Gender Bias in Rumors among Professionals: An Identity-based Interpretation

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Abstract

This paper measures gender bias in what people say about women versus men in an anonymous online professional forum. I study the content of posts that refer to each gender, and the transitions in the topics of discussion that occur between consecutive posts in a thread once attention turns to one gender or the other. I find that discussions about women tend to highlight their personal characteristics (such as physical appearance or family circumstances) rather than their professional accomplishments. Posts about women are also more likely to lead to deviations from professional topics than posts about men. I interpret these findings through a model that highlights posters' incentives to boost their own identities relative to the underrepresented out-group in a profession.

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1 Introduction

Occupational segregation by gender has been declining but at a slower pace in the past decades (Blau, Brummund and Liu 2013). Gender gaps also persist in math-intensive fields like economics, engineering and computer science (Ceci et al. 2014), and institutional efforts to promote integration in these fields often face a backlash, as evidenced by the highly publicized anti-diversity memo from a software engineer at Google.[1] Some analysts argue that gender role attitudes have changed little since the 1990s and discrimination at the workplace today can take a subtler form than blatant expressions of sexism (e.g., Cotter, Hermsen and Vanneman 2011; Basford, Offermann and Behrend 2013) In particular, the increasing share of women may still be perceived by men as diluting (or "polluting") the rigor and prestige of a profession (Goldin 2015).

Understanding attitudes towards gender among colleagues is important because such attitudes may contribute to a stereotypical professional climate that discourages women to enter and stay in certain fields and leads to a persistent underrepresentation of women. Yet it remains challenging to study this issue in real world settings where people who are concerned about social correctness will not readily reveal their beliefs about gender.

This paper aims to measure gender bias in an anonymous online setting where members of the economics profession are presumably freed from social pressure and thus are more likely to reveal their true gender attitudes. Economics is one of the largest academic disciplines where men still substantially outnumber women at both student and faculty levels (Lundberg 2018). The persistently low share of women has attracted substantial interest and concern (see Bayer and Rouse 2016 for a summary), and recent research on publications, a key performance metric for economists, suggests that women face a higher bar than men in the peer review process and are given less credit when collaborating with men (Card et al. 2018; Hengel 2019; Sarsons 2019). A new professional climate survey conducted by the American

[1] Damore, James. "Google's Ideological Echo Chamber: How bias clouds our thinking about diversity and inclusion". July 2017.

Economic Association also finds that women are much less likely to feel included socially or intellectually within economics, and more likely to report experiencing discrimination as a student or faculty member (AEA 2019).

The Economics Job Market Rumors forum (EJMR), as its name suggests, was established to share information about job interviews and outcomes anonymously in each year's hiring cycle, though it is active year-round. According to a report by the forum administrator, about 80% of EJMR users who visit or post on the forum were males as of September 2017.[2] I scraped about 2.2 million posts from the first and the last page of each thread initiated or updated between October 2013 and October 2017 on this forum. Using a list of gender classifiers such as "she"/"he" from the most frequent 10,000 words in the EJMR postings, along with the names of over 9,000 active researchers and recent Economics Ph.D. graduates, I identify about 100,000 posts that discuss women (Female posts), and about 330,000 posts that discuss men (Male posts). About 63% of the threads in this four-year sample include at least one Female or Male post.

To guide my analysis I develop a model of rumors that lays out a set of explanations for why people post differently about women and men in the profession. Posters are assumed to value their contribution to public knowledge about the relationship between professional characteristics and jobs in the profession. They are also assumed to gain utility by boosting the professional reputation of members of their own gender group relative to that of members of the opposite gender group. In any given thread, a poster can either reveal his or her private signal about the subject's professional ability, or "change the subject" and discuss the subject's personal characteristics, adding noise to the discussion and clouding readers' assessments of the subject's true ability. As a result of the competing incentives, a poster will tend to reveal positive information about the abilities and accomplishments of members of their own affinity group, and negative information about members of their out-group.

[2] The administrator of the EJMR forum released a statement in September 2017, which claimed 20% of EJMR users are female (https://www.econjobrumors.com/topic/kirk-statement-on-recent-events-and-moderation-policy) . The number appeared to come from a third-party analysis of users' web-browsing cookies.

Posters who receive a positive signal about a member of the out-group will instead post about personal characteristics, casting doubt on the professional accomplishments of the opposite group.

I test these ideas by measuring the differences in the topics of discussion in Female and Male posts, and by quantifying the effects of gender on transitions between topics in the dynamics of a conversation. I begin by classifying the most frequent 10,000 words in the EJMR postings into different categories, grouping them into two broad topics: Academic/Professional, and Personal/Physical. I record the number of words from each topic in each post, and use the token count as a proxy for the extent to which the poster emphasizes the professional or personal characteristics of the subject. In August 2017, a New York Times article by Justin Wolfers raised concerns about the gendered content on EJMR and led to some changes in moderation efforts on the EJMR forum.[3] To take into account the influence of media coverage and moderation, I split the sample by whether a thread started before August 2017.

A direct comparison between gendered posts shows that Female posts on average contained 42% less Academic/Professional terms but 196% more Personal/Physical terms than Male posts prior to August 2017. I then break down these topic differences by job rank of the subject, which can be assigned to about 15% of gendered posts through keywords such as "job market candidate" or the name of the economist mentioned in a post. The gender gap in the number of terms related to professional characteristics is relatively smaller at the junior or senior faculty levels than at the graduate student and job market candidate levels but remains statistically significant. I also find that female posts continued to contain significantly more Personal/Physical terms at each job rank. These contrasts reveal a systematic tendency to de-emphasize professional characteristics of women, which can be interpreted as a mechanism by which male posters boost their in-group identity and reinforce

[3]Wolfers, Justin. 2017. "Evidence of a Toxic Environment in Economics". New York Times. 18 August. https://www.nytimes.com/2017/08/18/upshot/evidence-of-a-toxic-environment-for-women-in-economics.html. The forum released an official statement regarding its new moderation policy in September 2017 (https://www.econjobrumors.com/topic/kirk-statement-on-recent-events-and-moderation-policy).

the perception of women as the out-group in the profession.

While the media coverage of EJMR in August 2017 led to some initial narrowing of the gender gap in the emphasis on professional characteristics, this pattern did not persist. Moreover, changes in EJMR's moderation policies appear to have had little to no effect on the average number of Personal/Physical terms in Female versus Male posts. Both findings suggest strong inertia in stereotype beliefs about gender.

Since posters interact with each other within each thread, I present an empirical framework to measure gender bias in the dynamics of a conversation. I test whether a discussion about a female versus a male in a post systematically affects the likelihood that later posts focus on professional versus personal topics. Using a discrete choice model, I estimate the average marginal effects of gender on the probability of each possible transition between three different states that represent the main topic of discussion in the thread: Purely Professional, Personal, or Others. I focus on posters who have decided to join an existing thread after seeing it most recent post, and assume that the heterogeneity in posters' preferences can be absorbed by observable characteristics of threads that posters select themselves into. Relative to the baseline where the prior post is not gendered (Genderless), I find a significant 2.3 percentage points (ppt's) difference-in-differences between the probability of deviating from purely professional topic when the prior post is Female than when it is Male.

Although threads with more posts are less likely to get off track than those just started, a Female post still has a significant higher chance of triggering a deviation from professional topics than a Male post. Once such a deviation occurs, it is also significantly less likely to come back to professional topics from personal or other topics after a Female post. These gender differences in transition rates further support the hypothesis that an emphasis of a female subject's professional characteristics can pose an identity threat to some male posters who will then mention nonprofessional attributes as a means to muddy the understanding about the subject's true ability and protect their own identity in return.

Previous analysis of the EJMR forum documents the occurrences of explicitly sexual and discriminating terms associated with discussions about women that suggest an unwelcoming culture online (Wu 2018). I add to this evidence by documenting a systematic tendency to de-emphasize women's professional accomplishments while highlighting their personal characteristics, and by providing an identity-based interpretation of peers' attitudes towards women in traditionally male-dominated fields that extend beyond this particular forum or the economics profession. The model of rumors in this paper is linked to the social identity theory in Tajfel and Turner (1986) that highlights a bias towards members of the insider group, and to the formal development of identity theory in economics in Akerlof and Kranton (2000) and more recently in Gennaioli and Tabellini (2019). The divergence in the portrayal of women and men along the professional versus personal dimensions is also consistent with the prediction of the model developed by Bordalo et al. (2016) in which stereotype bias leads to an exaggeration of the contrast between groups.

Taken as a whole my findings suggest that at least some men are reluctant to let the public learn about the true distribution of women's professional ability, which would be crucial to promote integration in a profession (Goldin 2015). Finally, this paper is related to the literature on the link between gender role attitudes and women's labor market outcomes (e.g., Fortin 2005; Fortin 2015; Dahl et al. 2018). The lack of progress in attitudes towards women as indicated by the EJMR forum can help explain part of the persistent gender gap in a profession.

2 A Model of Rumors

In this section I develop a simplified model of rumors that lays out two incentives of posters to engage in anonymous discussions about other members in the profession: (1) contribution to the public knowledge and (2) identity boosting, and explains how the tradeoff between these incentives can lead to stereotyping behavior that favor each poster's in-group while diminishing the out-group. I present only the key elements of this model and its main predictions. The details of the model can be found in Appendix A.

