Twitter and the Professionalization of Women in Congress

Abstract

Many quantitative studies detail the electoral challenges that face women, yet little attention is paid to how these challenges continue on Capitol Hill and what women can do to build influence in Congress. Congresswomen use Twitter — a low-cost, public-facing platform — to bypass barriers to social and professional ties with influential members of the Congressional network. Using network analysis, we show that Congresswomen are more likely to engage directly with other female legislators and with Congressional leadership compared to male legislators. Our findings support the theory that Twitter offers women a way to strategically build and signal professional ties.

Keywords: Congress, gender, Twitter, social media, networks

Twitter and the Professionalization of Women in Congress

Introduction

Historic landmarks such as the "Year of the Woman" in 1992, where voters elected an unprecedented number of women to Congress, highlight the progress that Congress has made in the representation of women. Over a decade has passed since the historical election and, though the presence of women in the House of Representatives has steadily increased, the percentage of women still remains around less than 20% of the entire chamber and less than 35% of either party. Women, therefore, are still a clear minority in Congress. Many scholars have tried to explain the lack of female representation in Congress by focusing on the challenges that the electoral environment presents to women (e.g. Huddy & Terkildsen, 1993a, 1993b; McDermott, 1997; Sanbonmatsu, 2006; Jenkins, 2007; Lawless & Pearson, 2008). In contrast, there are few quantitative studies that explore the challenges that Congress as an institution presents to female legislators (e.g. Volden, Wiseman, & Wittmer, 2013). To the best of our knowledge, this analysis is the first of its kind in the study of Congressional behavior in that it studies female representation in Congress using quantitative data and network analysis[1].

In the past decade, social media has become embedded into the fabric of U.S. politics. The benefits of social media engagement being close to real-time and reaching a wide audience beyond their constituents appeal to legislators' professional goals. Legislators also leverage the public-facing nature of social media to ensure that their positive valuation by other members is well-documented and noticed by the rest of the legislature. We contend that social media is a tool that can provide added utility to women in Congress; being able to easily and publicly engage with other members of

[1]Part of the reason why there is a dearth of quantitative studies that acknowledge the gendered nature of Congress may be because gender research is not integrated into research on Congress, but rather treated as a separate research area of women in politics (e.g. Duerst-Lahti, 2002).

Congress is particularly useful for members who historically do not have formal institutional power and face barriers to building these ties. We believe that demonstrating the degree to which women are integrated into Congress and analyzing their strategies will help professionalize more women in Congress.

Women as Office-Holders in Congress

Fenno (1973) argued that members of Congress have three goals upon arrival in the national legislature: attaining reelection, policy production, and gaining influence within the House or Senate.[2] By focusing on women as office-holders as opposed to congressional candidates, we are, therefore, focusing on their goals of policy production and gaining influence in the legislature. Specifically, we are interested in actions that female legislators take to professionalize within Congress, in order to gain a positive reputation and power among their colleagues. However, we recognize that the intention for members to gain influence in Congress is not completely independent from other goals: the success of passing policy, including policy that directly benefited a legislator's constituency and thus improved chances of reelection, hinges on that legislator's reputation and power within Congress (e.g. Hibbing, 1991).

Congress is a social institution, which means that inter-legislator ties are integral for legislators to achieve their goals of policy production and gaining influence. Indeed, research has shown that members of Congress develop relationships during legislative sessions that can work towards helping them achieve career goals (Young, 1986; Caldeira & Patterson, 1987; Patterson, 1988; Caldeira, Clark, & Patterson, 1993; Fowler, 2006a, 2006b; Kirkland, 2011). These studies suggests that information and expertise are diffused through ties, and members who are not able to develop these ties may not be able to achieve their career goals. Unfortunately for female legislators, the

[2]Fenno's (1973) original question was what member's original goals within their committee settings were, as opposed to member's original goals as congresspersons. However, we believe that part of professionalization is understanding the importance of all three goals, which is why we are applying the research question in a more generalized way.

relatively short history of allowing women to run for congressional seats has caused many congresswomen to face challenges in successfully embedding themselves in the predominantly male institution of Congress.[3] In the 1960's, women had to work much harder to infiltrate male spaces and cultivate open friendships with men who might help them within the congressional workplace (Pierce 2014). In other words, women could not rely on friendships as a tool of "legislative entrepreneurship"(Wawro, 2000) to the extent that their male colleagues could. Although the formal restrictions have gradually phased out since then, long-standing social ties among senior congressmen, as well as persisting gender norms and biases, still present challenges for women who are trying to integrate themselves in Congress. In each branch of government, scholars have shown there is a climate that appreciates and promotes masculine norms (Mezey, 2003; O'Connor, 2012).

