

The Pandemic and Gender Inequality in Academia

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ABSTRACT

Has the pandemic exacerbated gender inequality in academia? We provide real-time evidence by analyzing 1.8 million tweets from approximately 3,000 political scientists, leveraging their use of social media for career advancement. Using automated text analysis and difference-in-differences estimation, we find that although faculty members of both genders were affected by the pandemic, the shift to remote work caused women to tweet less often than their male colleagues about professional accomplishments. We argue that these effects are driven by the increased familial obligations placed on women, as demonstrated by the increase in family-related tweets and the more pronounced effects among junior academics. Our evidence demonstrating the gendered shift in professional visibility during the pandemic provides the opportunity for proactive efforts to address disparities that otherwise may take years to manifest.

The COVID-19 pandemic brought new attention to existing gender inequalities. With the transition to remote work and limited access to childcare, household responsibilities grew dramatically. Because women consistently shoulder most of these obligations (Perry-Jenkins and Gerstel 2020), these arrangements placed greater demand on their time and energy. For example, in April, mothers with young children reduced their work hours significantly more than fathers (Collins et al. 2020). Furthermore, as governments reopened the economy without full-time, in-person schools and daycares, it was mothers who disproportionately faced the untenable tradeoff between parenting and careers (Cohen and Hsu 2020; Perelman 2020).


Have the changes brought about by the pandemic influenced the careers of women in academia? On the one hand, academia provides more flexible schedules than most white-collar occupations, which could facilitate easier adaptation to new circumstances. On the other hand, even in the academy, where men hold more egalitarian views on parenting and gender roles, “men do much less childcare relative to their spouses than female professors do...even when [his] wife works full time” (Rhoads and Rhoads 2012). Moreover, evidence from the pandemic suggests


that work-from-home disproportionately burdened female academics (Viglione 2020; Vincent-Lamarre, Sugimoto, and Larivière 2020), particularly those with young children (Myers et al. 2020).

Early investigations into the impact of the pandemic on scholarly productivity have reached different conclusions. Although female economists are less likely to be working on COVID-19 research (Amano-Patiño et al. 2020) and female social scientists have publicized 14% fewer working papers across disciplines (Cui, Ding, and Zhu 2020), some major journals (Kitchener 2020) and preprint repositories (Shurchkov, Deryugina, and Stearns 2020) found no differences in submissions from women.

To measure the impact of COVID-19 on the careers of female academics, we analyzed Twitter behavior before and after the work-from-home and compared communications over time by gender. Tweets provide a sufficiently granular means of assessing individual-level behavior in real-time compared to the long-time horizons of academic research. They are far reaching, including not only publications but also grants, awards, presentations, media coverage, working papers, tenure, and promotions, which allowed us to broadly operationalize career-advancing activities in academia rather than focusing solely on publication.

To assess the effect of the pandemic on academics' careers, we identified a sample of 2,912 primarily political science tenure-track faculty employed in the United States. From biographies, faculty webpages, and curriculum vitae, we extracted gender, rank, and institutional affiliations. We then collected all tweets between

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June 1, 2019, and May 30, 2020, and posted as of June 2, 2020—approximately 1.8 million tweets.

Using a difference-in-differences (DiD) design, we estimated the effect of the pandemic on the content of faculty tweets. We determined the proportion of work tweets sent by academics using subject-specific keywords. The amount of data available allowed us to leverage the within-person variation during this period to provide a clearer estimate of the pandemic’s effect. Comparing the variations by gender before and after transition to work-from-home reveals a gendered shift in the work–life balance described on Twitter, in which women experienced a greater reduction in professional communications than their male colleagues.

We present two further pieces of evidence that suggest an explanation: parenting responsibilities. First, the lockdown also increased the gap between male and female faculty members’ propensity to tweet about family and caregiving. Second, by disaggregating our models by academic rank, we show that the effect is driven primarily by junior faculty—those most likely to be balancing professional obligations with the parenting commitments of young children. Although we do not suggest that women bear all caregiving activities—both men and women experienced an increase in family-related tweets—the patterns we uncovered suggest that female careers are more taxed by these commitments.