Suppose in a profession there are two groups $\{F, M\}$ where the M group is more numerous and is traditionally considered the insider group. Given an anonymous message board and a thread of posts about a given subject (who is either F or M), a poster can either reveal his private signal about the subject's professional characteristics, which each poster derives from the subject's observable records such as publications and presentations, or discuss the subject's personal characteristics, which add uncertainty to the public's assessment of one's professional accomplishment. For example, under a discussion about a female economist's publications, a post that says "She also had two kids during the 7 years hence the extended tenure clock." suggests that the subject's childbearing decision boosts her job promotion more than warranted by professional records alone and thus casts doubts on the subject's true ability.

I assume the utility of posting arises from two sources. First, a poster values his or her contribution to the public knowledge about the job market. The further is the poster's private signal from the opinion of other posters, the more utility he derives from moving the average perception closer to his own belief. In contrast, emphasizing personal characteristics is costly as the poster makes the public information less precise. Second, following Akerlof and Kranton (2000), I incorporate a poster's identity relative to the subject into the utility function. Specifically, a poster perceives an identity threat if the subject from the out-group has higher professional characteristics than his own, but affirms a positive image of himself if the subject comes from his in-group. These assumptions are consistent with a key argument in social identity theory that people aim to achieve a positive image of their own group in contrast with the opposite group (Tajfel and Turner 1986).

This framework yields a set of predictions about posting behavior towards different groups:

1. **A poster who cares about identity tends to reveal positive signals about the professional characteristics of subjects from the in-group, but hides positive signals about subjects from the out-group.**

- Revealing a positive professional signal about a subject from the same group enables a poster to contribute to the public knowledge and simultaneously perceive a more promising professional identity of his own. In contrast, when the subject comes from the out-group, he faces a trade-off between enhancing the public understanding about the job market and protecting his self-image relative to the out-group. Appendix Figure A1 illustrates the contrast between the group-specific ranges of private signals over which a poster is willing to reveal.
- Without concerns about identity, each poster will be equally likely to reveal professional signals about subjects from in- versus out- groups.

2. **A poster who cares about identity tends to discuss personal characteristics of subjects from the out-group but not from the in-group.**

    - Discussions about the subject's personal characteristics increase the uncertainty about the his or her true professional ability and thus is costly to posters who are assumed to care about their contributions to knowledge about the job market. However, by avoiding admitting to a positive professional portrayal of someone from the out-group, a poster can protect his identity in comparison. This tradeoff leads to a higher emphasis of personal characteristics of the out-group rather than the in-group.

3. **The more a poster cares about identity, the larger the gap between the average professional signals he reveals about subjects from in-group versus out-group, and the more likely he discusses personal characteristics of the out-group than the in-group.**

    - Appendix Figure A2 illustrates that when a poster puts more weights on the self-image, there is a higher divergence in the average professional signals he reveals between the two groups, and it follows that the gap in the average personal signals revealed is also larger.

4. **When posters take into account how others would react to their remarks, those selected into posting either hold very different views from other posters, or are relatively more sensitive to their identity relative to the subject.**

    - Posters are discouraged from expressing outrageous opinions when they are concerned about an immediate backlash against them. I use a simple extensive game as in Akerlof and Kranton (2000) to illustrate this point (Figure A3). Combining with the third prediction, this result suggests that the gaps in the professional and personal signals revealed on the forum are exaggerated by posters who hold stronger views, and are more vulnerable to identity threats from the out-group.

I test for the first two predictions (corresponding to Proposition 1 in Appendix A) from both a static and a dynamic perspective. Assuming that the majority of EJMR posters are male, if the predictions were true the data would show a higher emphasis of professional characteristics of men than women and a higher emphasis of personal characteristics of women than men. Since each thread environment is dynamic and interactive in nature, a positive signal about a woman's professional ability in one post is more likely to trigger a transition towards her personal characteristics in future posts than that of a man's professional ability.

The selection of posters is not testable in the data, but it provides an explanation for the prevalence of stereotyping behavior that exaggerates the true differences between women and men in the profession. Anonymity presumably aggravates the selection as it enables posters with more biases to voice their opinions without constraints of social pressure as in other public settings. As a result, the professional information about women is systematically negatively biased relative to that of men on the forum, and the discussions about personal characteristics make the public less certain about the subject or the entire group's professional abilities, which slows down the information updating about the under-represented group that are crucial to the integration in the profession under the pollution theory in Goldin (2015).

3 EJMR Data

As of October 28th, 2017, there were 306,253 threads on the EJMR forum originating over the previous seven years. The threads are organized in reverse chronological order, by the time of each thread's latest post. Figure 1 shows that the number of new threads per month peak in December and January when candidates finish academic job applications and employers start to arrange interviews and fly-outs, but the forum remains active in other months.

I took two steps to create my dataset. First, I scraped the main pages of the forum. At the time of my data extraction there were 8,759 pages. A typical page contains 35 threads, and it records each thread's title, the time of the latest update, the number of posts, the number of views, and the votes by users (see Appendix Figure B1). I then scraped the posts on the first and last page of each thread initiated or updated between October 2013 and October 2017.[4] In this way, I obtained a dataset of 2,217,046 posts (including titles) across 223,475 threads.

In the absence of a pre-existing dictionary I identified the most frequent 10,000 words from the raw text and recorded the word counts for each word in each post. Based on this list I constructed measures of topics – {Academic/Professional, Personal/Physical}, gender and if possible, job rank – {graduate student, job market candidate/post-doc, junior faculty, senior faculty} of the subject of discussion (see Appendix B).

Identifying Gendered Posts

Among the most frequent 10,000 words, there are 53 words that indicate a post about a female (e.g., "she"/"woman") and 204 words that indicate a post about a male (e.g.,

[4]A typical thread contains at most 20 posts on each page (see Appendix Figure B2 for a screenshot). Among threads in the past four years, about 12% exceeded one page and about 4% exceeded two pages at the time of data extraction.

"he"/"man"). Appendix Table B1 provides a complete list of such gender classifiers. The imbalance in the number of classifiers arises from the different numbers of gendered first names or economists' last names among the top 10,000 words. Using these classifiers, I identified $102,956$ posts that discuss women (Female posts), and $327,670$ posts that discuss men (Male posts). About 10% of Female/Male posts include classifiers of both genders and they have been re-classified through a Lasso-regularized logistic model that predicts gender through counts of the most frequent 10,000 words excluding the gender classifiers.[5]

To address the imbalance in the number of economists' names among the 10,000 words and further identify the posts about specific economists, I assembled a list of 5,003 authors of National Bureau of Economic Research (NBER) working papers from 2014 to 2017, and a list of 4,724 job market candidates who graduated from 36 top economics Ph.D. programs in the U.S. and Canada from 2011 to 2018. Table B2 summarizes the number of female and male economists in each sample.

The sample of NBER authors comprises active researchers in the economics profession. Since 2014, the administrators of the EJMR forums post abstracts of new working papers from NBER every week. I scraped information about 5,003 authors of 4,478 working papers from the NBER website, among whom 1,008 are affiliated with NBER as research associates, 301 are faculty research fellows and the rest are their collaborators.[6]

Junior economists are less likely to be affiliated with NBER and are thus under-represented in the NBER sample. To address this selection issue, I collected an additional sample of recent job market candidates from top economics programs between 2011 and 2018. I focused on institutions in the U.S. and Canada that ranked among top 50 economics departments by econphd.net in 2004.[7] I found 4,724 Ph.D. graduates from these institutions

[5] I trained a Lasso-logistic model with 5-fold cross-validation on 75% of posts that refer uniquely to one gender or the other, and then selected the optimal p-score threshold that minimizes the mean squared error for predicting gender on the remaining 25% as a test set. The model and the training process are discussed in detail in Wu (2018).

[6] As mentioned on NBER's website (https://www.nber.org/info.html), research associates are tenured faculty at their home institutions and their appointments at NBER are approved by the NBER Board of Directors, whereas faculty research fellows are typically junior faculty.

[7] The ranking of economics departments can be found at: http://econphd.econwiki.com/rank/rallec.htm

on the ProQuest database of doctoral dissertations, and lists of job market candidates or placement records from the department websites. Table B3 provides a list of schools in this sample.

To identify the gender of each person, I first matched his or her full name with the data set of 48,000 economists with gender assignment assembled by Card, DellaVigna, Funk and Iriberri (2018). For those who were not matched, I used the "gender" and "genderizeR" packages in R to predict gender from first names and assign gender only if the predicted probability of being a female or male was at least 0.85. Finally, manual searches and assignments were done on the remaining 1,200 economists.

I searched each person's full name in the sample of 2.2 million EJMR postings. If a post includes one's full name, I then searched her first name, last name, and initials within the same thread of this post and therefore identified more posts that discussed this person. In this way I found 57,816 posts that mentioned NBER authors and 16,739 posts that mentioned job market candidates. About 87% of posts that include economists' names have already been picked up by gender classifiers, as these posts are likely to include pronouns like "he" or "she". An advantage of identifying gender through names, however, is that I can collect information about the job rank of the subject of discussion and explore patterns across the job ladder in later sections.