Evidence suggests that women have a more difficult time gaining institutionalized positions of influence within Congress: for example, through the 112th Congress, only fifteen women have served as House committee chairs (Dodd & Oppenheimer, 2012). Seniority plays a major role in a member's likelihood of becoming a committee chair, and as women have lower average seniority than men due to their lower numbers and relatively recent entry to the House, the longer average tenures of men make them more likely to achieve leadership positions (Lawless & Fox, 2012). Furthermore, women who do achieve high-ranking posts are often subject to challenges resulting from gendered norms of power (Rocca, Sanchez, & Morin, 2011). For example, as the ranks of women grow in a legislature, women are increasingly marginalized by their colleagues during committee hearings (Kathlene, 1994). These challenges should not only decrease the efficacy of senior female legislators, but also affect the ability of new female members to gain influence in Congress by achieving positions of power.

[3]One might wonder if the increasing proportion of women is a sign of increased female integration and influence in Congress. However, increasing diversity in legislatures do not automatically produce commensurate gains in minority group influence in these representative institutions (Kanthak & Krause, 2014).

Technology and Opportunities for Professionalization

Although Congress as an institution may not have changed, we believe that recent advances in communications technology may have created new avenues for female legislators to build and strengthen ties with other members in Congress. In 2009, only a small proportion of Congress used social media, and now all 100 Senators and almost all Representatives have adopted social media tools like Twitter and Facebook (Straus & Glassman, 2016). Compared to other social media platforms, Twitter is a common way in which members connect with their peers and senior members on a daily basis with low effort or time commitment. A service now boasting over 300 million accounts across the world (Twitter, 2017), Twitter is a mobile application allowing users to publicly post 140-character messages, or 'tweets,' visible by other users that opt to follow them. Twitter users can also amplify and re-broadcast other users' messages by 'retweeting' them, and can directly engage with other users by explicitly tagging their user name, or 'handle' (Sagolla, 2009).

Electronic forms of communication like Twitter have two important properties that are relevant for this study. First, social media platforms have virtually no barriers to entry. Members who lack on-demand access to major 'traditional' media platforms such as prime-time network television interviews can reach out to their constituents and their colleagues on social media with very little effort, bypassing a major barrier facing members who might otherwise struggle to make their voices heard. Second, social media platforms are public-facing communications tools. Messages broadcast on social media do not only go to the recipient, or even the constituents of the sender; rather, they are visible to any viewers who choose to opt-in to receiving these messages. Communication via social media is therefore inherently performative, as these interactions take place in front of an audience. Therefore, legislators can simultaneously target one another with specific messages while using the public nature of these communications to publicize the nature of their relationships.

From a methodological and theoretical standpoint, social media sources like Twitter provide a promising way of understanding how relationships form and grow between members of Congress. Previous research has been limited to qualitative data, such as autobiographies and personal interviews, when observing extant relationships between legislators or understanding how these relationships are cultivated (e.g. Matthews, 1959; Pierce, 2014). Existing quantitative studies tend to use indirect measures such as contributions from member-to-member leadership PACs (Kanthak & Krause, 2014), cosponsorship (Fowler, 2008; Kirkland, 2011), and roll-call votes (Arnold, Deen, & Patterson, 2000) as a means of gauging members' latent private valuations of each other. Social media engagement among legislators, on the other hand, makes these private valuations directly observable. Therefore, this study builds on the literature on congressional behavior by leveraging new data that allows us to observe and quantify inter-legislator support within Congress.

This study also builds on the communications literature by examining the use of social media platforms for inter-legislator communication as opposed to member-constituent communication. Twitter is most commonly known for being adopted as a campaigning tool, as incumbents and challengers alike leverage social media to mobilize and inform potential voters (Evans, Cordova, & Sipole, 2014). In fact, studies have shown that electoral strategies leveraging Twitter tend to to pay political dividends. Candidates who effectively use social media are better at raising money, particularly from voters outside their own constituencies with whom they would otherwise have little contact (Hong, 2013), and better at winning House races (LaMarre & Suzuki-Lambrecht, 2013).