These results have important implications for an academy increasingly coming to terms with gender inequality. Gender

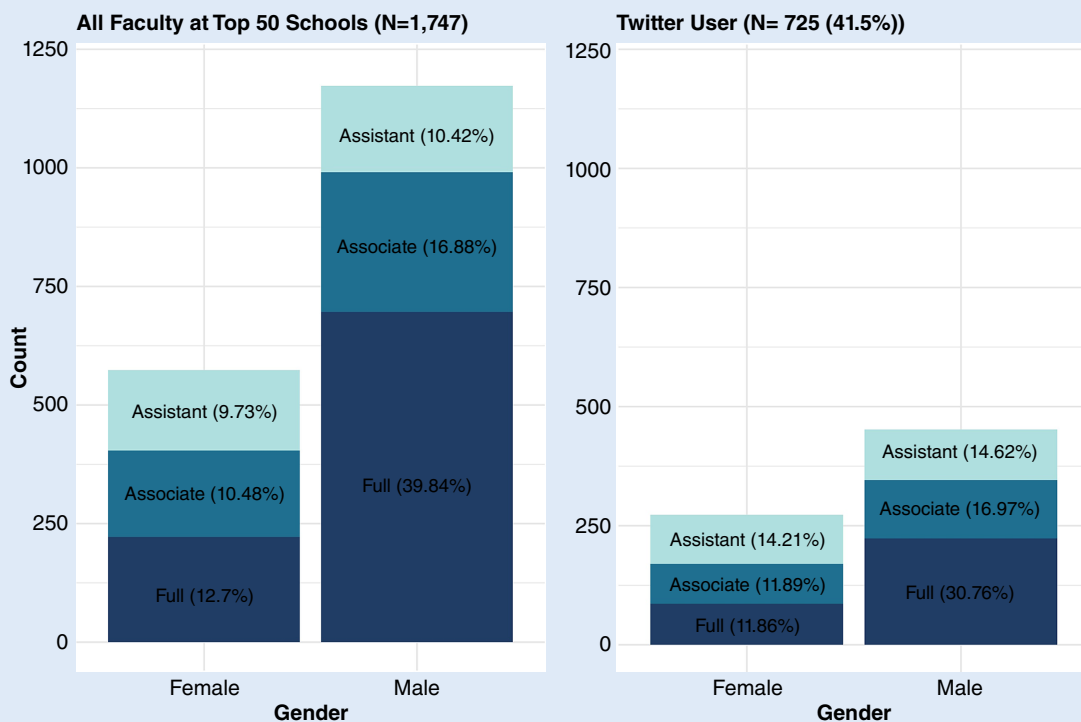
disparities exist in hiring and salary decisions (Monroe et al. 2008; Monroe and Chiu 2010); teaching evaluations (MacNell, Driscoll, and Hunt 2015); tenure and promotion (Antecol, Bedard, and Stearns 2018; Sarsons 2017); publication (Djupe, Smith, and Sokhey 2019; Samuels and Teele 2020); and the citation (Dion, Sumner, and Mitchell 2018; King et al. 2017) and dissemination (Bisbee, Larson, and Munger 2020) of scholarly work. These more visible inequalities provide a cumulative advantage to the careers of male academics. This article highlights another more immediate obstacle: the disproportionate impact of the pandemic. Our ability to detect these differences in real time provides the opportunity for proactive intervention against disparities that otherwise may take years to manifest in publication records. Moreover, these preliminary results should stimulate future work on the intersectional effects of the pandemic on the academy.

