International Public Administrations on Twitter: A Comparison of Digital Authority in Global Climate Policy

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ABSTRACT International organizations and their secretariats, called international public administrations (IPAs), have been found to hold considerable authority in world politics. This study conceptualizes and measures IPA authority in the digital sphere. It proposes the concept of digital authority to measure the authority of actors in online social networks (OSN), such as Twitter. Applying exponential random graph models (ERGMs) based on Twitter data during climate change negotiations the article compares the authority of IPAs to that of other actors. The findings show that IPAs are attributed as much authority as state actors in global climate communication networks on Twitter.

Keywords: international public administrations; authority; global climate policy; Twitter; comparative analysis; exponential random graph models (ERGMs)

Introduction

The landscape of world politics has become increasingly fragmented. Issues such as human rights, labor standards, or climate change are no longer governed by nation states...
alone but rather by a variety of state and non-state actors on multiple levels. This growing complexity raises questions of who holds authority in global governance and how authority can be conceptualized and measured.

Within the global governance literature, the secretariats of international organizations (IOs), referred to as international public administrations (IPAs), have received increasing scholarly attention. IPAs are “bodies with a certain degree of autonomy, staffed by professional and appointed civil servants who are responsible for specific tasks and who work together following the rules and norms of the IO in question” (Bauer et al. 2017, p. 2). Traditionally in the International Relations literature, IPAs were considered servants of nation states with little autonomy of their own. However, within the last two decades, scholars have argued that IPAs are more than that – they are “actors in their own right” (Jinnah 2014, p. 21) that possess agency and can act strategically (see e.g. Heinkelmann-Wild and Jankauskas 2020; see also Bayerlein et al. 2020). Hence, a growing number of scholars recognize that IPAs have autonomous influence on global governance processes (Barnett and Finnemore 2004; Biermann and Siebenhùner 2009; Bauer and Weînlich 2011; Eckhard and Ege 2016; Bauer et al. 2017).

One major factor for the influence of IPAs is their authority (Busch and Liese 2017). Authority is described as an asymmetrical social relationship based on recognition which enables actors to exert influence (Simmel and Zùrn 2016). This concept is also central to the global governance literature. According to Zùrn, “patterns of authority are the key to the understanding of any political system” (2018, p. 37). Different sources of authority have been identified for IPAs (Barnett and Finnemore 2004, pp. 20–24). Most commonly, authority is ascribed to their expertise and knowledge (expert authority or de facto authority) as well as to their impartial and apolitical appearance (legal-rational authority or de jure authority). Besides, their moral standing and senior leadership skills have been identified as crucial sources of authority. A vast literature has emerged that aims at conceptualizing and measuring the authority of IPAs (Barnett and Finnemore 2004; Ecker-Ehrhardt 2012; Hooghe and Marks 2015; Busch and Liese 2017; Hooghe et al. 2017; Zùrn 2018).¹

This study aims to add to that literature by providing a conceptualization of authority that allows IPA authority to be measured and compared vis-à-vis other actors. We argue that the increasing use of online social networks (OSN) as means of communication offers a vast potential to observe interaction patterns that allow conclusions to be drawn about authority structures. We refer to this kind of authority as digital authority. Rather than presenting a completely new concept, we define digital authority as de facto authority within the digital sphere.²

For this study, we use data from the OSN Twitter. Particularly for political content, Twitter has become an important communication tool (Dubois and Gaffney 2014; Williams et al. 2015; Jungherr 2016) due to the opportunity to follow political events such as UN negotiations or elections, online in real time. Most IOs and heads of government have a Twitter account (Burson Cohn and Wolfe 2018). Twitter users also include citizens, representatives of civil society organizations as well as businesses. For IPAs, Twitter presents an opportunity to reach stakeholders that are not usually involved in multilateral negotiations. By providing policy-specific information to a wider audience, IPAs can build transnational support to bring multilateral negotiations to a successful end (Jörgens et al. 2017). Moreover, by shining light on their activities,
they can use Twitter as a form of self-legitimation (Duncombe 2017). However, not only the activity of users provides information about them, but also the extent to which other users interact with them. We argue that being an addressee of interaction on Twitter (through a mention, reply, or retweet) allows us to measure their de facto authority.

As a case study, we use the climate policy domain. Similar to other policy areas, governance patterns in the area of climate change have become more complex (Keohane and Victor 2011; Abbott 2012). Due to the slow and limited progress of multilateral negotiations in an issue area that requires immediate action, transnational climate governance (TCG) initiatives and schemes have seen a considerable growth (Andonova et al. 2009; Bulkeley et al. 2012; Roger et al. 2017). Hence, authors argue that authority in global climate governance has partially shifted from multilateral actors to transnational ones, or at least has become more fragmented (Hoffmann 2011; Bäckstrand et al. 2017; Hickmann 2017). In this context, the role of IPAs within the complex climate governance networks has been discussed by an increasing number of scholars (Jörgens et al. 2016; Kolleck et al. 2017; Hickmann et al. 2019; Saerbeck et al. 2020). Global climate policy presents thus an interesting case to examine the authority of IPAs in comparison to other actors within the digital sphere.