However, these studies ignore other potential uses for Twitter data, uncovering underlying social and professional networks in the House. Legislators who are integrated into the social structure of the House have stronger ties to their colleagues and these relationships should manifest themselves through Twitter (e.g. Aiello et al.,

2012).[4] Furthermore, regular and positive engagement between members on social media should strengthen existing ties or illuminate existing 'real-world' relationships.

Hypotheses

The challenges women face in Congress, coupled with Twitter's availability as a means to professionalize within the institution by building supportive ties, should lead to a pattern of behavior that distinguishes female legislators from their male colleagues. Goal-oriented female legislators have a choice to either build a broad base of connections within Congress generally, or to focus their energy on certain members. We expect that the calculations of professional networking will drive women to choose the latter. Specifically, we expect women to maximize the impact of establishing and maintaining their relationships choosing women and leadership as engagement partners. Other women who face the same challenges and can provide mutual information and support, while leadership can provide valuable information, advice, and opportunities in the long-run. Given the limited amount of time and resources that all members have, as well as the inherent lack of support that the institution presents women with, we derive three expectations regarding how female legislators use Twitter compared to their male counterparts.

First, we expect that female members will engage a greater number of their colleagues on Twitter compared to male members. Female members have been shown to work harder and achieve more professional outcomes than many of their male counterparts. Once in office, women tend to give more floor speeches (Pearson & Dancey, 2011), introduce and sponsor more bills (Anzia & Berry, 2011), more successfully usher sponsored legislation through Congress (Volden et al., 2013), and

[4]Most members delegate day-to-day management of their official Twitter account to staffers, and we cannot differentiate staff-driven tweets from those directly authored by members. However, we make the assumption, following Glassman, Straus, and Shogan (2011), that staff-driven tweets are directed and managed by the legislator they represent. In other words, we assume that the content and tone of the tweets are not substantively different.

engage in credit claiming at a higher rate (Dolan & Kropf, 2004; Cormack, 2016). Given the low cost of Twitter as a communication tool, and the fact that social media engagement ignores many of the social and institutional barriers to relationship-building that still face women in Congress, we expect that female members will take advantage of this tool at a higher rate, with a higher number of partners, compared to their male colleagues.

Second, we expect that female members are *more* likely to engage members of the same gender on Twitter than male members. A number of studies examine the application of gender stereotypes in citizens' perceptions of political candidates (Huddy & Terkildsen, 1993a, 1993b; McDermott, 1997; Koch, 2002). Observational studies also find that women at all levels of politics tend to face more electoral competitors and higher-quality competitors (Lawless & Pearson, 2008), while receiving less support from party organizations (Sanbonmatsu, 2006) and needing to work harder to secure campaign funds (Jenkins, 2007). Having faced similar challenges before entering Congress, female legislators often emphasize the importance of support from their female colleagues (History, Art & Archives, n.d.). Similarly, Carroll (2002) finds that women tend to bond with other women in Congress because of their shared experiences of living in a male-dominated society. These real-life relationships should manifest themselves in social media engagements. Furthermore, social network theory suggests that people who have similar beliefs, motivations, cultural backgrounds, and so on are more likely to engage with one another more often and in a more positive way overall.

Finally, we expect that female members are *more* likely to engage House leadership on Twitter, compared to male members. Goal-oriented legislators should try to build supportive relationships with members in positions of power. Fostering relationships with leaders benefits members in several ways. First, these are generally senior members with extensive professional experience who can provide guidance and insight on legislative strategy. Second, leaders can wield formal power and informal

power. For example, getting support from committee leaders on important committees is a crucial step in moving legislation forward. Given the institutional barriers facing women in Congress who seek to achieve positions of formal influence noted in previous sections, female members should feel a greater need than their male colleagues to leverage the influence of powerful legislators by establishing personal and professional ties with these leadership figures.

Research design

Gathering Twitter data

Using open-source data tracking legislator social media presence, we were able to identify 532 members of the House and Senate over the past eight years who currently use, or have used in the past, an official Twitter account (US Github, 2017)[5]. By 'official Twitter account', we mean an account explicitly linked to that member in their official capacity as a legislator. As a result, we excluded accounts created during a campaign (and abandoned afterwards) and unofficial accounts set up by outside parties.