In summary, I found 104,476 Female posts and 334,721 Male posts in total, comprising over 20% of all posts during the sample period. These gendered posts come from 139,981 threads, representing about 63% of all threads in the sample. Table 1 further breaks down the sample by identified job rank, before and after August 2017 when there was a change in the forum's moderation policy.

4 Topic Differences between Gendered Posts

To measure the topics at the post level, I manually classified the most frequent 10,000 words into 15 categories. Table B4 explains how I grouped certain categories to consider two main topics of interest: (i) Academic/Professional; (ii) Personal/Physical. The first topic is consistent with the professional purposes of the EJMR forum, whereas the second topic emphasizes personal characteristics, which add noise to professional discussions and to some extent reflect posters' stereotyping behavior under the model of rumors.

For each post, I count the number of occurrences of words from each topic, which represents the degree to which a post emphasizes a given type of characteristic of the subject. Table 2 displays the differences between Female and Male posts in the mean number of Academic/Professional words, the mean number of Personal/Physical words, the fraction of posts related to each topic separately, and finally the fraction of posts that are purely Academic/Professional.[8] The standard error for each measure of topic difference is clustered at the thread level.

Panel A in Table 2 shows that prior to August 2017, on average there were 3.25 Academic/Professional terms in Male posts, but 1.37 significantly fewer such terms in Female posts. Figure 2 – (a) further breaks down this gap by the month in which a thread was started, identified among threads initiated between November 2016 and October 2017.[9] The gender gap in terms of a percentage difference fluctuated between 34%-51% before August 2017, and it did not show significant differences between the job market season and other months.

The other topic - Personal/Physical gives a different picture. On average Female posts contained about one word concerning personal information or physical appearance, more than double the means across Male posts. Although the magnitude of this difference seems smaller than that in the number of Academic/Professional words, it is worth noting that this category includes a significant fraction of words related to physical attributes or sexual content, which objectify women and reinforce the perception of them as an out-group in the

[8] A post is considered purely Academic/Professional if it contains at least one term from the professional topic but none from the personal topic.

[9] I used the rough time stamp under the first post of each thread to identify the month in which a thread was initiated. The time stamps are written as "1 day ago", "1 month ago","11 months ago","1 year ago", "2 years ago" and so on. Therefore I was only able to identify the start month of threads between November 2016 and October 2017, within one year as of my latest web scraping.

profession.

These topic differences show that the overall population of posters put a significantly lower emphasis on women's professional characteristics than on men's, and a significantly higher emphasis on women's personal characteristics. Both patterns are consistent the predictions in the model of rumors (Section 2) from a static perspective. I interpret discussions about women's personal characteristics as a means to cast doubts on their professional abilities and thus protect male posters against an identity threat.

4.1 The Role of Moderation Policies

I split the data by whether a thread was initiated before August 2017, during which a New York Times article by Justin Wolfers drew attention to gender issues in the economics profession and triggered a strengthening of EJMR's moderation policies that removed controversial or inappropriate content on the forum. Figure 1 shows that the total number of new threads first increased in August but then dropped by about 36% in September when the forum put new moderation policy into effect. In particular, there were 38% less new threads related to gender in September than in August. This pattern suggests that the content since August 2017 was more selective than before and might not be representative of the views of the original population of posters.

Panel B in Table 2 shows that between August and October 2017 there was a notable shrinkage of the gender gap in the Academic/Professional topic, which can be attributed to both a rise in the emphasis on professional attributes in Female posts and a selection of threads due to new moderation. Figure 2 – (a) provides a more nuanced picture that during August 2017, Female posts contained 2.7 academic terms on average, 11% less than the mean across Male posts. However, the gender gap exceeded 30% again in the next two months.

Figure 2 – (b) shows that the gender difference in the Personal/Physical topic remained significant in each month between August and October 2017. The changes in EJMR's moder-

ation policies since August 2017 did not make an immediate change on the Personal/Physical topic as it did for the Academic/Professional topic, suggesting that it is particularly difficult to break the association between women and non-professional and stereotypical discussions.

4.2 Gender Gaps by Job Rank

To examine whether these topic differences vary across positions on the job ladder, I use information about specific economists and a list of keywords to identify the job rank in each post (see Appendix B for details). I focus on four observable ranks: 1 - Graduate Students; 2 - Job Market Candidates and Postdocs; 3 - Junior Faculty; 4 - Senior Faculty. About 15% of all gendered posts are assigned a job rank. Table 1 summarizes the number of Female and Male posts at each job rank.

Figure 3 - (a) displays the mean number of Academic/Professional terms at each job rank among posts before August 2017. In comparison with the full sample, both Female and Male posts with assigned job ranks contained more Academic/Professional terms on average. However, the gender gap at each rank was significant before August 2017. for example, a typical post about female job market candidates or post-docs had about 6.66 Academic/Professional words, 2.14 less (t = -7.63) than a typical post about male candidates. The gap shrank in both absolute and relative terms for junior and senior faculty but remained statistically significant. The change in EJMR's moderation policies and other factors around the media exposure in August 2017 appeared to reduce this gender gap as shown in Figure 3 - (b), most strikingly among discussions about job market candidates and junior faculty.

Figure 4 shows that the emphasis on personal characteristics remained significantly higher in Female posts than in Male posts across all job ranks, and strengthened moderation policies did not make a notable difference for this topic. Posts about senior faculty of each gender contained less words concerning personal information or physical appearance. Assuming the majority of EJMR posters are early in their career, an identity-based interpretation of this pattern is that posters put more weight on their self-image relative to subjects closer to them on the job ladder, and thus they are less likely to feel professionally threatened by senior economists. In contrast, the gap became significant again among junior faculty, many of whom were evaluated by EJMR posters over whether they deserved tenure. The emphasis on a female assistant professor's personal characteristics can be interpreted as adding noise to the public assessment of her professional ability, which potentially helps a poster maintain a relatively higher professional status of his own.

5 Dynamics of Topics in Sequential Conversation

Moving beyond the static analysis of topic differences between gendered posts, I present an empirical framework to measure stereotyping in the dynamics of a conversation. Each thread on the forum is a dynamic environment in nature where posters interact with each other. In the model of rumors, a poster's choice of topic depends not only on his or her private information about the subject, but also on the signals revealed by previous posters, and the expected reactions from future posters (see Appendix A). A model without consideration of the interactions between posters would not be able to explain why state dependence in topics could arise within a thread.

I use a discrete choice model to estimate the effects of gender on the transition probabilities between topics in gendered threads that contain at least one Female or Male post. I interpret the transitions as a means to (1) contribute to the public understanding about the job market and (2) boost a poster's professional identity relative to the subject. Since about 80% of EJMR users (visitors and posters) were claimed to be male as of September 2017, I consider the patterns discussed below to be primarily driven by the preferences of male posters.[10] Table 3 provides some examples of consecutive posts in actual EJMR threads that illustrate the transitions between topics when the prior post is gendered.

[10]The administrator of the EJMR forum released a statement in September 2017, which claimed 20% of EJMR users are female (https://www.econjobrumors.com/topic/kirk-statement-on-recent-events-and-moderation-policy). The number appeared to come from a third-party analysis of users' web-browsing cookies. Please note users include all visitors of the forum. It is not clear whether female and male users have the same propensity to post on the forum.

5.1 Choice between Discrete States of Posts

I focus on the decision making of a poster regarding the topic of a new post added to an existing thread t with N number of posts. There are three possible states of each post: $s(n) \in$ {Purely Professional, Personal, Others}, which lead to nine possible transitions between the states of consecutive posts. Each post can be either gendered (Female or Male), or not gendered (Genderless).

Let $\mathbf{Gender_{t,N}}$ denote a vector of indicators for whether the last post observed by the poster discusses a female or a male respectively. Conditional on the N-th post of thread t in state s_0, I specify the utility function of poster k creating the $(N+1)$-th post in state s as

$$u_{ks} = \alpha_{ks} + \beta_{ks}\mathbf{Gender_{t,N}} + \epsilon_{ks} \tag{1}$$

where α_{ks} represents k's utility from writing a new post in state s in reaction to a Genderless post, and the vector β_{ks} captures the additional utility k obtains when the N-th post is Female or Male respectively. I assume the error ϵ_{ks} is independently and identically distributed according to type I extreme value across posters and choices.

In this anonymous setting, I do not have information about individual posters but I proceed by assuming that posters who select themselves into the same type of threads have the same preferences for topics. Following the modeling assumptions in Bayer, Ferreira and McMillan 2007, I allow each poster's preferences for topics to vary with a set of observable thread characteristics denoted by $\mathbf{Z_{t,N}}$, according to

$$\alpha_{ks} = \alpha_s + \pi_\alpha \mathbf{Z_{t,N}}$$

$$\beta_{ks} = \beta_s + \pi_\beta \mathbf{Z_{t,N}}$$

where $(\alpha_s,\, \beta_s)$ is shared by all posters and $(\pi_\alpha,\, \pi_\beta)$ capture the heterogeneity in preferences under different types of threads. The variables in $\mathbf{Z_{t,N}}$ control for initial conditions that indicate the topic (Purely Professional, Personal or Others) and the gender of the subject (Female, Male or Genderless) in the title and the first post of the thread. Initial conditions should be taken into account if they are assumed to be correlated with any unobserved permanence in a dynamic decision process (see Eckstein and Wolpin 1989; Keane and Wolpin 1997; also Aguirregabiria and Mira 2008 for a survey). In particular, the initial state is considered important in shaping the theme and triggering subsequent discussion in recent studies about the dynamics of online conversation (see Farajtabar et al. 2015; Farajtabar et al. 2017; Rizoiu et al. 2017).