ACADEMIC TWITTER

Twitter has become an important avenue for self-promotion and the dissemination of new research (Knight and Kaye 2016; Van Noorden 2014), particularly among junior faculty in the social sciences (Costas, Zahedi, and Wouters 2015). Although academics’ adoption is far from universal (figure 1), many rely on Twitter to bring greater visibility to their work and to develop professional reputations within their field. As Bisbee, Larson, and Munger (2020) summarized, “[b]y exposing new research, participating in

Figure 1

The left panel displays the proportion of assistant, associate, and full professors by gender at Top 50 political science graduate programs according to the 2019 U.S. News & World Report (N = 1,747). The right panel displays the proportion of assistant, associate, and full professors by gender at Top 50 institutions who have an active Twitter account (N = 725).



online discussions, and generally curating a recognizable online identity, Twitter may have important effects on who advances in the academic political science discipline.”

One reason that scholars have adopted Twitter for professional purposes is its ability to increase the audience for scholarship. Observational studies have shown that greater engagement with Twitter leads to a wider dissemination of academic work (Ortega

There are notable omissions from this sampling procedure. For example, graduate students and adjunct faculty were excluded. This is not to suggest that we assume that these populations were unaffected by the pandemic—quite the contrary. We believe that less-resourced positions would experience even greater obstacles. Yet, because our primary dependent variable is scholarship-centric, restricting our sample to tenure-track faculty allowed us

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2016). These larger audiences can increase future citations. A recent experiment found that tweeted research was cited three times more often after one year (Luc et al. 2020). Academic journals and university presses, including the *American Political Science Review* (APSR), most of which maintain Twitter accounts of their own, now include Twitter engagement in their altmetric evaluation of article dissemination. Some major universities, including the University of Minnesota and Virginia Tech, even include public engagement in tenure dossiers (American Sociological Association 2016).

Not all academics use Twitter to promote their work, and those who do may not be representative of the academy at large. However, among this vocal population that contributes to academic debates and stimulates scholarly discussion, changes in the content of these communications represent real change in their career-advancing activities and the substance of discourse in the discipline. We believe that this variation in content represents real change in lived experiences, even if offline productivity is unaffected. However, changing the visibility of scholarship will influence career trajectories and professional reputations.

DATA AND METHODS

To generate our corpus, we compiled a sample of Twitter profiles for tenure-track political scientists in the United States. Lacking an authoritative sampling frame, we gathered the followers of the four major political science associations’ official Twitter accounts (i.e., @APSAtweets, @MPSAnet, @SPSAnews, and @theWPSA) and Women Also Know Stuff (i.e., @womenalsoknow), a “database of women experts in political science.” Next, we used a regular expression search to return all Twitter biographies that include roots of either “professor” or “political science” (e.g., “prof,” “polisci,” or “polisci”). Finally, we verified their profession, gender, rank, and institution from CVs and department web pages.

The most obvious concern is the representativeness of this sample. Not all academics are on Twitter and neither is every political scientist on Twitter in our sample. Although there is no general account of how many academics are active Twitter users (Bisbee, Larson, and Munger 2020), we gathered the accounts of tenure-track faculty at the top 50 political science graduate programs—according to *U.S. News World Report*—and found that 41% have identifiable Twitter accounts (see figure 1). As shown in table 1, assistant professors are 20 percentage points more likely to be Twitter users. Yet, relevant to our design, we found no evidence that female academics are less likely to use Twitter than male colleagues conditional on academic rank.

to make more point-by-point comparisons among a population with more consistent research expectations.

We identified all tweets related to career-promoting and family-related activities using regular expression searches. We began by randomly selecting sets of tweets and coding whether they were work- or family-related. Based on this hand-coded data, we chose a set of keywords to classify the entire corpus, as shown in online appendix A. Because papers often are shared via URLs, we also classified tweets as work-related if they shared links containing file types (*pdf*), publication venue (*ssrn*, *jstor*), or data repository (*github*).