Next, we gathered tweets from each member's official account using Twitter's open-source API tool, which allows users to retrieve recent tweets by any account on Twitter. The free API allows us to retrieve the most recent 3,200 tweets made by each member. Due to the Twitter API quota, the time span over which we can observe Twitter activity is directly related to a member's Twitter usage frequency; some member's accounts have not yet generated 3,200 tweets in their entire existence, while others tweet so frequently that the quota is reached within a year or two. This means our analysis is limited to the temporal window for which we have complete or

[5]Note that this figure does not amount to the population of the House and Senate over the same six-year period. While we do not address why and when members adopt Twitter in this study, several consecutive studies have shown that Congressional adoption of Twitter has been fairly rapid, with the majority of legislators using Twitter regularly by the 112th-113th Congressional session (c.f. Chi & Yang, 2011; Straus et al., 2013).

near-complete Twitter coverage for all accounts on record.

Members' behaviors are shaped by the different institutional rules and incentives that each chamber presents to the members. Most notably, the frequency with which elections are held, should motivate Representatives to be more strategic and active in their pursuit to achieve their career goals, making engagement with other legislators a greater priority. As a result, we decided to focus our analysis on the House of Representatives. In this study, we were able to achieve near-complete Twitter coverage for all members for the period between January 2015 and January 2017, or the 114th congressional session. We use the term "near-complete" because we found four accounts (Representatives Donald Norcross, Mike Quigly, Joe Wilson, and Steny Hoyer) who use Twitter with such high frequency that the API quota covers their activity for only part of the 114th Congress. For the other 363 Twitter-using members of the 114th Congress, however, we are confident that we have captured all of their Twitter usage during this two-year period.

Our analysis focuses on 369 House members with active official Twitter accounts (Congress Legislators 2017) during the 114th session, out of the 446 legislators who served for part or all of the congressional session, including special appointments and retirees. The data set contains 587,055 unique tweets issued by members of the 114th Congress. With this data set, we construct a network of supportive communication ties between House members. Of course, not all interpersonal engagements on Twitter are positive; Twitter certainly has the potential to serve as a vehicle for expressing negative sentiment towards other legislators. However, in our analysis we focus on positive engagement as we are interested in relationships that can help Representatives gain influence in Congress.

Surveying the content of the tweets in this data set suggests most tweets falls within the general categories of social media communication as identified by Glassman et al. (2013). Personal communication and pleasantries are fairly common (e.g. wishing

someone happy birthday, discussing social events):

> "Enjoyed participating in my first congressional hotdish competition. *@BettyMcCollum04*'s winning wild rice/turkey dish was quintessentially MN"
>
> — Rep. Tom Emmer, MN-6, 4/22/2016

Members also frequently engaged in professional interaction, discussing conversations or professional events in which they participated with their colleagues:

> "Just met w/ Mayor Cranley & *@RepBradWenstrup*. Productive meeting about coordinating efforts to benefit our city"
>
> — Rep. Steve Chabot, OH-1, 12/12/2013

Another use of Twitter is for members to re-tweet content produced by other members. Because retweets call attention to the user who first produced the tweet they become another avenue for public association with another Representative:

> "RT *@RepGwenMoore*: So much love on these steps tonight. Surrounded by passionate advocates determined to #DisarmHate #LightingTheWay"
>
> — Rep. Kathy Castor, FL-14, 7/15/2016

Finally, other members' legislations was also a common content. Members often discussed a bill's merits, called attention to bills up for vote, and congratulated one another on successful passage. We understand that showing support for a specific legislation may be an effort to 'position-take' to one's constituency (e.g. Mayhew, 1974). However, we view members' choices to explicitly mention other Representatives and give credit to their efforts as constituting more than a vote-revelation strategy since there is not always a direct benefit to the member who produced the tweet. Here is an example of such content:

> "Thanks to fellow Ohioans *@RepSteveStivers* & *@TiberiPress* for co-sponsoring HR 5172,the POW Accountability Act"
>
> — Rep. Bill Johnson, OH-6, 7/25/2014

In isolation, such tweets may not present themselves as strong evidence of socializing and relationship-building between legislators. However, we believe that thousands of 140-character messages over months and years of a congressional session allow us to separate signal from noise and identify underlying relationships between members that would otherwise be difficult to observe. To this end, our next step was to identify Twitter engagements between members that were supportive or positive, indicating some level of positive sentiment between two members.