To test for posters' preferences over discussions about specific job ranks, $\mathbf{Z_{t,N}}$ includes an indicator for each job rank along with a group without rank assigned in the N-th post. Preferences over length of existing threads are captured by $ln(N)$ - the log number of previous posts, which allows for differential returns to posters when switching topics in shorter versus longer thread. Finally, $\mathbf{Z_{t,N}}$ includes the fraction of posts under each possible state in thread t, which do not vary across posts and presumably absorb any remaining unobserved thread-level propensity for each possible transition of topics.[11]

Given the specification above, I re-write (1) as

$$u_{ks} = (\alpha_s + \pi_\alpha \mathbf{Z_{t,N}}) + (\beta_s + \pi_\beta \mathbf{Z_{t,N}})\mathbf{Gender_{t,N}} + \epsilon_{ks} \tag{2}$$

Under the assumption that ϵ_{ks} is distributed type I extreme value, the problem can then be estimated as a multinomial logit. When each poster chooses the state that maximize (2), the realized choice probabilities are

$$P(s(N+1) = s|s(N) = s_0) = \frac{exp(u_{ks})}{\sum_{s'} exp(u_{ks'})}$$

[11]As discussed in Section 4.2, about 15% of gendered posts are assigned one of the four job ranks based on reference to a specific economist or keywords: Graduate Students, Job Market Candidates / Post-docs, Junior Faculty and Senior Faculty. The controls include an indicator for the 85% of the sample without job rank assigned and this group is used as base.

I begin by estimating the average marginal effects of gender in the prior post on the probability of transitioning from state s_0 to state s in the current post. It is particularly interesting to examine the gender differences in the persistence in professional topics, and the switches between professional and personal topics. The incentive to affirm a poster's own status may lead him to continue emphasizing the professional characteristics of subjects similar to him, whereas the incentive to improve one's self-image relative to subjects from the opposite group is likely to result in a deviation from the professional topics (see Table 3 for examples). In Section 5.3, I also discuss some alternative explanations for my findings.

5.2 Main Results

I estimate the model above on 132,936 gender-related threads initiated or updated before August 2017 to avoid contaminating the results by heavily censored content since then.[12] The sample includes 99,659 Female posts, 318,873 Male posts, and about 1.1 million Genderless posts in total.[13]

Figure 5 shows the average marginal effects of gender on the probability of each possible transition, conditional on the state of the previous post. Standard errors are clustered at the thread level to take into account the correlation between posts within the same thread. All the estimates are relative to the base group comprising transitions from posts that are not gendered (Genderless).

First, there is a relatively lower persistence in purely professional topics when the prior post mentions a female, but this is not the case following the mention of a male. Conditional on the prior post being purely professional, the current post is on average 2.9 percentage points (t=-6.5) less likely to stay on the professional topic when the prior one is Female rather than Genderless, but 1.0 ppt (t=3.9) more likely to switch to a personal topic and

[12] By "gender-related" I mean each thread contains at least one Female or Male post.

[13] Since I only scraped posts on the first and the last page of each thread, I drop the "transition" from the last post on the 1st page and the first post on the last page if there are missing pages in between. Part of the difference between posts on the first page vs. those on the last page is absorbed by the control $ln(N)$ where N is the total number of previous posts, including those I did not scrape.

1.9 ppt (t=4.4) more likely to switch to miscellaneous topics not identified as professional or personal. Yet when the prior post is Male, the deviation from a purely professional topic relative to the base group is 0.6 ppt (t=-4.1), a much smaller difference compared with the Female group.

Figure 6 further reveals that the gender gaps in transitions from professional topics are salient at all different lengths of threads. When a thread just begins with one or two posts, a new post is about 4 ppt significantly less likely to be persistent in professional topics following the mention of a female, and about 2 ppt significantly less likely so following the mention of a male (see Figure 6 – (a)). As the thread gets longer, the probability of leaving professional topics shrinks for both gender, suggesting a decline in the leverage of new posters over a thread that has been going on for a while. Nevertheless, even in threads at the 90th percentile with about 23 existing posts, the relative likelihood to deviate from purely professional topics after a Female post does not become insignificant as it does after a Male post. Figure 6 – (b) shows that about 40% of the deviations from professional topics go to personal ones after a Female post and such a tendency remains significant at 5% level until the 90th percentile. Male posts, in contrast, do not trigger a significant transition towards personal topics at any length of thread on average.

Once a deviation from the professional topic occurs, it is less likely to come back to the professional track in discussions about women than those about men. Figure 5 shows that among transitions from personal topics, there is on average a 0.6 ppt significantly higher chance of escape from personal to purely professional or other topics when the prior post is Male rather than Genderless, while the Female group does not show any significant difference from the baseline. The Male group also shows a 0.7 ppt significantly higher probability of moving back to professional topics from miscellaneous ones, in contrast with a 1.1 ppt significant increase in the probability of switching to personal topics instead when the prior post mentions a female.

As the majority of posters are male, the lack of persistence in professional topics following a Female post is consistent with the main prediction from the model of rumors: male posters are less likely to reveal signals about a female subject's professional characteristics when their own identity is threatened by the out-group. The transition from professional to personal topics is arguably inappropriate in a professional setting and to some extent represents a belief that personal characteristics provide a premium to women's career (see the second example in Table 3). Finally, the difficulty in moving back to professional topics from non-professional ones after a Female post suggests that stereotypical views can be easily reinforced on the forum, leading to a systematic de-emphasis of professional characteristics of women as the out-group in the profession.

5.3 Alternative Explanations

I test for two alternative hypotheses that may explain the divergence in the transition rates between topics.

i. Selection of Posters into Different Threads

Posters who select themselves into threads that start off with a personal topic related to women are unlikely to move the discussion towards a professional topic, whereas those who join a thread about a man's professional attributes are more likely to stay on the initial professional topic. The heterogeneity in posters' preferences over threads can contribute to the gender gaps in transitions in the data. In the discrete choice model I assume posters' preferences are absorbed by the controls for thread characteristics including initial topic and gender, and mean topics across all posts. In particular, posters are prompted to click on a thread by its title listed on the main sites of the EJMR forum (see Appendix Figure B1). A typical title contains less than ten words, but it is arguably sufficient in conveying whether the thread means to be professional or personal and whether it pertains to a particular gender.

Table 4 reports the estimated average marginal effects of gender on transition probabilities from purely professional topics under different types of thread titles. In threads with purely professional titles, the mention of a female in the middle of a discussion leads to a significant 2.8 to 4.2 ppt decrease in the probability of staying on purely professional topics, whereas the mention of a male shows insignificant difference from the baseline where the prior post is not gendered. The gender gap in this dimension is most salient in threads that are initially professional and mentions a male in the title. Posters selected into male-oriented threads may be particularly reluctant to see professional discussions about women, which are perceived as a "pollution" to their own group and pose an identity threat. Nevertheless, the selection hypothesis does not explain why there is also a significant lack of persistence in professional topics under initially gender-neutral threads.

Under threads that begin with a personal topic and a female subject, a purely professional Female post is 3.0 ppt more likely to trigger a transition towards personal topics; however, this transition rate remains significantly positive under initially professional threads. That is, the tendency to deviate from professional to personal topics is more systematic than what can be explained by selection of posters into different threads.

In summary, the heterogeneity in the estimates suggest that the selection of posters into different types of threads does play a role in driving the gender gaps in transitions, but there are systematic patterns across all types of threads that cannot be explained by selection alone.

ii. Valuations for Knowledge about Different Job Ranks

About 15% of gendered posts are assigned a job rank, either through information about economists they discuss, or through keywords such as "job market candidates" and "junior faculty" (see Appendix Table B5). Posts that discuss a specific job rank tend to include more Academic/Professional terms on average than the rest of the sample (see Figure 3). If posters value the public knowledge about the profession and in particular the job market for both genders, there should be less gender differences in deviations from purely professional topics.

Figure 7 shows the average marginal effects of gender on transitions evaluated at four different job ranks: Graduate Students, Job Market Candidates/Post-docs, Junior Faculty, and Senior Faculty. At each job rank, a Male post does not trigger a significant deviation from purely professional topics relative to the baseline (Genderless), whereas a Female post leads to a 3 to 5 ppt significant decrease in persistence in professional topics. There is a significant gender difference in persistence at junior faculty level, where the effect of a Female post is most negative. However, a null hypothesis of no gender difference in persistence cannot be rejected at other ranks, partially because the estimates for the Female group are noisier as the number of Female posts identified at each rank is much smaller than that of Male posts (see Table 1). The estimates for the effects of Female posts on transitions from professional to personal topics are also imprecise, and thus I cannot reject a null hypothesis of no gender difference at the 5% level.