There are limits to using a keyword-based approach. Without hand-coding each tweet, we missed some family- and career-related tweets and undoubtedly included some false positives. For example, in early iterations, the word *father* in isolation was included as a family-related keyword. Given our sample of political scientists, we collected more tweets on Adams, Jefferson, and

Table 1
Predictors of Being a Twitter User and of the Number of Tweets

	Twitter User (1)	Total N (Logged) (2)
Female	0.045 (0.046)	-0.197 (0.299)
Assistant Professor	0.165** (0.046)	0.126 (0.280)
Full Professor	-0.097** (0.034)	-0.569* (0.237)
Female X Assistant	-0.021 (0.069)	-0.111 (0.417)
Female X Full	0.022 (0.059)	0.260 (0.401)
Constant	0.417** (0.028)	2.186** (0.190)
Observations	1,747	725
R ²	0.043	0.016

Note: The first column shows the predictors of being a Twitter user (1 if yes, 0 if not). The second column uses the logged number of total tweets (among Twitter users) as the outcome. *p<0.05; **p<0.01; ***p<0.001.

other “Founding Fathers” than parenting tweets. However, if we assume that the accuracy of these keywords does not change before and after treatment, then the measure—albeit imperfect—should reflect change in that topic’s occurrence. Moreover, this manual procedure provided more useful keywords than unsupervised processes, which provided many general terms (e.g., *excellent*) and omitted infrequent but predictive terms (e.g., *LSQ*, *preprint*). After applying this routine to the corpus, we recovered a total of 109,867 family-related and 189,173 work-related tweets from a total sample of 1,836,896. We aggregated a weekly measure of the proportion of academics’ family- and career-related tweets. The average number of family- and work-related tweets per week was 6.39 and 14.02, respectively. Full summary statistics are in online appendix B.

RESULTS

We used a DiD identification strategy that compares academic tweeting before and after President Trump declared a national emergency and most schools and childcare facilities had closed. We tested three hypotheses: (1) work-related tweets decreased more among female academics than their male counterparts; (2) family-related tweets increased more among female academics than their male counterparts; and (3) gender disparities were more pronounced among junior scholars, who are more likely to have young children.

Figure 2 presents the daily proportion of tweets by topic and gender during this period. Before the national lockdown, male and female academics tweeted similarly. Although women were slightly more likely than men to tweet about professional activities and much more likely to tweet about family issues, they followed roughly parallel trends. Following the mass closing of colleges and universities and the transition to work-from-home, however, noticeable changes occurred. Not only did male academics become relatively more focused than their female colleagues on career-related tweets; female academics also disproportionately increased their discussion of family-related topics. These trends and differences suggest that female academics shifted their public communications from career promoting to family obligations to a greater degree than male academics.

It is notable that whereas women regularly tweeted more about family-related issues before the pandemic, they also devoted their feed to work-related topics more consistently than men. Of course, this could suggest simply that women were more productive than men before the pandemic. It also could suggest that women are cognizant of preexisting biases and counterbalance these dynamics with greater Twitter self-promotion—similar to how female leaders take “tough” national security stances to broadcast their competence in an historically male-dominated enterprise (Huddy and Terkildsen 1993). However, whatever drove these pretreatment differences does not affect the interpretation of our post-treatment effects.

To better investigate the effect of school closures on Twitter behavior, we modeled the change in tweeting behavior using individual fixed effects to control for within-unit differences in Twitter behavior. Given the daily variability shown in figure 1, we measured the weekly share of career- and family-related tweets for each individual. To identify the effect of the pandemic, we estimated the average within-person change in behavior before and after the second week of March—the week that President Trump

declared a national emergency, followed by the nationwide transition to work-from-home and the closure of most daycare facilities and schools.

Table 2 presents the effect of this transition on what is discussed on faculty Twitter feeds, controlling for the total number of tweets from each faculty member. Among all faculty members, female academics showed an approximate 0.97-percentage-point increase in the percentage of family-related tweets and a 1.36-percentage-point decrease in the percentage of work-related tweets relative to their male colleagues. Although these effects may not appear large, it is important to remember that, as categorized, “work” and “family” tweets constitute approximately 20% of an average timeline, which suggests a more sizeable shift among a subset of communications. The average weekly proportion of work-related tweets for women decreased from 14.6% before the pandemic to 11.1% afterward. This 3.5-percentage-point reduction is 160% larger than the corresponding decline among men (i.e., from 15% to 12.8%). Moreover, even a small reduction in Twitter activity can have a significant effect on dissemination. For instance, Auerbach and Thachil (2018)’s *APSR* article was tweeted 69 times, generating an audience with an upper bound of 289,724 people.