Identifying supportive engagements on Twitter

To assess sentiment in each tweet, we used the Valence Aware Dictionary and sEntiment Reasoner (VADER) — an open-source sentiment-classification package in the Python programming language that has been shown to be highly accurate and comparable to human coders in multiple tests (Hutto & Gilbert, 2014; Ribeiro, Araújo, Gonçalves, Gonçalves, & Benevenuto, 2016). VADER's sentiment algorithms work by comparing a given word to a crowd-source and human-curated sentiment 'lexicon' to assess the intensity of positive, negative, and neutral sentiment generally associated with that word. This platform is unique in that it is built and calibrated specifically for modern English in a 'microblog' context (Hutto & Gilbert, 2014, p.219), or the type of linguistic patterns found on social media platforms like Twitter, which makes VADER an excellent tool for identifying the sentiments contained in this large body of unstructured text.[6] VADER's algorithms classify the sentiment weighting of a given tweet on a scale of positive versus negative net sentiment, normalized here to range

[6]More detailed information about VADER's approach to sentiment analysis, including the source code itself, can be found on the project website (https://github.com/cjhutto/vaderSentiment).

from +1 (most positive) to -1 (most negative). Only tweets with an overall positive weight (i.e. greater than zero on the normalized scale) were included in our analysis. This process reduced the number of tweets in the data set to 332,507 entries with net-positive sentiment, or about half the original data set.

Next, we subsetted the data to only include tweets that are clearly directed at other members. Mentioning other users explicitly on Twitter is done through 'tagging', or including another user's account name in the text of a tweet. Tagging users notifies them that they have been mentioned, meaning that any time one member tags another in a tweet the targeted member can be made aware of the tweet. Tagged tweets are therefore highly relational, as the origin member makes a conscious choice to engage with another member with the expectation that the receiver will take notice.

We also include quoted tweets (or 'retweets') in which one user quotes another user's original message. Retweeting is generally used to echo the original tweet's sentiment or amplify it for a broader audience. We also discard tweets that are unrelated to relationship-building between members (i.e. purely self-referencing, targeted outreach to constituents, or targeted outreach to potential funders). As a result, we arrive at a final Twitter data set that includes 24,245 instances in which one Representative specifically engages another Representative in a positive-weighted tweet [7].

Building a Twitter Network of Supportive Ties

We see a gap in the existing congressional behavior literature in that inherently network-driven processes and structures are not treated as such. Since we are interested in factors that affect the likelihood of Representatives developing meaningful ties, we

[7] This leads to a potential issue in which member A might say something positive about member B, who would then retweet the original message. The resulting retweet would show up as a reciprocal $B \rightarrow A$ dyad, even though B is not actually saying anything good about A. To deal with this, we drop all retweets in which only the original member is tagged.

are asking questions that are intrinsically linked to network dynamics. To analyze positive Twitter engagement in a network structure, we generate directed, dyadic ties based on the frequency of positive messaging in an $i \rightarrow j$ member dyad. A tie connects dyad (i, j) if member i frequently engaged with member j. As a threshold for 'frequent engagement', we use the session's mean engagement frequency (denoted here as F) plus one standard deviation:

$$Tie_{(i,j)} = \begin{cases} 1, & \text{if } F_{(i,j)} > (\mu(F) + \sigma(F)) \\ 0, & \text{otherwise} \end{cases}$$

We exclude relatively low-frequency dyads because these are more likely to be incidental mentions in passing, and less likely to indicate underlying relationships.[8] Granovetter (1973,1983) argues that those who are weakly tied in a network are tied together as a result of some interactions that lead to an association (e.g. being elected in the same congressional session) but typically occur between individuals with important fundamental differences. We believe that building a congressional Twitter network where only frequent positive engagements between members are denoted as ties allows us to detect meaningful inter-legislator relationships.

Insert Figure 1 about here.