Although there is less precision in this relatively small sample at each job rank, the results point to alternative hypotheses on posting behavior towards women versus men. First, as discussed in the model of rumors, part of the utility of posting comes from contributing to the public knowledge about the job market (see Section 2 and Appendix A). When discussing a specific economist or groups of individuals at a specific job rank, posters may want to get as much professional information as possible. A possible explanation for the contrast between the effects of Female versus Male posts on persistence in professional is that male posters care more about professional discussions of other men, but not of women. As a result, they are more likely to stay on track in a male-oriented professional discussion. In Appendix A, I discuss how the tradeoff between contributing to public knowledge and identity boosting leads posters to act differently towards men versus women. However, empirically it is difficult to identify the extent to which the gender gap in movements between topics can be attributed to each incentive separately.

Second, when a poster refers to a specific economist rather than talk about female or male colleagues in general, other posters can form their own interpretations of the subject's professional ability by evaluating his or her works. In this case, the cost of saying something outrageous or deviating to irrelevant personal characteristics is higher to the poster if he takes into account how other posters may react, a component of poster's utility that I discuss in the model of rumors. However, this hypothesis cannot explain why the effect of a Female post at each job rank on the persistence in professional topics remains to be significantly negative.

In summary, posters' incentive to protect their own professional identity provides a relatively robust explanation for the divergence in the effects of gender on the transition rates between topics. There are alternative explanations based on posters' preferences over different types of threads, or over discussions at different job ranks. In future works it would be particularly meaningful to quantify the tradeoff between the incentive to contribute to the public knowledge about the profession and the incentive to boost one's own identity.

6 Conclusion

This paper uses anonymous discussions on the Economics Job Market Rumors Forum to study people's true attitudes towards women in the profession, which they are unlikely to openly express in other public settings. Posts that discuss women focus significantly less on their professional characteristics but more on physical appearance and personal information than posts that discuss men. Moreover, in the dynamics of conversation there is a significantly lack of persistence in purely professional topics when the prior post mentions a female.

The model of rumors provides an identity-based interpretation of these findings: posters reinforce the perception of women as outsiders in the economics profession through diminishing their professional image, and by doing so, male posters can improve their in-group identity in the profession relative to women. Discussions about women's personal characteristics also cast doubts on the public's understanding about women's true professional ability, which slows down the process to overcome hostility against the underrepresented group and improve integration. There are also alternative explanations to these findings. In future analysis it would be interesting to quantify the role of identity threat in driving discrimination, and further look into the tradeoff between the incentive to contribute to the public knowledge and the incentive to boost one's own identity.

The stereotypical gender attitudes revealed on the EJMR forum are most likely not exclusive to the economics profession, but reflect the challenges women are facing in many traditionally male-dominated fields. Understanding people's true gender attitudes is crucial to improving policies aimed at increasing diversity in a profession. There is indeed hope to reduce gender bias by promoting interaction between groups (Dahl et al. 2018), increasing exposure to female leaders (Beaman et al. 2009), or more broadly speaking any mechanism that increases information about the true distribution of the ability of women (Goldin 2015).

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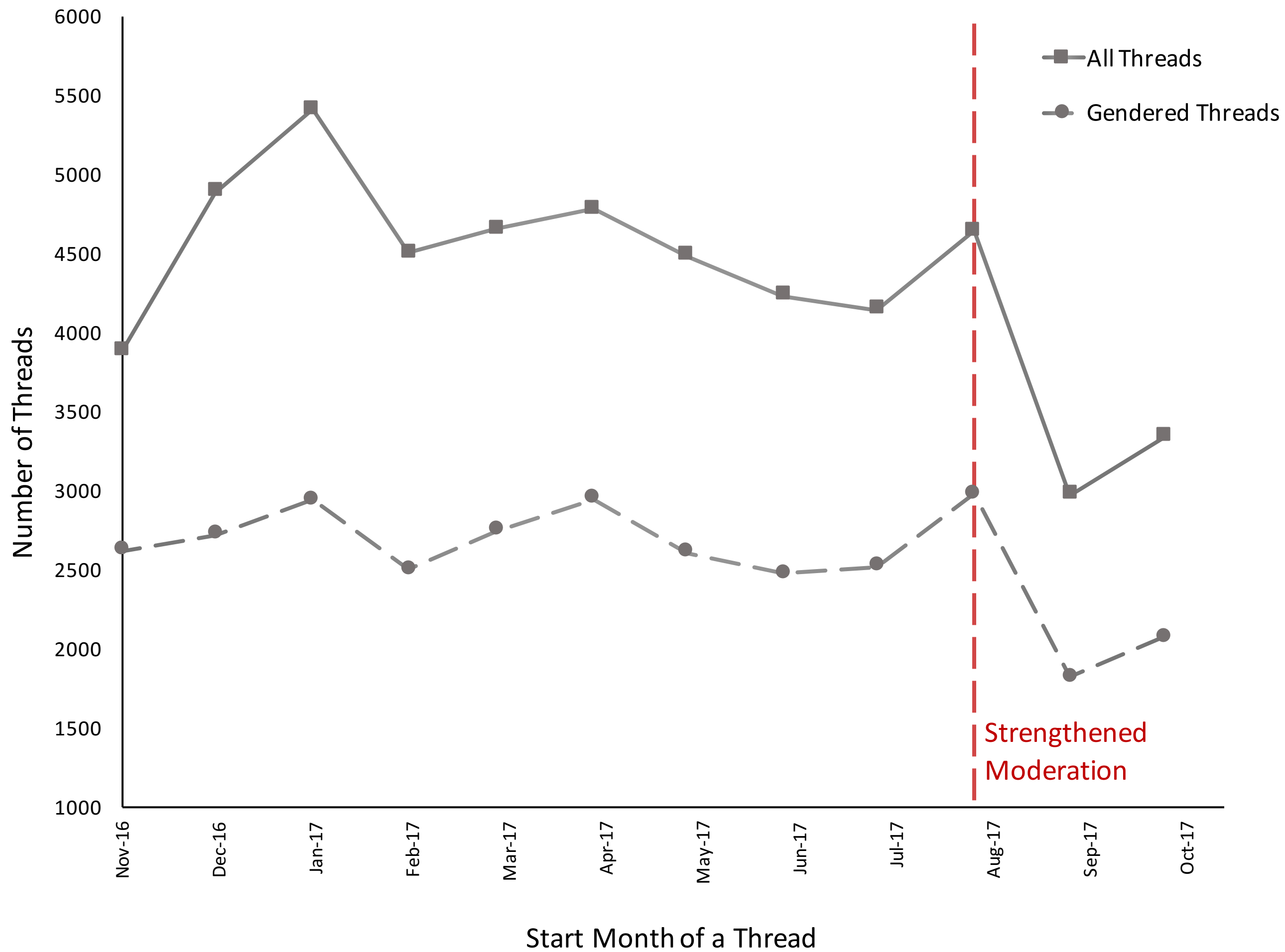
Figures

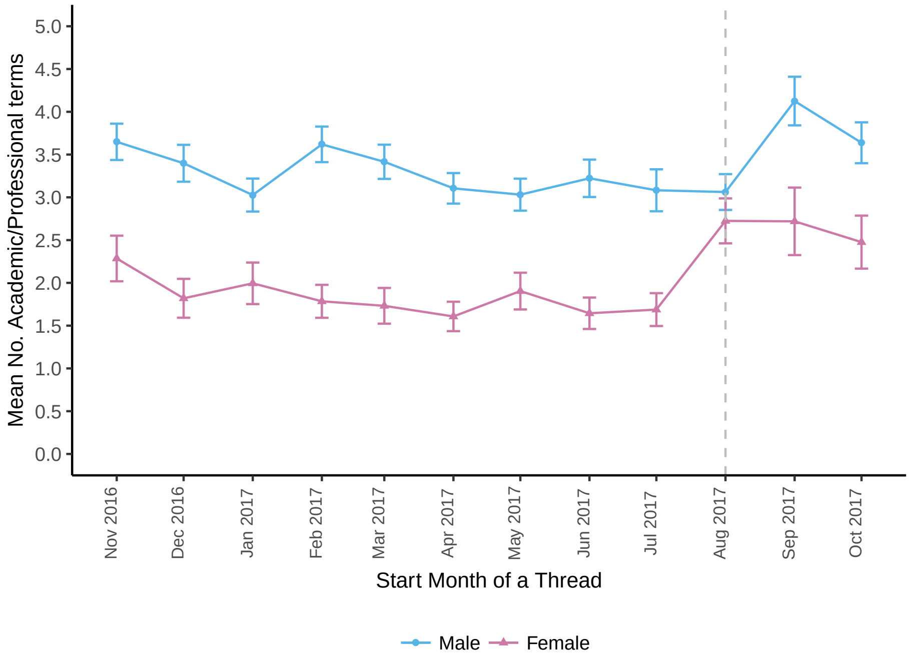
Figure 1: Number of New Threads per Month