Disaggregating these results by academic rank reveals an effect most pronounced among assistants, with significant—albeit smaller—effects for associates. There is no differential effect on work-from-home at the rank of full professor, which is consistent with our hypothesis that these gaps are driven by the increased obligations placed on women who are parenting young children.

Robustness Checks

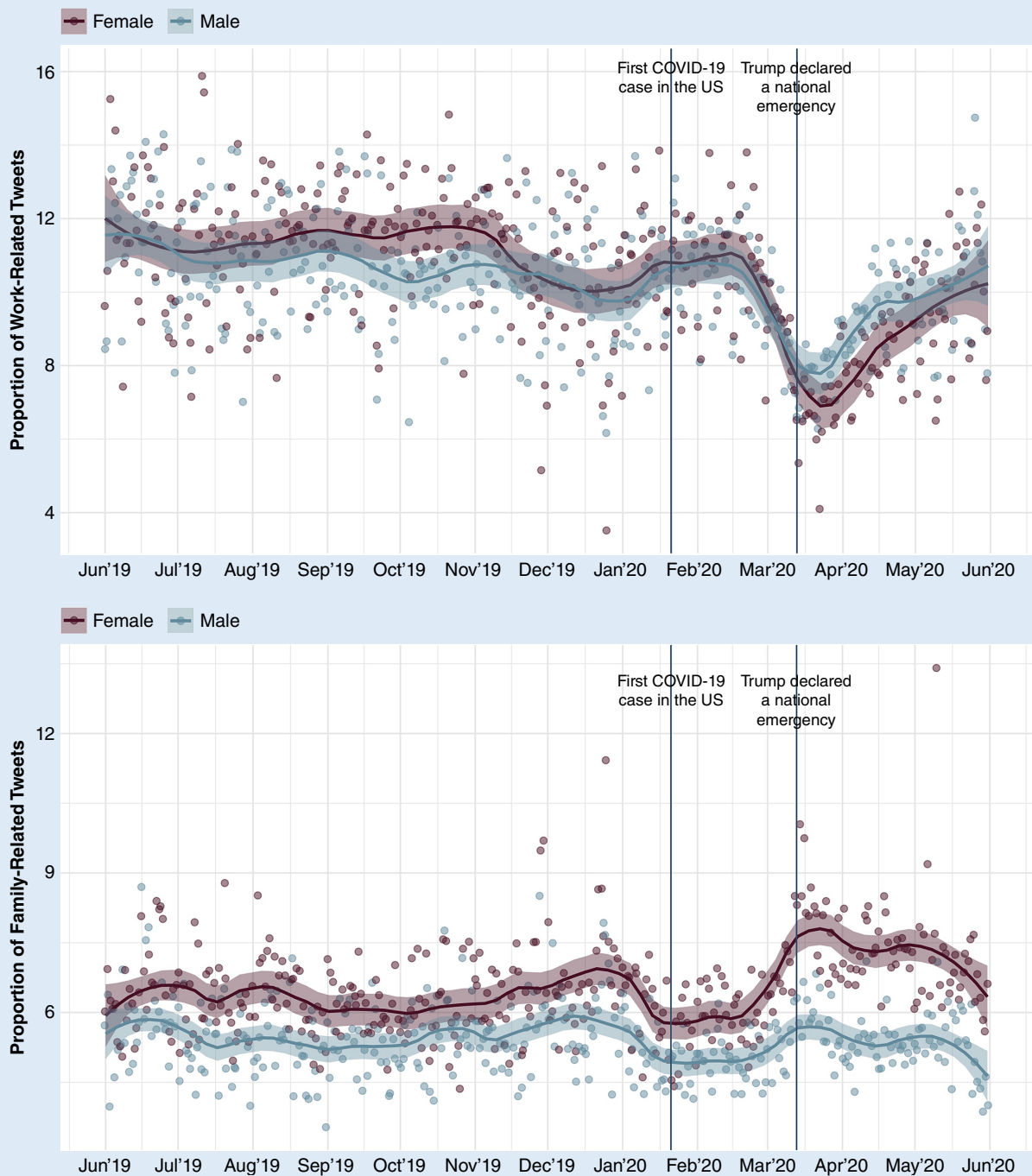
Our results are consistent across alternative specifications and numerous robustness checks. Online appendix C controls for the total number of tweets as well as its interaction with gender and treatment indicators, respectively. We also replicate our main results using the first week of March as an alternative cut-off point. Whereas figure 1 does not suggest a violation to the parallel-trends assumption, online appendix D tested this systematically (Cui, Ding, and Zhu 2020) and found no evidence. In online appendix C, we tested for and found no general seasonality effect. Online appendix F also presents a placebo test using the 2020 presidential-candidate keywords to demonstrate that there was no increase in the gender gap post-pandemic. These additional analyses highlight the unique effect of the pandemic on work-life balance in professional communications.