Figure 1 displays the resulting 114th House Twitter network. Nodes represent legislators who have an official Twitter account, and ties exist between members if one member engaged with another frequently. Isolates, or nodes who have no ties, are members who had Twitter accounts but did not frequently engage with their colleagues during the 114th Congress. Node shape indicates gender (circles indicate female, squares indicate male) and shade indicates party affiliation (grey denotes Democrats and black

[8]Note that by excluding these dyads we are treating members who use Twitter but do not frequently engage with their colleagues as being observationally equivalent to those who do not use Twitter at all.

denotes Republicans). This initial visualization shows several interesting patterns. Primarily, it strongly suggests a partisan divide between Democrat and Republican legislators: the two parties form blocks of Twitter engagement that (1) concentrate ties within the party and (2) center around relational 'hubs' representing highly active legislators such as the Republican and Democrat leaders (Paul Ryan and Nancy Pelosi).

While not all members used Twitter in the 114th Congress, the demographic composition of the Twitter network resembles that of the House of Representatives. Republicans make up 58% of the 114th House and 56% of the House Twitter network; 19% of the 114th House is female, as is 19% of the House Twitter network. Age, as proxied by terms served, is also not a major factor in adopting Twitter: the median legislator in the 114th House had served three terms, and this figure is the same for the subset of House members using Twitter in this period. This means that the House Twitter network we construct is, if not a complete data set, then at least a highly representative sample. We are therefore not concerned with selection effects biasing our results in terms of what kind of legislator tends to choose to adopt Twitter in their professional life. We now turn to a discussion of the methods we use to analyze the Twitter network.

Methodology

In any communication network, the actors involved choose partners for engagement based in part on what other actors are doing. The House Twitter network is no exception: members choose to engage with one another not just based on their own preferences and characteristics, but based on what other actors in the network are doing. From a technical perspective, this means that we cannot make the fundamental assumption that the data points making up our sample are independent and identically distributed (IID). To to test hypotheses about how female legislators choose partners in the Twitter network, we need a model that can properly account for this

non-independence, or risk producing results that are biased at best and misleading at worst (Cranmer & Desmarais, 2010; Cranmer & Desmarais, 2012).

Exponential random graph models (ERGMs) are a family of statistical models that account for interdependent network data by treating the network itself as the unit of analysis. Fundamentally, an ERGM estimates the conditional likelihood of observing a given network structure, based on the observed data and a set of parameters provided by the scholar. These parameters can function at multiple levels of analysis from the individual actor, to the pair or dyad, to the level of the network itself.

These parameters can capture substantive characteristics of the nodes in the network (for example, number of terms a legislator has served in the House), but what sets the ERGM approach apart is that the user can also specify parameters based on the underlying structural processes theorized to generate the observed network (Snijders, 2002; Newman, 2003). For example, in any communications network where ties represent some choice to communicate between individuals, it is likely that reciprocality plays some role: if A contacts B with some message, B is more likely to respond, regardless of the content of the message (Robins, Pattison, Kalish, & Lusher, 2007). In other words, B's choice to communicate with A is partially dependent on A's decision to communicate with B. The decisions made by each actor are not independent of one another, and this reciprocation must be taken into account when modeling actor behavior.

ERGMs not only allow researchers to gauge the effects of actor-level or dyad-level characteristics on tie formation, but also to explicitly model the impact of structural factors in how, when, and why actors engage with one another in a network. By controlling for structural factors, a properly specified ERGM can produce more accurate and robust estimates of how and why ties are formed in a network compared to a more standard estimation approach that assumes all actors are independent from one another.

Analysis and Findings

In specifying the ERGM, we control for two *individual* variables, beginning with **number of terms served** by a given member. We expect that Twitter may be used differently by members with less time served in the House. Long-serving members have had time to build strong ties in person and via other mediums than Twitter, meaning that new members may have higher incentive to leverage this tool to quickly build their own social and professional network. In addition, ranking member connectivity shows that members who occupy formal leadership positions are generally more active on Twitter, with the Republican and Democrat leaders (Paul Ryan and Nancy Pelosi) occupying two of the most central positions in the network. To ensure this tendency does not bias our results, we include an indicator of whether a given member occupies a position in **House leadership**[9].