We use Twitter data gathered during climate change negotiations of five consecutive years (2013–2017) to measure the digital authority of key actors. Since the concept of authority is understood as a social relationship, we apply social network analysis (SNA), which offers ideal techniques due to its emphasis on social relations between actors. In particular, we apply an inferential SNA technique, called exponential random graph models (ERGMs), that allows inferences to be made about the network topology (Robins et al. 2007). Hence, we aim to introduce SNA to the study of IPA authority. Combining communication data from Twitter with SNA enables us to infer digital authority of IPAs in comparison to other actors in global climate communication networks.

This article is organized as follows. The first section describes why authority structures in world politics have changed and discusses the forms of authority that can be attributed to IPAs. Next, the measure of digital authority proposed in this study is explained. Thereafter, the case of global climate policy is presented. The fourth section describes our data set, methodological approach, and model specification. Subsequently, the results of our pooled ERGM are presented. A concluding section discusses our findings, limitations, and present prospects for future research.

Changes in Global Authority Structures

Authority structures in world politics are no longer represented by national borders (Rosenau 2003). Businesses and civil society organizations operating from the global to the local level as well as sub-national units, such as regional governments and cities, are becoming increasingly active in global governance processes. Two main explanations for this development have been brought forward (Green 2013; Roger and Dauvergne 2016). The first is a functional explanation. State-led governance activities are often not sufficiently successful in certain policy areas and therefore private actors start to engage. The second explanation emphasizes the structural shifts that have occurred during the last decades – technological developments and globalization processes in general – which
enable private actors to communicate and organize more easily (Bennett and Segerberg 2012). Hence, a wide variety of private and public actors at different levels have emerged within the global governance space.

To account for the activities of these types of actors, the concept of transnational governance (TNG) emerged and since has attracted a lot of scholarly interest (Hall and Biersteker 2002; Prakash and Potoski 2006; Abbott and Snidal 2009; Andonova et al. 2009; Green 2013; Ruggie 2014; Roger and Dauvergne 2016). TNG is defined as a process in which at least two non-state or sub-state actors, located in different nation states, follow a common set of rules aimed at steering their behavior towards a public goal (Andonova et al. 2009; Roger et al. 2017). Nation states and international organizations can also be part of these processes (Abbott and Snidal 2009). This collection of various actors cooperating across multiple levels in combination with the multilateral processes, make global governance increasingly complex (Keohane and Victor 2011; Abbott 2012; Alter and Raustiala 2018).

The question of who holds authority within these complex governance structures becomes a crucial one. In this context, a growing literature is scrutinizing the work of IPAs (Biermann and Siebenhüner 2009; Eckhard and Ege 2016; Bauer et al. 2017) whose influence on global policy-making processes has often been ascribed to their authority (Barnett and Finnemore 2004; Busch and Liese 2017; Zürn 2018). However, the concept of authority is multifaceted and various forms of authority have been identified in the literature. Most prominently, IPAs possess legal-rational authority (Barnett and Finnemore 2004). Based on Max Weber’s tripartite classification of authority, legal-rational authority is derived from the laws and formal rules that created the bureaucracy (Weber 1922). Hence, the legal-rational authority can be considered as the basic source of authority or, as Barnett and Finnemore put it, “[b]ureaucracies are by definition authorities – the rational-legal authorities in their domain of action” (2004, p. 20). The rational-legal authority is also described as de jure authority, which puts IPAs “in” authority (Friedman 1990, pp. 77–80).

In contrast to the de jure authority, expertise and information are often associated with de facto authority, which make actors “an” authority (Friedman 1990, pp. 80–85; Katsikas 2010, p. 117). This type is also referred to as expert authority (Busch and Liese 2017; Littoz-Monnet 2017). IPAs possess unique knowledge and expertise about the procedures of the institution that they are part of, turning them into an international organization’s institutional memory (Bauer 2006). Moreover, they can have expertise within their policy field and provide information about distinct policy options (Littoz-Monnet 2017). IPAs have been found to be central actors within their policy domains, by publishing and disseminating important information for stakeholders regarding a policy issue (Jörgens et al. 2016). Hence, their expertise and knowledge are often considered to be the core of their power (Barnett and Finnemore 2004).

Other sources of authority that can be found in the literature are moral authority (Hall 1997) and authority associated with the senior leadership of IPAs (Barnett and Finnemore 2004). These two forms are intertwined because they often are derived from moral claims made by individuals, such as the UN Secretary General (Busch and Liese 2017). Authority rooted in the senior leadership of an IPA, however, can also be considered charismatic authority as defined by Weber (1922). What unites all different forms of authority mentioned above is that they all only occur on a relational level. Authority is
considered an asymmetrical social relationship based on recognition which enables actors to exert influence (Simmerl and Zürn 2016).

A concept that is closely related to that of authority but needs to be distinguished from it, is legitimacy. Defined “as beliefs of audiences that an IO’s authority is appropriately exercised, and legitimation as a process of justification and contestation intended to shape such beliefs” (Tallberg and Zürn 2019, p. 583), legitimacy thus is an assessment of authority and requires authority to exist in the first place.