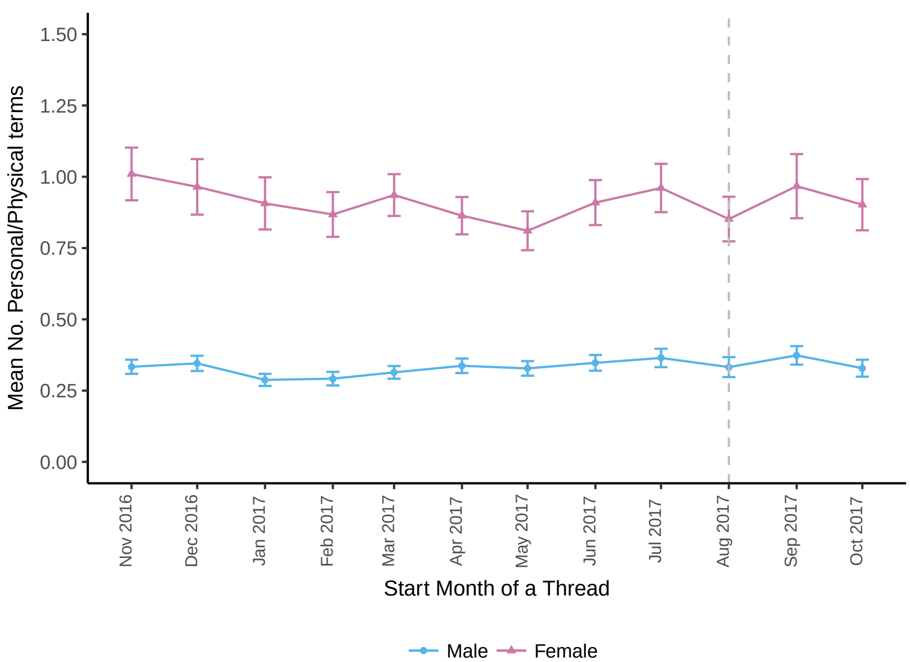
This figure shows the number of new threads initiated in each month between November 2016 and October 2017, in the full sample and the gender sample (threads that include at least one Female or Male post) respectively. For threads started before Nov 2016, I cannot identify the calendar month from the rough time stamps such as “1 year ago”, “2 years ago” listed on EJMR. In August 2017, a New York Times article by Justin Wolfers raised concerns about the gendered content on the EJMR forum and led to strengthened moderation policies by EJMR, which appeared to result in the removal of a significant amount of threads in September and October 2017.

Figure 2: Trends of Topics in *Female* versus *Male* Posts

(a) Mean Number of *Academic/Professional* by the start month of each thread



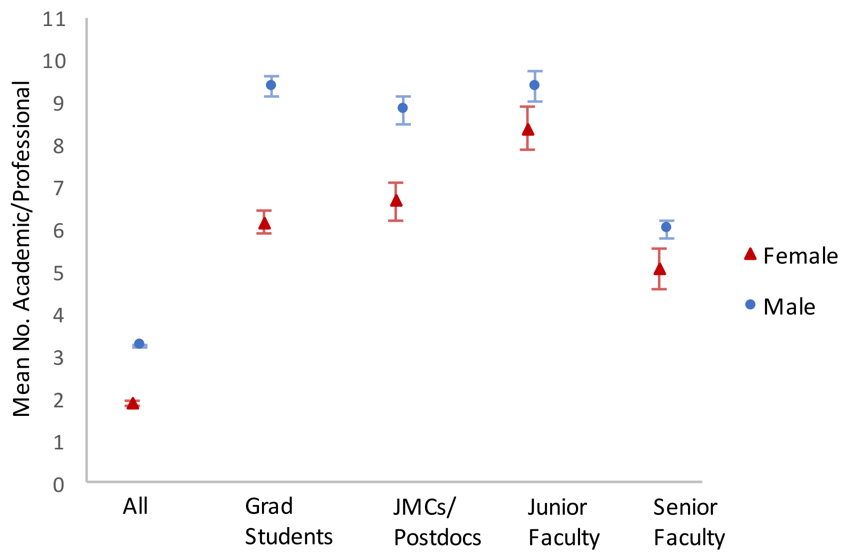
(b) Mean Number of *Personal/Physical* by the start month of each thread



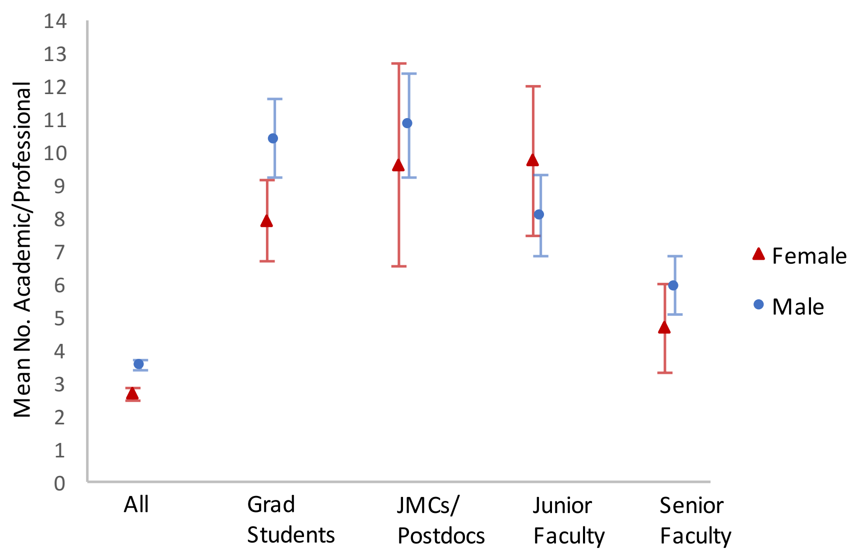
This figure plots the sample means (95% CI shown) of the number of Academic/Professional or Personal/Physical terms in Female vs. Male posts from threads initiated within each month between November 2016 and October 2017. I identify the start month of each thread by the rough time stamp of its first post. The dashed line at August 2017 indicates the beginning of media coverage and strengthened moderation policies on the EJMR forum.

Figure 3: Gender Differences in *Academic/Professional* by Job Rank

(a) Before August 2017



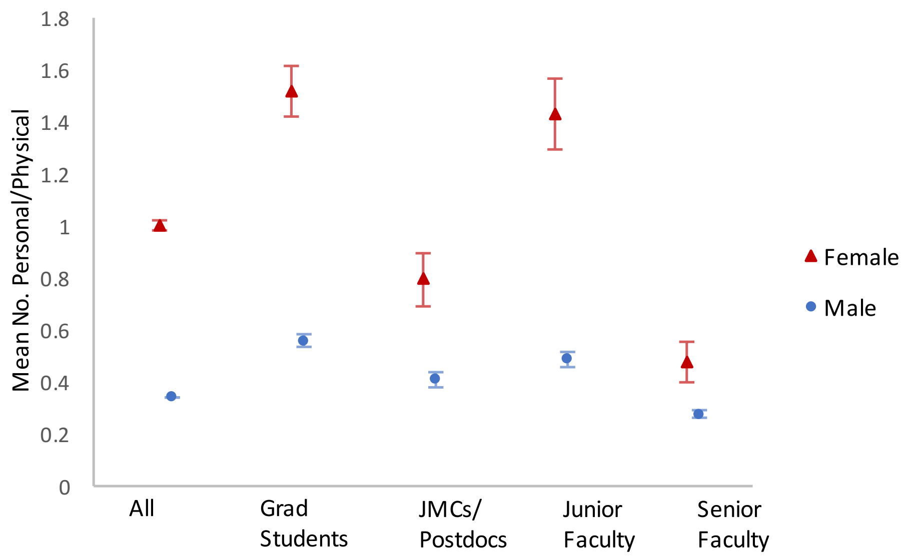
(b) August - October 2017



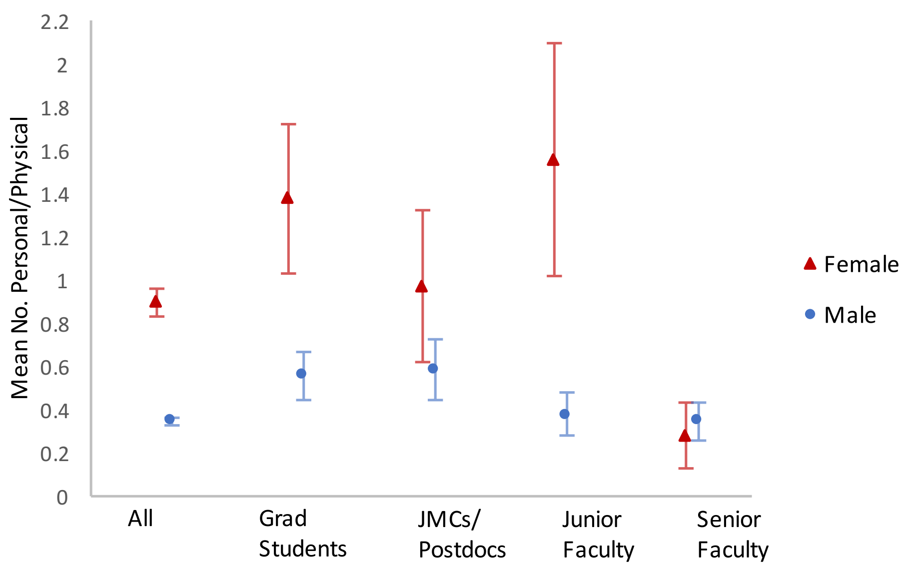
This figure plots the sample means (95% CI shown) of the number of Academic/Professional terms among all Female vs. Male posts, and among Female vs. Male posts at each job rank, assigned to about 15% of all posts in the sample (see Appendix B).

