. In this paper, we were agnostic on the topic and tested only for literal citation rate equality. In this respect, we are not alone. Every other study of which we are aware has approached the topic in this manner.<sup>171</sup> Although our purpose was merely to

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167. James H. Fowler & Dag W. Aksnes, *Does Self-Citation Pay?*, 72 *SCIENTOMETRICS* 427, 432-33 (2007) (finding that self-citation generates additional cites from others).

168. Whether male legal scholars cite themselves more often than women legal scholars is unknown, but analyses of JSTOR data suggest it may be the case. See *Self Citation Rates by Gender Across Research Domains*, EIGENFACTOR PROJECT (2014), <http://www.eigenfactor.org/gender/self-citation/> [<https://perma.cc/9JQ6-6ZB7>].

169. There are perfectly legitimate reasons to cite one’s own work, of course. See, e.g., Dag W. Aksnes, *A Macro Study of Self-Citation*, 56 *SCIENTOMETRICS* 235, 242-43 (2003) (noting the motivation to build upon one’s earlier work). But the phenomenon of self-citation may affect overall measures of impact and is in any event a substantial feature of citation patterns studies. See, e.g., Cotropia & Petherbridge, *supra* note 130, at 26-27 (addressing self-citation’s potential effect on team author citation pattern and impact study results).

170. See Aksnes, *supra* note 170, at 242-43.

171. In this vein, evidence from other fields indicates that women researchers publish fewer articles than their male counterparts. See *supra* Part I.A. Moreover, studies show that publication frequency impacts the number of citations a researcher receives. See *supra* Part I.A. More publications generally mean more citations. If present in legal studies, this phenomenon might further amplify the citation rates associated with male authorship, and, depending on the reasons why, might even be cause for concern.

measure and describe, future researchers should be alert to the issue, especially if they desire to make normative claims about the evenness with which women experience the challenges of professional research and writing.<sup>172</sup>

A final concern worth noting is that, with our dataset, we cannot establish that articles authored by women and men accumulate citations at the same speed and with the same level of persistence. This concern is perhaps most easily explained in connection with Figure 4, which, among other statistics, shows that when it comes to the most extremely impactful articles—those in the 90th, 95th, and 99th percentiles—female-authored articles published from 1990 to 1994 have a much greater relative impact than female-authored articles published from 2006 to 2010.

In view of this, one could speculate that the cohort of female law professors placing articles in top 100 law reviews from 1990 to 1994 was exceptionally talented compared to the cohort publishing from 2006 to 2010. This interpretation could be consistent with the possible existence of hiring and publication barriers<sup>173</sup> present at the time these women were first hired and working. Such environmental pressures may have comparatively relaxed for female authors publishing by 2006. Another possibility is that male law professors have improved their work product, and so they are catching up, so to speak, in the highly impactful category.

Unfortunately, these possible explanations, as well as others, are not on firm empirical or theoretical footing at the moment. This is due in part to the fact that it is unknown whether female-authored law review articles accumulate citations at the same speed and with the same persistence as male-authored articles. To make

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Something like this might also help explain Merritt's finding—that women law professors are somewhat less cited than their male counterparts—in view of ours. *See* Merritt, *supra* note 9, at 347. Notably, Merritt followed a cohort of law professors and counted citations to a number of their writings. *Id.* at 347-48. If the women professors in Merritt's study had fewer publications, it might explain their lower comparative tally of citations.

172. To put it more plainly, the notion that female legal scholars receive the same or slightly more citations to their professional writings than do their male counterparts does not necessarily mean that they do not experience gender-related burdens that unevenly suppress their opportunity to make scholarly contributions. *See supra* notes 56-58 and accompanying text.

173. Jonathan Gingerich, *A Call for Blind Review: Student Edited Law Reviews and Bias*, 59 J. LEGAL EDUC. 269, 270 (2009).

this concern more concrete, there is no evidence (or theory) to confidently claim that female-authored articles published from 2006 to 2010 will not accumulate citations at a higher rate as compared to 2010 through 2020, or male-authored articles published from 2006 to 2010. That said, it is worth pointing out that there is presently no evidence that female-authored articles do peak in citations earlier or later than male-authored articles, or that female-authored articles have a significantly longer or shorter citation shelf life.