Beyond conceptualizing the authority of IPAs, a few scholars also undertook the vital task of measuring different forms of IPA authority. Hooghe and Marks (2015) analyzed the de jure authority of different IPAs using a quantitative approach. They find that the extent of de jure authority is dependent on the number of member states of the IO and the scope of its policy portfolio, and hence varies greatly across IOs. An approach to measure de facto expert authority of IPAs was conducted by Busch and colleagues (2020). They also use a quantitative approach to measure de facto expert authority, questioning domestic civil servants about the authority of IPAs, and compare their results with Hooghe and Marks (2015) and Zürn et al. (2020) data sets for de jure authority. They show which IPAs are attributed more de facto expert authority than de jure and vice versa. Ecker-Ehrhardt (2012) measures de facto expert authority of various actors (not only IPAs) using a communication theoretical approach, which defines authority as a discursive mode of power. Analyzing media coverage of the Darfur crisis, he finds that UN agencies, such as United Nations Children's Fund (UNICEF) and United Nations High Commissioner for Refugees (UNHCR) are overwhelmingly perceived as authoritative sources.

This article aims to add to this emerging strand of literature by assessing the digital authority of IPAs. Building on the different conceptualizations of authority discussed above, we argue that we can measure the de facto authority of IPAs by studying communicative relationships on Twitter. In the next section, we explain how we aim to measure this form of authority in the digital sphere.

**Towards Digital Authority**

Twitter has become a widely used communication tool for political purposes (Conover et al. 2011; Dubois and Gaffney 2014; Williams et al. 2015; Häussler 2019). Due to the nature of the platform, it has become the most important OSN for political communication. First, Twitter users usually have public profiles. This makes interactions with users across different geographic areas easy in comparison to other OSN such as Facebook, where many users are private, and interactions rather occur among friends who are more likely to be closer to each other. Second, the use of hashtags on Twitter allows public discourses to emerge and to be identified around specific issues easily. Thus, Twitter creates a digital public sphere that enables interactions between a variety of political actors but also citizens. Especially during high-level political events, Twitter is used by these actors to communicate with each other and the wider public to inform about or comment on current negotiation processes and outcomes. By using Twitter, IPAs can reach actors that are outside of the formal negotiations. Extending policy debates beyond the official parties to multilateral negotiations and observers, secretariats may try to build transnational support for the policy issues at
stake, thereby raising pressure from the outside on national governments to continue and successfully conclude negotiations (Jörgens et al. 2017). Hence, the relatively informal character of digital communication carries the potential of enhancing a bureaucracy’s de facto authority by reaching stakeholders outside of the multilateral negotiation system within which they operate. By engaging in the digital public sphere, IPAs can potentially contribute to the solution of global policy problems (in our case, climate change). Second, by spreading information on Twitter, IPAs can promote either their initiatives or the policy preferences of actors that they want to strengthen. This could be described as a process of (self-)legitimation (Duncombe 2017). A potentially influential position of IPAs has also been found for the annual climate change negotiations (Conferences of the Parties, COPs) under the United Nations Framework Convention on Climate Change (UNFCCC) (Jörgens et al. 2016; Kolleck et al. 2017).

As a micro-blogging tool, Twitter allows its users to write short messages up to 280 characters,⁴ so-called tweets, and to share them with their followers. Within these tweets, users can refer to all other users of the platform. This communication provides the relations that are the main interest of our study and, as we argue, enable us to measure authority. Relations on Twitter are created through a mention, a retweet, or a reply. A mention occurs if a user writes a message and links another user within it, using an @-sign. When users answer messages of other users it is referred to as a reply. Moreover, users can share tweets of other users with their followers, which is called a retweet. Debates around specific topics can be identified through the hashtag-sign #. For example, tweets referring to climate conferences use the hashtag #COP and the corresponding number of the conferences, e.g. #COP21 for the 21st COP that took place in Paris in 2015.

Due to these characteristics, Twitter can be conceived as a digital public sphere which allows analysis of authority structures. We refer to de facto authority of political actors in OSN as digital authority. Hence, we aim to add another layer to de facto authority. We argue that OSNs are not detached from the “real world” but present another dimension to it. Therefore, OSN can allow identification of patterns similar to the “real world”. However, these platforms also develop their own dynamics that are important to consider, for example the tendency to strengthen radical opinions. Thus, patterns identified in OSN are not necessarily a direct mirror of the “real world” but can rather provide an additional dimension to de facto authority. It is therefore important to account for digital authority to create a more comprehensive account of the de facto authority of political actors.

We argue that due to the rather informal character of the digital public sphere, IPAs can stretch beyond the limits of their mandate. For example, Twitter communication is less subject to critical scrutiny by nation states than official secretariat documents. Moreover, communication in the digital sphere is faster and increases the chances for IPAs to build support for specific positions in the ongoing negotiation process. IPAs can make use of these opportunities by acting as knowledge brokers, giving voice to certain positions of transnational civil society in the negotiating system, and, conversely, building external support for certain positions. It is a form of inverse “boomerang pattern of influence” (Keck and Sikkink 1999) where IPAs may try to increase their influence on multilateral negotiation outcomes by bypassing the negotiation parties and directly
seeking transnational allies to try to put pressure on the parties from outside. Hence, digital authority is likely to go beyond the limited de jure authority that IPAs possess.

Based on these considerations regarding the opportunities of the digital public sphere and the global authority structures described in the second section, we aim to derive expectations about the digital authority attributed to different types of actors and test them in a subsequent analysis. Instead of assessing authority in absolute terms, we use a relational approach. This means that we analyze the authority of IPAs in comparison to state and non-state actors.