We also control for a set of *pair-wise* variables that may increase the likelihood of a tie forming between a given pair of members. **Co-partisanship** between a given pair of members is an important variable to control for, given the severe partisan division in the House: we expect that Democrats are more likely to form ties with other Democrats than with Republicans, and vice versa. Geography is another important control, as we expect **shared state representation** to play a major role in how members engage with one another on Twitter. Representatives from the same state share many similar constituency-level concerns, along with the ability to appeal to a shared geographical coalition, and these similarities are likely to make ties between members from the same state more likely.

Additionally, we control for a set of *structural factors* that may affect how the network forms. These variables are not driven by the characteristics of the actors

[9]We define House leadership in a broad fashion: a given member is in leadership if they (1) hold a formal position of leadership including Speaker, Whip, or Majority/Minority Leader; or (2) if they chair or sit as ranking minority member on a Congressional committee. The data used to code this variable is drawn from Stewart & Woon (2017).

making up the network, but represent indirect effects of the network structure itself. Determining which structural variables to include in an ERGM is a question of research design, as researchers have to identify factors that are likely most important in the network being analyzed. While ERGMs can include a wide range of complex structural factors, we endeavor to keep our model parsimonious by focusing on basic structural controls common in analysis of directed networks. In this model, we control for the number of **edges** in the network, analogous to the baseline intercept term in a non-network model (Cranmer & Desmarais 2011). We also control for the number of **isolates** (nodes without any ties) in the network, as this also affects the baseline probability of a tie existing between any two nodes. Finally, we control for whether or not a tie is **reciprocated**, as we expect that regardless of who is involved or what is being said, a tie from legislator A to B is more likely if a tie from B to A also exists.

Table 1 shows the results of our analysis. Model (1) is a binary logistic regression that serves as a baseline for comparison, including only our structural (non-gender-related) control variables. Model (2) adds node- and pair-level variables related to legislator gender to the binary logistic model. For Models (3) and (4), we adopt the more complex but more statistically appropriate ERGM estimation method. Model (3) includes only structural controls, while Model (4) includes both controls and our key gender-related variables in the ERGM framework. For each model, we also ran a standard logistic regression model, since a case for a simpler approach that will accomplish the same goal with fewer assumptions and less complication could be made. We use Akaike Information Criteria (AIC) as a metric to compare how well the two modeling approaches fit the data.

The level of analysis at which each variable is measured is as follows. *Sender* coefficients estimate the impact that a given legislator's own characteristics have on their propensity to form new Twitter ties in the House network. *Dyadic* coefficients estimate how the similarity or difference between two legislators along some dimension

affects their likelihood of forming a tie. Finally, *directed* coefficients denote how some combination of potential sender and target characteristics affect the likelihood of the sender forming a tie with the target.

Insert Table 1 about here.

To address the question of how the ERGM approach compares to a simple logistic regression model, we report the Akaike Information Criteria (AIC). AIC drops from 7,787.15 in the fully specified logistic model (Model 2) to 6,502.0 in the fully specified ERGM (Model 4). We also see that the structural factors in the ERGM are highly statistically significant. This suggests that the ERGM, which takes network structural factors into account, is a more correct approach in modeling House Twitter ties.

Second, we see that both the baseline and fully-specified models (3) and (4) pass common-sense checks: the control variables describing seniority, leadership status, shared party and state that we draw from the literature on Congressional behavior are all in the expected direction and achieve statistical significance. This gives us more confidence that the model is able to capture the real-world dynamics we expect to see in this system.

Third, even after controlling for a range of factors, gender still plays a role in how legislators engage with one another on Twitter. Our hypotheses find mixed support, but show some interesting patterns in how female members of Congress use Twitter to engage with their peers differently from their male colleagues. Addressing each of our three hypotheses in turn based on the fully-specified Model 4:

Do female legislators engage other legislators on Twitter at a higher rate than male legislators? Contrary to our expectations, it appears that men and women engage their colleagues at about the same rate. The coefficient for *female gender* is near zero, negative, and not statistically significant. Twitter engagement seems to provide both male and female legislators with an easy way to publicize their supportive

relationship with their colleagues. It may also be the case that women are faced with the choice between connecting with as many legislators as possible versus connecting with certain members that provide them with maximum utility in the limited amount of time they have performing the numerous tasks that that require their attention.