DISCUSSION

We present evidence that the pandemic has affected professional communication among academics on Twitter. Changes to Twitter behavior may seem inconsequential in comparison to the litany of obstacles brought about by the pandemic. However, we believe that these short-term changes in communications represent the seeds of a cumulative disadvantage that one day will come to bear tangible, long-term disparities in productivity, promotion, and tenure. We believe this variation represents a real change in the lived experiences of faculty. However, even if offline productivity is unaffected, changing the visibility of scholarship will itself influence career trajectories and professional reputations.

Figure 2

The figure displays the daily proportion of work- and family-related tweets From June 2019 to May 2020.



We believe that these results constitute three contributions to our understanding of gender disparities in academia. First, this approach takes a broader view of career-advancing behavior, highlighting both short- and long-term effects of work-from-home on women's careers. Second, Twitter data allow us to consider effects of the pandemic in real time, allowing for proactive remediation. Third, the amount of data allows us to leverage within-

person variation to provide clearer causal estimates largely absent in observational studies of pandemic-induced gender disparities.

We may question whether the changes in women's work-related Twitter behavior were driven, in fact, by changes in lived experiences or were merely a reflection of existing gendered communication patterns in our field. For example, central actors such as Women Also Know Stuff consistently raise issues of

Table 2
The Pandemic Effect on Family- and Work-Related Tweets

	Family Tweet	Work Tweet	Family Tweet	Work Tweet	Family Tweet	Work Tweet	Family Tweet	Work Tweet
	All Faculty		Assistant		Associate		Full	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female * Pandemic	0.965*** (0.220)	-1.355*** (0.324)	1.263*** (0.353)	-1.626** (0.499)	0.811* (0.387)	-1.188* (0.579)	0.575 (0.406)	-0.891 (0.630)
Total	-0.003** (0.001)	-0.0002 (0.002)	-0.003* (0.002)	0.003 (0.002)	-0.005* (0.002)	-0.002 (0.003)	-0.001 (0.002)	-0.004 (0.003)
Individual Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	100,152	100,152	43,052	43,052	31,735	31,735	25,365	25,365
R ²	0.114	0.181	0.107	0.154	0.116	0.200	0.128	0.209

Note: The outcome variables are the proportions of family- and work-related tweets. To address the concern that the total number of tweets might affect the distribution of topics, we control for it. Online appendix C1 shows the same analysis without this control. +p<0.1; *p<0.05; **p<0.01; ***p<0.001.

gender equity, and female academics are more likely to study gender bias. It is possible that this relationship is driven by a greater discomfort with self-promotion among women during a crisis or gendered differences in the propensity to tweet about current events. However, if these effects were driven only by gender, we would not expect to see the variation in effects between junior and senior faculty, as demonstrated previously. The other