First, it has to be acknowledged that state actors continue to play a central role within multilateral negotiations. Despite the partial shift of authority from nation states to non-state actors (see also the previous and next sections), nation states are still likely to be attributed higher levels of authority than non-state actors. Nation states are the primary actors negotiating multilateral agreements and therefore we expect them to be often targets of advocacy strategies online. Hence, the authority of state actors in the “real world” is likely to be mirrored in the digital sphere.

Second, we expect IPAs to be attributed similar degrees of digital authority as state actors. IPAs perform important functions for different groups of actors. For nation states, IPAs’ role as a direct information source within the multilateral negotiation system can provide them with epistemic or expert authority, making them a trusted source of information that is potentially shared online. For non-state actors, IPAs’ potential to be brokers and orchestrators might make them important communication targets in issue-specific online debates. Due to these multiple roles of IPAs, overall, we expect them to be attributed similar authority to state actors in the digital sphere.

Third, we expect non-state actors, such as business, research, and civil society organizations, to be attributed less authority than IPAs and state actors. Although non-state actors’ authority has increased within the global governance regime over time, they are unlikely to be attributed more digital authority than IPAs and nation states when compared directly. Non-state actors hold de facto authority through their expertise and resources (e.g. research organizations, businesses, and think tanks), however, we expect that their policy preferences or expertise are not systematically sought after by national governments in the digital sphere during multilateral negotiations, but rather in national debates that precede multilateral negotiations. Therefore, we argue that non-state actors are likely to be attributed less digital authority than IPAs and state actors.

In line with other studies, we propose to measure de facto authority on Twitter through the number of times an account is the addressee of communication (Asserhofer and Maireder 2013; Riquelme and Gonzalez-Cantarugian 2016). Hereby, we do not distinguish the different types of communication that occur on Twitter, i.e. mention, retweet, or reply. All these communicative actions allow to measure digital authority. If an account engages in any kind of communication with another account on Twitter, we assume the targeted account holds de facto authority. For example, when account A mentions account B directly in a tweet, it draws the attention of B to A. This shows that it is important to A that B knows about A or the message that A shares within its tweet. When A retweets a message of B, either to show support or to criticize, this also indicates de facto authority of B because the message of B was worth the reaction of A. A similar logic applies to replies: if A replies to a tweet of B, B must be important enough to be
replied to. Hence, we argue that the more other accounts mention, retweet, or reply to an account, the more authority they attribute to the user.

**The Case of Global Climate Policy**

We will use the field of climate change as a case to study the digital authority of IPAs with the help of SNA. Shifts in authority structures within the policy area as well as the increasing prominence of IPAs within recent literature make the case especially relevant for our purpose. From a research design perspective, we decided to examine the area of climate change because the annual negotiations (COPs) offer the opportunity to gather data over time to create a more comprehensive picture. Moreover, climate change has emerged as an important topic in international politics, which attracts a lot of attention and hence creates loads of Twitter data that can be analyzed.

Climate change is a policy field that has seen a lot of growth in transnational initiatives (Pattberg and Stripple 2008; Bulkeley et al. 2012; Roger et al. 2017). Due to the nature of the challenge that climate change poses, it is an area especially favorable to transnational governance (Andonova et al. 2009). Climate change affects many different sectors and various groups of society across borders. Moreover, multilateral negotiations did not result in sufficient climate action. The pressure to address climate change as fast as possible is therefore rising and non-state actors are actively encouraged within the Paris Agreement to participate (UNFCCC 2015, Decision 1/CP.21).

Due to the increasing relevance of transnational governance schemes and initiatives, some authors argue that authority within global governance has shifted away from nation states towards non-state actors (Hoffmann 2011). They claim a private sphere of authority has been created governed by NGOs, businesses, and other non-state actors (Betsill et al. 2015). Other scholars perceive TCG initiatives rather as complementary to the multilateral process (Bäckstrand et al. 2017; Hickmann 2017). Instead of a shift of authority, they speak of a reconfiguration of authority structures (Hickmann 2017) or a deep intertwining of public and private authority (Green 2013; Bäckstrand et al. 2017). Both strands, however, observe a substantial change of authority structures within global climate governance.

This reconfiguration or shift of authority structures has implications for the authority of IPAs as well. Traditionally, IPAs, are regarded as servants of member states, and thus their relationship with and importance to nation states has been examined thoroughly (Abbott and Snidal 1998; De Francesco 2016). Within the multilateral process, IPAs are administrators and information providers to member states and observers to the negotiations. However, within TCG, IPAs are often perceived as “orchestrators” which use soft governance modes and act through other like-minded actors to steer their targets towards their governance goal (Abbott et al. 2015; Abbott 2017; Hickmann et al. 2019). IPAs are hence crucial actors within both governance spheres, the multilateral as well as the transnational one, putting them amid nation states and non-state actors.