Figure 4: Gender Differences in *Personal/Physical* by Job Rank

(a) Before August 2017

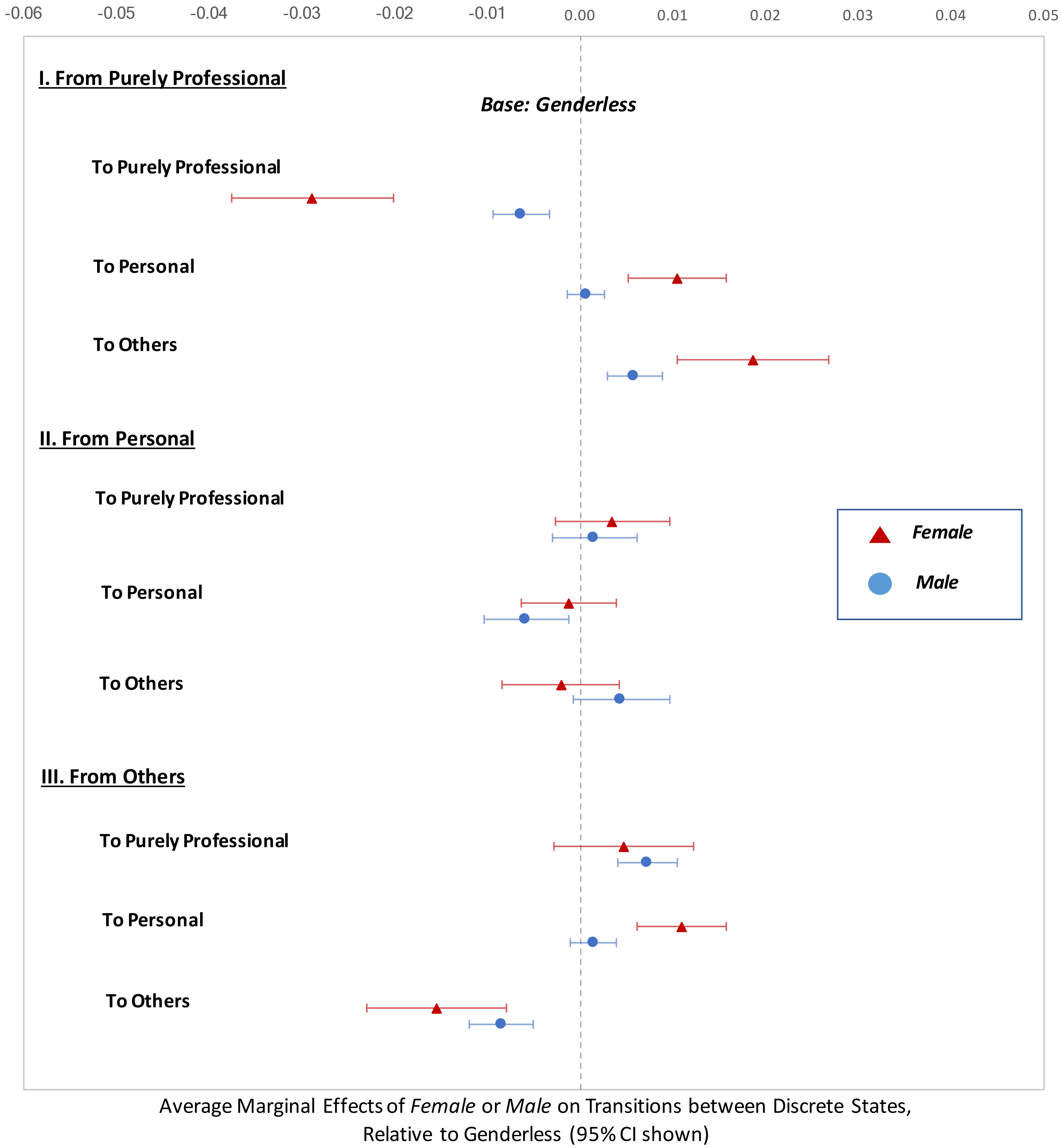


(b) August - October 2017



This figure plots the sample means (95% CI shown) of the number of Personal/Physical terms among all Female vs. Male posts, and among Female vs. Male posts at each job rank, assigned to about 15% of all posts in the sample (see Appendix B).

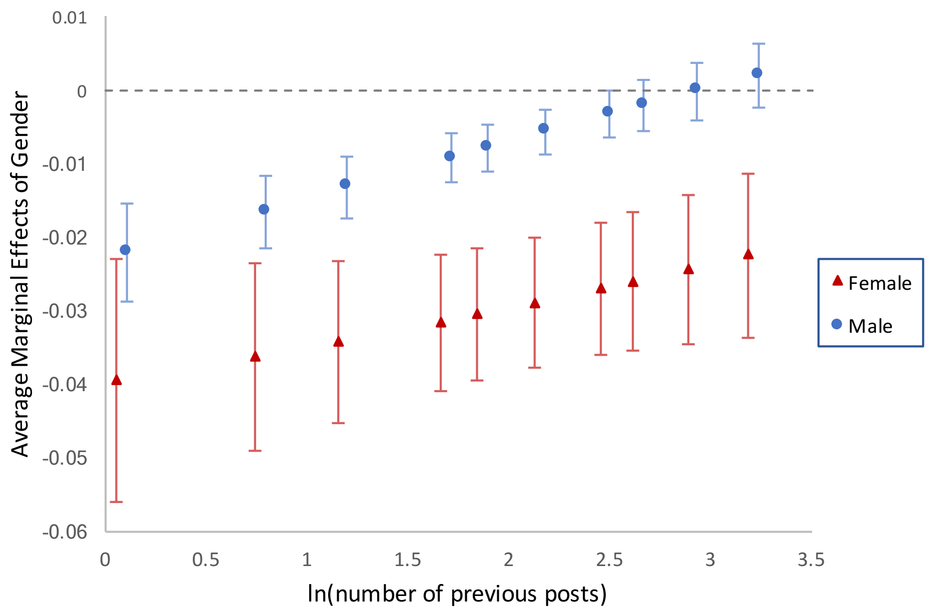
Figure 5: Average Marginal Effects of Gender on All Possible Transitions



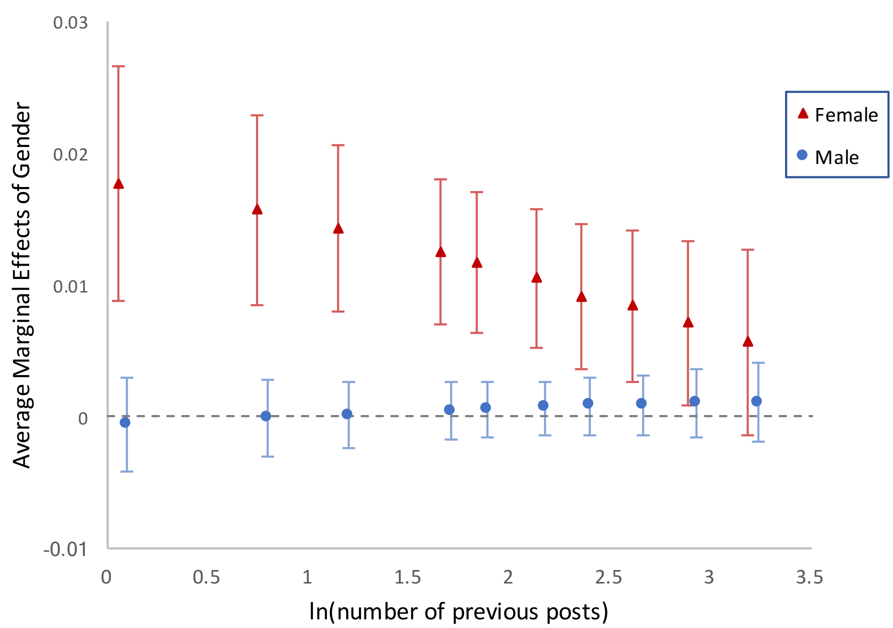
I estimate a multinomial logit model for transitions in topics on all threads started before August 2017 with at least one gendered (Female or Male) post. Standard errors are robust and clustered at the thread level.