Although we argue that these differences are driven by stage-of-life factors (i.e., full professors are likely to have older, more self-sufficient children and therefore are less reliant on childcare), we could argue that these are selection effects. Female academics who attain full professor have overcome existing barriers. Like female members of Congress who outperform their male colleagues (Anzia and Berry 2011), women who attain full professor may be

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possibility is that junior female scholars may have more progressive gender values and a stronger sense of “gender-linked fate,” which leads them to be more vocal about issues of childcare (Stout, Kretschmer, and Ruppner 2017) regardless of their personal circumstances. Absent survey data, the consequences of such behavior would be observationally equivalent to those having more childcare burdens—a limitation that we hope future work will address.

better prepared to compensate for additional obstacles created by the pandemic. Given the impact of gender disparities on all stages of career progression, it also could be the attrition of women most strongly affected who are driving this relationship. These forces undoubtedly influence the composition of academic ranks. However, in the immediate aftermath of the lockdown, surveys found that parenting obligations (Myers et al. 2020) overshadowed all other factors in limiting research productivity, which highlights

The amount of data allows us to leverage within-person variation to provide clearer causal estimates largely absent in observational studies of pandemic-induced gender disparities.

Similarly, these results focus on scholarship to the exclusion of teaching and service obligations. Could these effects be driven by existing imbalances in teaching effort (Winslow 2010), further exacerbated by the pandemic? Again, we believe that any inherent gender difference would have affected female faculty regardless of rank. Although we find that women consistently tweet more than men about teaching (see online appendix D1), as demonstrated in table 3, the pandemic does not appear to systematically influence the existing gender gap in teaching communications in a similar manner.

the important effect of parenting on productivity.

We posit that parenting obligations drive the gendered results observed in professional communications among junior faculty. Yet, surveys of the profession suggest that male faculty are more likely to have children. Does this trend undermine our conclusions? We believe not. First, parenting obligations disproportionately fall to mothers (Perry-Jenkins and Gerstel 2020), even in the academy, where men, on average, hold more egalitarian views on parenting and gender roles (Rhoads and Rhoads 2012). The pandemic appears to have only exacerbated these underlying

Table 3

The Pandemic Effect on Teaching-Related Tweets

	All Faculty	Assistant	Associate	Full
	(1)	(2)	(3)	(4)
Female*Pandemic	-0.429 (0.288)	-0.425 (0.464)	-0.349 (0.498)	-0.535 (0.543)
Individual Fixed Effect?	Yes	Yes	Yes	Yes
Time Fixed Effect?	Yes	Yes	Yes	Yes
Observations	100,152	43,052	31,735	25,365
R ²	0.143	0.140	0.134	0.159

inequities. In summary, we believe that our results are driven not by having young children as much as fulfilling the responsibilities of childrearing.

We also stress that our mechanism is the childcare obligations of young children. Myers et al. (2020) found that having children under the age of five most dramatically influenced the time that faculty were able to dedicate to research following the pandemic. Whereas surveys of faculty suggest that associate professors, rather than junior faculty, are most likely to be living with children, we believe that because this cohort is older on average, so also are their children; therefore, they are less reliant on childcare.

Despite increased efforts to address deep-rooted inequalities, cracks in the pipeline continue to loom large (Monroe and Chiu 2010). We hope that this evidence can serve as a catalyst for additional research into the subtle and no-so-subtle barriers that affect women rising through the academic ranks. With gender imbalances less pronounced among the ranks of junior faculty, efforts to account for these effects in early-career trajectories would have important long-term impacts on the representation of female academics. Moreover, because female mentors can positively influence young women's propensity to enter male-dominated fields (Bonneau and Kanthak 2018) and succeed in academia (Bennion 2004), addressing inequalities now could have downstream implications for female representation in the academy for the next generation.

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DATA AVAILABILITY STATEMENT

Research documentation and data that support the findings of this study are openly available at the *PS: Political Science & Politics* Harvard Dataverse at <https://doi.org/10.7910/DVN/IDCU63>.

SUPPLEMENTARY MATERIALS

To view supplementary material for this article, please visit <http://dx.doi.org/10.1017/S1049096521001049>. ■

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