The IPA at the core of the climate regime complex is the UNFCCC secretariat. Accordingly, it has obtained a lot of attention from scholars (Busch 2009; Jinnah 2011; Hickmann et al. 2019). The climate secretariat has been found to exert influence within different issue areas (Jörgens et al. 2016; Kolleck et al. 2017; Michaelowa and Michaelowa 2017). Hickmann et al. (2019), for example, show that the secretariat is
increasingly engaging through “orchestration” in a policy dialogue with non-state actors, and thus has taken on a more active role over the past years. In addition to the climate secretariat, other IPAs, such as the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP), have also been found to exert influence by disseminating different kinds of information to stakeholders (Saerbeck et al. 2020). These studies indicate that the expert authority of the secretariat can be considered as the basis of its influence.

The climate secretariat has also been identified to exert influence in the digital sphere. Using Twitter data in combination with descriptive SNA measures, Jörgens et al. (2016) found that the climate secretariat occupies a central position within the communication network around climate and gender, indicating the IPA’s authority in terms of being an information broker. These results are not limited to the issue of gender and climate, however. Kolleck et al. (2017) observed an influential climate secretariat in the digital sphere also during the actual climate negotiations on the topic of climate change education. Our analysis builds on these studies and uses inferential network analysis techniques based on Twitter data to measure the authority of IPAs in the digital sphere.

Data and Methodological Approach

Twitter Data

The Twitter data analyzed for this study covers the UN climate negotiations during five consecutive COPs (2013–2017). We added two days before and after each conference so as not to miss any relevant information. We obtained the data from a third-party vendor called Texpaper using a search query with specific hashtags and keywords, such as #COP21 or #unfccc. \(^3\) We received raw data from which we created data sets appropriate for network analysis. Overall, the data sets contain between 240,000 tweets in 2013 and over 4 million for the year 2015.

The OSN Twitter can be described as a public space, which enables communication among individual and collective actors. Not all communication that occurs during COPs is important, hence identifying relevant actors within the Twitter network becomes a crucial task. This process is also known as boundary specification. Based on our definition of digital authority, we use the measure of in-degree, i.e. how often an account was mentioned, retweeted, or replied to, to identify the most authoritative actors for each of the five COPs. Using this approach, we extracted the 300 most authoritative actors (the ones with the highest in-degree) during COPs in each year (2013–2017). These actors and their interactions form the base of our analysis. Hence, we examine authority patterns within a high-authority sample.

The nodes in the networks represent Twitter accounts (both individuals and organizations) and the edges represent retweets, mentions, and replies. To compare the specific network behavior of different organization types, we coded the involved accounts by hand and assigned them to the following groups: business, NGOs, state actors (incl. sub-state), media, research organizations, IOs/IPAs, transnational initiatives, others. Concerning the group of IOs, we assume that the secretariats of the IOs, the IPAs, are managing the Twitter accounts. Overall, we obtained directed and unweighted one-mode networks.
Methodological Approach

For the present study, we employ exponential random graph models, as described by Robins et al. (2007). Calculating ERGMs is an inferential network technique that can be used to statistically examine the topology of a network. The underlying assumption of this approach is that “the patterns within networks can be seen as evidence for ongoing structural processes” (Lusher et al. 2013, p. 10). This, in turn, allows hypotheses about factors influencing the structure of the network to be tested. The main idea is to model the characteristics of a theoretical network and fit them to an observed network by estimating their parameters. In other words, the dependent variable within an ERGM represents the observed network (tie formation) and the independent variables – endogenous network statistics (i.e. self-organizing network dependencies) as well as exogenous covariates (i.e. structural attributes at the node and dyad level) – are modeled explicitly (Robins et al. 2007). This way, we can identify characteristics in the observed network that occur significantly more often in the empirical network than expected by chance. The received estimates can then be interpreted in the same way as in a logit regression model (Leifeld and Schneider 2012).

As we examined multiple networks, we estimated pooled ERGMs. This technique is used to calculate the average estimates of several independent, yet identical models (Leifeld et al. 2018a). Although some temporal dependencies might exist in our data set, we were not able to model them using a longitudinal analysis (with e.g. temporal ERGMs) due to the high fluctuation of actors. We therefore decided to employ this approach. The model estimation was performed in the free and open-source development environment R (R Core Team 2019) with the “btergm” package as implemented by Leifeld et al. (2018a) in the “xergm” meta-package (Leifeld et al. 2018b). The model was fitted using maximum pseudo-likelihood estimation (MPLE) (Leifeld et al. 2018a).

Model Specification

The model we estimated contains both exogenous and endogenous covariates. As our main variable of interest, we used a node’s incoming ties differentiated according to actor groups, actor type (alter). This presents our measure of digital authority. It allows us to detect whether some actor groups are more likely to be targets of communication than others. Similarly, we incorporated the outgoing ties of a node, actor type (ego), which can be described as a measure of activity. Moreover, we included a term for homophily, nodematch, within actor groups. Homophily describes the phenomenon that “contact between similar people occurs at a higher rate than among dissimilar people” (McPherson et al. 2001, p. 416). Homophily does not only apply to people, but also organizations, and hence is important to consider within network models. In our case, we assume actors of the same organization type to be more similar and therefore show a tendency to interact more frequently.