### CONCLUSION

This Article provides empirical evidence of gender disparity in scholarly influence—measured in terms of differential citation rates to academic work—in the field of legal studies. In contrast to other fields, we observe that articles authored by women received significantly more citations than articles authored by men.<sup>174</sup> Although female authors are more likely to coauthor than male authors, this factor alone does not fully explain the citation disparity. We hope this research provides a foundation for fuller exploration of the reasons for these differences.

We cannot close without emphasizing that the relationship between author gender and scholarly influence is complex and poorly understood, not only in legal studies, but also in other fields. Thus, while we are encouraged to see that the professional writings of female legal scholars are cited at rates close to, if slightly higher than, those of their male counterparts, it would be naïve to conclude from that simple measurement—or the other measurements and observations provided in this Article—that female legal scholars do not experience gender bias related to their research, publications, and ultimately scholarly influence. Nor do the findings diminish the challenges that women legal scholars have had to address and overcome to achieve a level of recognition for their research commensurate with that of their male counterparts.

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174. *See supra* Part I.A.



## APPENDIX

Table A1. Negative Binomial Models Exploring the Possibility of Distorting Influences from Other Independent Variables

	(1)	(2)	(3)	(4)	(5)	(6)
<b>VARIABLES</b>						
fem_authorship	1.0778	1.109	1.146	1.088	1.101	1.062
	(0.031)**	(0.030)***	(0.028)***	(0.024)***	(0.026)***	(0.023)**
pub_year		X	X	X	X	X
law_rev			X	X	X	X
title_words				0.991		0.993
				(0.002)***		(0.002)***
abstract				1.081		1.073
				(0.033)*		(0.032)*
toc				0.929		0.943
				(0.028)*		(0.027)*
no_footnotes				1.019		1.026
				(0.004)***		(0.004)***
no_pages				1.214		1.185
				(0.013)***		(0.013)***
sm_conlaw				1.002		1.005
				(0.029)		(0.029)
solo_author					0.792	0.842
					(0.024)***	(0.023)***
law_prof					1.694	1.430
					(0.046)***	(0.036)***
auth_inst_t_15					1.107	1.229
					(0.029)***	(0.030)***
n	6981	6981	6981	6978	6981	6978
Pseudo-R2	0.001	0.013	0.051	0.083	0.059	0.089
Log-likelihood	-	-	-	-	-	-
	27076.482	26723.693	25689.543	24834.718	25486.543	24671.156
p	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000

*Note:* Models are otherwise similar to those described in Table 4. The dependent variable is the untransformed count of number of citations. Model (1) is the female authorship alone; Model (2) is the opportunity to be cited; Model (3) is the

additional (qualified) opportunity variables; Model (4) is the paper characteristics; Model (5) is the author characteristics; and Model (6) combines all of the variables.

\* $p < 0.05$

\*\* $p < 0.01$

\*\*\* $p < 0.001$

Evidence indicates alpha does not equal zero for any model.

Table A2. Models Examining Only Solo-Authored Articles

	(1)	(2)	(3)	(4)	(5)	(6)
<b>VARIABLES</b>						
fem_authorship	0.284	0.354	0.323	0.207	0.281	0.186
	(0.064)***	(0.061)***	(0.054)***	(0.048)***	(0.052)***	(0.047)***
pub_year		X	X	X	X	X
law_rev			X	X	X	X
title_words				-0.022		-0.018
				(0.004)***		(0.004)***
abstract				0.134		0.115
				(0.065)*		(0.065)
toc				-0.093		-0.067
				(0.067)		(0.066)
no_footnotes				0.042		0.047
				(0.011)***		(0.011)***
no_pages				0.344		0.315
				(0.029)***		(0.028)***
sm_conlaw				-0.004		-0.013
				(0.067)		(0.060)
solo_author					omit	omit
law_prof					1.009	0.591
					(0.053)***	(0.047)***
auth_inst_t_15					0.176	0.374
					(0.060)**	(0.054)***
n	5925	5925	5925	5925	5925	5925
R2	0.003	0.073	0.296	0.454	0.334	0.472
p	<0.000	<0.000	<0.000	<0.000	<0.000	<0.000

*Note:* Models are otherwise similar to those described in Table 4. The dependent variable is the square root of the number of citations. Model (1) is female authorship alone; Model (2) is the opportunity to be cited; Model (3) is the additional (qualified) opportunity variables; Model (4) is the paper characteristics; Model (5) is the author characteristics; and Model (6) is all of the variables combined. Robust standard errors are reported in parentheses.

\* $p < 0.05$

\*\* $p < 0.01$

\*\*\* $p < 0.001$