Do female members engage other female members at a higher rate than they do male members? We find support for the hypothesis that women are much more likely to engage with other women than they are with men. On the other hand, men are neither more nor less likely to engage with women in the Congressional Twitter network as opposed to other men. The coefficient for *both female* is positive and statistically significant, while the estimate for *both male* is slightly negative but does not achieve statistical significance. While male and female members use Twitter at about the same rate, female members seem to direct more of their efforts towards other women on Twitter. Male legislators are neither more nor less likely to engage with other male legislators on Twitter. This is in line with our theoretical expectations: women are a minority in the social and professional network of Congress, which increases their likelihood of establishing supportive ties with one another.

Are female members more likely to engage House leaders compared to male members? We find mixed support for our third hypothesis. The results of the ERGM suggest that women are more likely to reach out to leadership relative to men, but only when they are male leaders. In fact, women are somewhat less likely to engage with female leaders on Twitter relative to their peers. The coefficient estimate for *female to male leader* engagement is statistically significant and positive, while the estimate for *female to female leader* is also significant, but negative. We argue that the negative coefficient is likely due to data scarcity. Given that men make up over 85% of Congressional leadership, we argue that the coefficient on male leadership engagement is more accurate than the coefficient for female leadership based on the available data. In other words, there simply are not enough female leaders in the 114th House to get an

accurate image of how they are engaged by other women in the legislature. Gathering more data on different congressional sessions may allow for a multi-session analysis that includes more female leaders, allowing us to speak with more confidence to how these women engage with the rest of Congress. Therefore, we interpret the positive coefficient on male House leadership as overall supportive of our hypothesis that women, most of whom are in relatively junior positions in the House, use Twitter as tool to build and publicize supportive relationships with House leadership, both to gain direct benefits from these relationships and to indirectly benefit from association with those in power.

Conclusions and Future Directions

Previous studies of Twitter have examined how legislators, both male and female, perceive Twitter as a tool for public outreach and constituent communication. Our analysis departs from previous work by examining the Twitter network within Congress, and showing that gender plays a major role in how legislators professionalize. Women build and maintain social media ties with other women and with House leadership at different rates than their male counterparts. Our theory suggests that this behavior is due to the fact that women have historically not been fully integrated in Congress, both socially and professionally. Formal House leadership positions are overwhelmingly held by male legislators while women have less seniority due to their short history of being allowed to run for office. Informally, gender bias seems to be contributing to a 'career ceiling' where women are not occupying leadership positions at the same rate as their male peers. Such institutional barriers suggest that women may benefit from alternative means of communication and networking. Assuming legislators are goal-oriented, strategic actors, our analyses suggest that women in Congress perceive Twitter as providing different benefits in building and publicizing relationships compared to men.

Understanding the underlying dynamics of Twitter engagement in the

Congressional network requires a modeling approach that lets us parse out the effects of gender from structural factors that affect the likelihood of forming ties in general. To do so, we leveraged ERGMs that explicitly separate the effects of individual- and pair-level characteristics from network structural factors. The results of these network models largely supported our hypotheses. Although women do not necessarily use Twitter at a higher overall rate than men, they focus their efforts in distinctly different ways, favoring ties with other female legislators and House leaders even after accounting for party, location, seniority, or other factors that incentivize communication on Twitter. All in all, we believe that this study supports the argument that Twitter matters — or at least, the behavior of members of Congress suggests that *they* think it matters. The implication for social scientists is that social media platforms, such as Twitter, should be used to study inter-legislator relationships in addition to constituent communication. There is a wealth of information in Congressional tweets, and this study is an example of how scholars can leverage this information to better understand the inner workings of Congress.

We believe our study suggest avenues for future work in largely three directions. The first avenue is expanding on our data gathering and coding efforts. Expanding the analysis to include Twitter network dynamics in the Senate and gathering more data from past and future Congressional sessions would expand the pool of legislators and increase the robustness of the results. The second avenue is analyzing the content of the tweets in addition to the sentiment analysis we conducted in our study. For example, subsetting Twitter networks based on discussions of key legislation or policy areas would allow us to see how public discussion around laws evolve over time. A third avenue for future research is identifying spill-over effects from the Twitter network to other Congressional networks. Having identified that female legislators tend to use social media in different ways from their male colleagues, a logical next step is to examine what the effects of these relation-building efforts are. For example, examining how Twitter ties line up with bill (co)sponsorship, voting decisions, fund-raising efforts,

and other 'real-world' outcomes may shed more light on the payoff that comes with their use of social media.

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