We also added the number of followers for each user in the respective years. Follower counts can also be used to measure authority in Twitter networks; however, it is only a passive measure. Accounts with many followers might be more likely to be targets of communication. Therefore, we decided to include the follower count as a control variable in our model. Twitter only offers metadata, such as follower count, for users who, at some point, actively participated in the Twitter communication, meaning that they had to
be the source of interaction. As this was not the case for all users involved in the analysis because some were only targets of interactions, we imputed missing data for follower counts using Fully Conditional Specification (FCS) as implemented in the multivariate imputation by chained equations (MICE) package by van Buuren and Groothuis-Oudshoorn (2011). To allow for a more concise interpretation of the estimates and to stabilize the model, we rescaled the number of followers by a factor of 0.00001.

As endogenous covariates, we added a term for reciprocity, which accounts for the phenomenon that if actor \( i \) mentions or retweets actor \( j \), it is more likely that \( j \), in turn, retweets actor \( i \). Moreover, the model included variables to account for transitivity, which means: if actor \( i \) and actor \( j \) cooperate and hence have a tie, and \( i \) and \( k \) also cooperate, it is more likely that \( j \) and \( k \) will cooperate as well. This effect can be controlled for in ERGMs by including the geometrically weighted edge-wise shared partner distribution (GWESP) and the geometrically weighted dyad-wise shared partner distribution (GWDSP). Whereas the GWESP statistic accounts for the number of connected actors with shared partners, the GWDSP term includes both connected and unconnected dyads. To take into account actors with few shared partners, we weighted the GWESP and GWDSP terms by a parameter of \( \theta = 0.2 \). This also leads to an increase in both model fit and convergence (Leifeld and Schneider 2012, p. 739).

We also included an edges term and degree terms as control variables in our model. The edges term keeps the number of ties constant throughout the simulations and controls for the density of the network. The geometrically weighted in-degree and out-degree terms control for the degree distribution in the network, emphasizing actors with few ties with a parameter of \( \theta = 0.2 \). Finally, we added the term of betweenness centrality of alter, which measures how often an actor lies on the shortest path between two other actors (see e.g. Borgatti et al. 2018) to account for the structural significance of specific actors. Due to the wide range of values, the centrality values were normalized (z transformation).

Results

The results of the pooled ERGM are presented in Table 1. Coefficients can be interpreted like log-odds in logistic regression models. The first term in the table, edges, is similar to a constant in linear regression models and represents the likelihood of any dyad to form a tie within the network. The second term is reciprocity, which is positive and significant, meaning that actors are more likely to target someone if they have been targeted by that same actor before.

The next term, actor type (alter), is the main focus of this study and indicates which actors are more likely to become targets of communication, and therefore, by our definition, are attributed authority in the communication network. We use IPAs as a reference category since it allows us to assess how IPAs compare to other actors (for an overview of all IOs included in the analysis, please see Table A1). The results are negative and significant for business, media, and transnational actors and negative, yet marginally insignificant, for NGOs and research organizations. The only actor group that obtained a small positive estimate are state actors; however, the estimate is not significant. This means that ties within the network are more likely to form if the target of communication is an IPA as compared to non-state actors. For state actors, we cannot
### Table 1. Results of the pooled ERGM

|                                      | Estimate | CI               |
|--------------------------------------|----------|------------------|
| Edges                                | −3.32    | [−3.81; −2.49] * |
| Reciprocity                          | 2.15     | [1.59; 2.36] *   |
| Actor type (alter)                   |          |                  |
| Business                             | −0.41    | [−0.63; −0.27] * |
| NGO                                  | −0.09    | [−0.46; 0.06]    |
| State actor                          | 0.04     | [−0.26; 0.14]    |
| Media                                | −0.10    | [−0.34; −0.01] * |
| Research                             | −0.19    | [−0.66; 0.02]    |
| Transnational                        | −0.23    | [−0.43; −0.09] * |
| Others                               | −0.03    | [−0.50; 0.31]    |
| Actor type (ego)                     |          |                  |
| Business                             | 0.10     | [−0.12; 0.25]    |
| NGO                                  | 0.27     | [0.19; 0.38] *   |
| State actor                          | −0.04    | [−0.27; 0.23]    |
| Media                                | 0.06     | [−0.18; 0.37]    |
| Research                             | 0.40     | [0.17; 0.81] *   |
| Transnational                        | 0.50     | [0.30; 0.86] *   |
| Others                               | 0.53     | [0.22; 1.21] *   |
| Homophily                            |          |                  |
| Business                             | 0.38     | [0.16; 1.08] *   |
| NGO                                  | 0.31     | [0.06; 0.58] *   |
| State actors                         | 0.40     | [0.20; 1.40] *   |
| Media                                | 0.46     | [0.13; 0.68] *   |
| Research                             | 0.60     | [0.37; 0.87] *   |
| IOs/IPAs                             | 0.41     | [0.30; 0.55] *   |
| Transnational                        | −0.05    | [−4.83; 0.00]    |
| Others                               | −0.05    | [−0.12; 0.78]    |
| Followers                            |          |                  |
| Alter                                | 0.00     | [−0.00; 0.05]    |
| Ego                                  | −0.02    | [−0.10; −0.01] * |
| Difference                           | −0.00    | [−0.04; 0.00]    |
| Betweenness (alter)                  | 0.05     | [0.00; 0.49] *   |
| Weighted degrees                     |          |                  |
| Indegree                             | −1.32    | [−1.77; 0.85]    |
| Outdegree                            | −4.84    | [−7.04; −2.72] * |
| Transitivity                         |          |                  |
| gwesp.fixed.0.2                      | 1.11     | [1.01; 1.21] *   |
| gwdsp.fixed.0.2                      | −0.09    | [−0.17; −0.06] * |

**Notes:** CI = confidence interval; *0 outside of the confidence interval.
observe a significant difference to IPAs when it comes to the likelihood of tie formation. It is important to note, however, that within the group of state actors, we included the COP accounts for each year because they are managed by the nation state that holds the presidency each year. Our results thus indicate that IPAs are attributed more authority than non-state actors within the communication network but there is no significant difference between IPAs and state actors.