Figure 6: Average Marginal Effects of Gender on Transitions by Length of Threads

(a) Staying on Purely Professional Topics



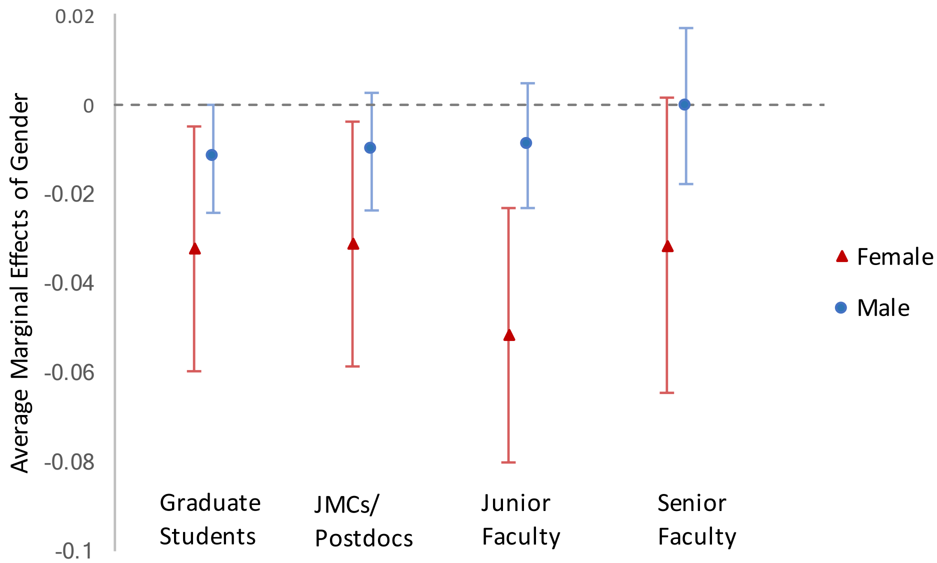
(b) Moving from Purely Professional to Personal Topics



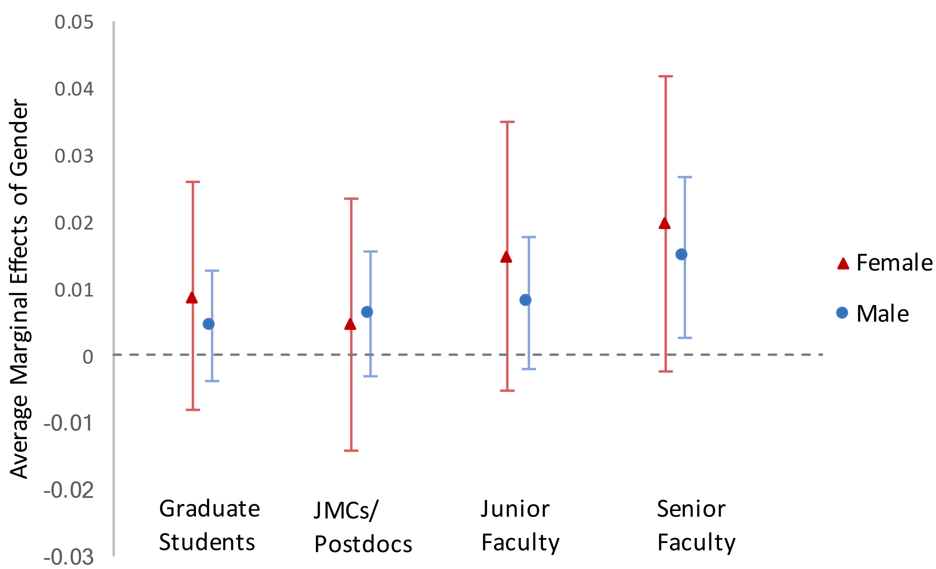
This figure shows the average marginal effects (with 95% confidence intervals) of the mention of a female or a male on the probability of (a) staying on the purely professional topics and (b) moving from professional to personal topics, relative to the baseline where the prior post is not gendered, at different lengths of existing threads. The minimum of the log number of previous posts at zero represents the second post of each thread, at which the first possible transition of topics between consecutive posts occurs in a thread. The other data points are located at the deciles of the log number of previous posts (denoted by $ln(N)$ in text), from 10% to 90% respectively. Standard errors are robust and clustered at the thread level.

Figure 7: Average Marginal Effects of Gender on Transitions by Job Rank

(a) Staying on Purely Professional Topics



(b) Moving from Purely Professional to Personal Topics



This figure shows the average marginal effects (with 95% confidence intervals) of the mention of a female or a male on the probability of (a) staying on the purely professional topics and (b) moving from professional to personal topics, relative to the baseline where the prior post is not gendered, at four different job ranks. Standard errors are robust and clustered at the thread level.

Tables

Table 1: Sample Overview

	Female	Male
Before August 2017		
No. Posts	99,659	318,873
No. Threads	41,243	116,996
No. Posts by Job Rank		
Graduate Students	3,111	11,359
Job Market Candidates/Post-docs	2,156	8,932
Junior Faculty	2,335	9,675
Senior Faculty	2,097	18,339
August - October 2017		
No. Posts	4,817	15,848
No. Threads	2,129	6,192
No. Posts by Job Rank		
Graduate Students	181	639
Job Market Candidates/Post-docs	112	374
Junior Faculty	159	718
Senior Faculty	131	1,059

Notes: Panel A restricts to posts under threads initiated before August 2017, whereas Panel B restircts to posts under threads initiated between August and October 2017. "No. Threads" records the number of threads that contain at least one *Female* or *Male* post, respectively.

Table 2: Topic Difference between Female and Male Posts

	Female	Male	Difference	SE
Panel A: Before August 2017				
Counts				
Mean no. Academic/Professional terms	1.8792	3.2468	-1.3676	(0.0236)
Mean no. Personal/Physical terms	0.9996	0.3379	0.6617	(0.0085)
Indicators				
Has any Academic/Professional term	0.4772	0.5925	-0.1153	(0.0023)
Has any Personal/Physical term	0.4396	0.1949	0.2446	(0.0022)
Purely Academic/Professional	0.2387	0.4595	-0.2208	(0.0020)
Panel B: August - October 2017				
Counts				
Mean no. Academic/Professional terms	2.6425	3.525	-0.8825	(0.1274)
Mean no. Personal/Physical terms	0.8943	0.3423	0.552	(0.0342)
Indicators				
Has any Academic/Professional term	0.5553	0.5968	-0.0415	(0.0102)
Has any Personal/Physical term	0.3971	0.1904	0.2068	(0.0096)
Purely Academic/Professional	0.3104	0.4597	-0.1494	(0.0097)

Notes: This table shows the topic differences between Female and Male posts, measured by counts of words in each topic and indicators for containing any word from a given topic. Standard errors in the last column are robust and clustered at the thread level. Panel A restricts to posts under threads initiated before August 2017, whereas Panel B restircts to posts under threads initiated between August and October 2017.

Table 3: Examples of Transitions between Topics in Consecutive Posts

N-th Post			$(N+1)$-th Post		
$Gender_N$	$s(N)$	Content	$Gender_{N+1}$	$s(N+1)$	Content
From Purely Professional					
Male	Purely Professional	"i think [Name] is the best. **He** has the most solid job market paper in IO ..."	*Genderless*	Purely Professional	"Agreed. Will certainly be best IO candidat on market"
Female	Purely Professional	"... this is a very weak record especially given the fact that **she** took 9 years to get tenure ..."	*Female*	Personal	"Collegial externalities - **she** looks nice, great gender."
Female	Purely Professional	"**Her** quantity is pretty outstanding. 3 publications, 4 working papers ..."	*Genderless*	Others	"Stop with the self-promotion you little shiets"
From Personal					
Male	Personal	"All that matters for **men** is what shows in a dress shirt ... hygiene shows best."	*Genderless*	Purely Professional	"It's really all about the JMP."
Female	Personal	"... when I asked them why that teacher got good evaluations the student literally said it was because: "**she** was hot!" "	*Genderless*	Personal	"Just put on a short dress, maybe show a little panties and at the very least show a panty line and then act cute and you'll do fine."

Notes: This table provides examples of transitions of topics between consecutive posts (from the N-th post to the $(N+1)$-th post) in actual threads from EJMR. *Gender* represents the gender of the subject in a post (Genderless if neither Female nor Male), s refers to the state or main topic of a post (Purely Professional, Personal or Others), and the content is abbreviated for illustrative purposes. For Female or Male posts, the gender classifiers (female or male) each post contains are in bold.

Table 4: Average Marginal Effects of Gender on Transitions under Different Initial Conditions

	(1) Staying on Purely Professional		(2) Professional → Personal	
	Female	*Male*	*Female*	*Male*
By Characteristics of Titles				
Purely Professional & Genderless	-0.0288	-0.0067	0.0106	0.0013
	(0.0051)	(0.0020)	(0.0033)	(0.0014)
Purely Professional & Female	-0.0277	-0.0105	0.0274	-0.0007
	(0.0103)	(0.0110)	(0.0059)	(0.0057)
Purely Professional & Male	-0.0415	0.0014	0.0153	0.0008
	(0.0125)	(0.0040)	(0.0074)	(0.0026)
Personal & Genderless	-0.0226	-0.0089	0.0152	−0.0001
	(0.0122)	(0.0074)	(0.0058)	(0.0036)
Personal & Female	-0.0203	-0.0130	0.0304	-0.0018
	(0.0152)	(0.0128)	(0.0076)	(0.0057)
Personal & Male	-0.0351	-0.0006	0.0195	-0.0005
	(0.0171)	(0.0083)	(0.0086)	(0.0041)

Notes: This table displays the average marginal effects of the prior mention of a female or a male on the probability of (1) staying on purely professional topics and (2) moving from purely professional to personal topics, relative to the baseline where the prior post is not gendered. Standard errors in parentheses are robust and clustered at the thread level. The initial conditions listed here are solely determined by the topic and gender in the title of each thread, which posters can see before clicking on the thread. The full set of initial thread characteristics in the model also include the topic (Purely Professional, Personal or Others) and gender (Female, Male or Genderless) in the first post of each thread.