Subsequently, we included the term actor type (ego) to estimate the likelihood of a tie, dependent on the type of actor who is the source of communication. For all actor groups, except for state actors, the estimates are positive. For NGOs, media, transnational actors, and uncategorized actors (others) the results are also significant. This implies that ties are more likely to occur in the networks when the ego is either one of these actor groups. Again, state actors present an exception with a negative but insignificant estimate. These results indicate that IPAs, similar to state actors, are not very active within the climate communication networks on Twitter when compared to non-state actors. These findings complement our former results that IPAs and state actors are rather targets than sources of communication. Hence, to be attributed authority, it is not necessarily crucial to be active in the communication network, according to our operationalization.

Concerning the control variables, the results support our expectations. The homophily estimates are positive and significant for most of the actor groups, including IPAs. Hence, the likelihood of a tie to be formed within the network is higher if the two nodes belong to the same actor group. Figure 1 illustrates the communication network for one conference (COP21) and the homophily structures become apparent. When including the number of followers, we differentiated between the followers of alter, ego, and the absolute difference between the follower count of ego and alter. We can observe that the follower count of ego is significantly negative in our model, indicating that, if the number of followers of ego increases, the likelihood for a tie in the network decreases. This implies that users with more followers are less likely to actively form ties in the network. Another estimate that we included in the model is the betweenness centrality of alters. The estimate is positive and significant, meaning that if alter tends to occupy a strategic position in the Twitter network, it is more likely that ego communicates with alter.

Moreover, we accounted for the geometrically weighted in-degree and out-degree in order to include the tendency of nodes to establish links with popular nodes. The weighted outdegree is negative and significant, which can be interpreted that users are more likely to target users that have high degree scores. With GWESP and GWDSP, we included a last set of variables to control for transitivity effects within the network. Hereby, GWDSP is considered the baseline effect for GWESP, and thus both effects can be interpreted together (Hunter 2007). GWESP is significant and positive, whereas GWDSP is significant and negative. This means that after controlling for the effect that two ties might have a tie in common if connected or not (GWDSP), the effect that two ties have a tie in common is more likely to occur when they are connected themselves (GWESP) than by chance.

Our comprehensive model included various exogenous variables and endogenous network statistics, but we can still observe that IPAs are attributed a degree of authority comparable to that of state actors within the climate communication network even when
controlling for these additional effects. Hence, our results can be used as an indication for the digital authority of IPAs in global climate governance networks.

**Discussion and Conclusion**

Our contribution aimed at conceptualizing and measuring authority of IPAs by using a network analytical approach. Using the case of global climate policy, we examined Twitter data during COPs with an inferential network analysis technique, called ERGMs, to assess the digital authority, i.e. de facto authority of IPAs in the digital sphere, in comparison to other actors. We proposed to measure this concept in terms of being the addressees of communication.
The results of our analysis indicate that IPAs are attributed a degree of authority comparable to that of state actors within the observed networks. We find that ties within the networks become less likely when the target of communication (mention, retweet, or reply) is not an IPA or a state actor. These findings are in line with our expectations that IPA and state actors are attributed similar digital authority. The authority of nation states in global climate governance in the digital sphere might mirror to a great extent their “real world” authority in multilateral negotiations, where nation states are still the single most important actors. The various functions of IPAs during multilateral negotiations, as, for example, information providers, brokers, or orchestrators, might help explain their digital authority. Our results lead to the suggestion that claims in the literature that authority within global climate governance may be shifting away from nation states (e.g. Hoffmann 2011) should not be overestimated.

Moreover, we find that IPAs are less active than most other actors on Twitter. All actor groups are more likely to be sources of communication, meaning that they mention, reply, and retweet more than IPAs. Similar to our first results, state actors present an exception. There is no significant difference for the likelihood of tie formation if the sources of information are state actors or IPAs. Non-state actors, in contrast, are more active than IPAs and state actors within the communication networks. There might be two motives behind this activity. First, this could indicate an advocacy strategy where non-state actors seek to feed information into the negotiation process, potentially through IPAs. This could be explained by the nature of their work, which often is centered around advocacy and awareness-raising (Briones et al. 2011; Guo and Saxton 2014). Second, the activity of non-state actors on Twitter might be perceived as a self-legitimation process. Since NGOs do not possess a formal mandate, they may use other measures to achieve legitimacy and influence global policy-making processes. Analyzing orchestration efforts, Abbott and Hale (2014) have identified similar processes. Multi-stakeholder networks of non-state actors benefited from the support of an IPA (the “orchestrator”) that provided legitimacy to the non-state actor network. In the digital sphere, Schuster et al. (2019) made similar observations in the field of education policy due to NGO activity on Twitter.

This finding is also complementary to our first one. If IPAs and state actors are perceived as authorities, other actors will try to interact with them to get their attention, disseminate their information, or participate in a discussion about information they tweeted. Hence, to hold digital authority it is not necessary to be extremely active, according to our operationalization.

Our findings can be interpreted as an indicator of the central roles of IPAs within the multilateral and transnational climate governance sphere and how international bureaucracies can use their digital authority to combine these two spheres. Non-state actors may see IPAs as a potential channel through which they can feed their policy preferences into the negotiation process. IPAs can then choose to pass this information into the multilateral negotiations. Our analysis does not allow us to assess whether and how IPAs use this information. Here, the main communication channels are not digital but direct between the secretariat and national delegations, often through the “special relationship” (Depledge 2007) between the UNFCCC secretariat and the chairpersons of the climate change negotiations. Within the multilateral sphere, IPAs are traditionally perceived as administrators and information providers, and thus, are attributed authority by member
states. The authority attributed to them then would result from their role as policy brokers in the multilateral process. Within the transnational governance activities, IPAs are often involved in the role of “orchestrators” (Abbott and Hale 2014; Abbott 2017). These orchestrators are usually attributed little authority for hierarchical governance; therefore, they rather use soft inducements, such as persuasion, ideational support, technical assistance, endorsement, or shaming (Abbott 2017). However, these pursuits can only be successful if the orchestrator is attributed authority. Moral authority for shaming or endorsement and expert authority for technical assistance, for example. Hence, various groups of stakeholders within global climate governance are likely to attribute authority to IPAs.

Some limitations of our study must be considered. It must be noted that our measure of digital authority should be distinguished from other forms of authority. In the digital sphere, radical views might receive more attention and are thus more often targets of communication. Therefore, actors with polarizing opinions might hold more authority online than offline. For extremely polarized issues this conceptualization might thus be less adequate. Another important aspect to consider are the time frames used for this study. We used the annual COPs to examine digital authority structures in global climate policy. Although this approach has advantages, such as comparability over time, it might lead the results to be skewed towards state actors.

In this study, we presented an innovative approach to measure and compare de facto authority in the digital sphere drawing on the case of climate change policy. Future research could build upon these findings and test whether similar patterns can be observed for other policy areas as well, considering the above-mentioned limitations. Moreover, an analysis of interaction patterns of different actor groups with IPAs would allow us to substantiate our interpretation that IPAs are attributed authority by various actor groups. On a general level, analyzing the differences and similarities of IPAs within online and offline networks is crucial to build a comprehensive understanding of IPAs in global policy-making.

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Notes

1. For an excellent overview of the literature on IPA authority, see Busch and colleagues in this issue.
2. In this study, “digital sphere” refers to online social networks, such as Twitter. We acknowledge that there are many other possibilities to conceptualize “digital spheres”, such as online blogs or emails.
3. Eckhard and Ege (2016) provide an excellent overview of the literature on determinants of IPA influence. Beyond an IPA’s authority, they find that structural aspects such as “hierarchy, personal selection, specialization and distance from policy-makers” (p. 968) also influence policy-making opportunities. Moreover, external factors such as the policy area, the salience of an issue area, as well as the control capacities of member states have been found to be crucial factors for IPA influence.
4. The limit was extended from 140 to 280 characters in 2017.
5. For further information on the data-gathering process, see Goritz et al. (2019).
6. One of the main differences between ERG and regression models is the assumption of the latter that the observations should be independent of one another and identically distributed. Especially in network-like structures this assumption would be violated due to the endogenous network formation processes that have
been identified. Therefore, in ERGMs, these endogenous structural processes, such as reciprocity and transitivity are modelled explicitly (Cranmer and Desmarais 2011).

7. In the Appendix (Tables A2 and A3) we provide robustness checks where we differentiate between retweets as well as mentions and replies. For the important covariates, the results remained very similar.

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Table A1. Overview of international organizations included in the analysis

| Twitter handle | Name                                                                 |
|----------------|----------------------------------------------------------------------|
| A_delpacifico  | Alianza del Pacifico                                                  |
| Adaptationfund | Adaptation Fund                                                       |
| Afdb_group     | African Development Bank Group                                        |
| Antonioguterres| Antonio Guterres (UN)                                                 |
| Asteiner       | Achim Steiner (UNDP)                                                  |
| Baseickhout    | Bas Eickhout (EU)                                                     |
| Bidcambioclima | Inter-American Development Bank (BID)                                 |
| C40cities      | C40 Cities                                                            |
| Carlmercer     | Carl Mercer (UNDP)                                                    |
| Cazacuofelia   | Ofelia Cazacu (WHO)                                                   |
| Cenucc         | UN Framework Convention on Climate Change (UNFCCC)                    |
| Cepal_onu      | Economic Commission for Latin America and the Caribbean (ECLAC)       |
| Cfigueres      | Christiana Figueres (UNFCCC)                                          |
| Cmnucc         | UN Framework Convention on Climate Change (UNFCCC)                    |
| Cohedegaard    | Connie Hedegaard (EU)                                                 |
| Connect4climate| Connect4Climate                                                       |
| Cop20cmp10     | UN Framework Convention on Climate Change (UNFCCC)                    |
| Ctaflash       | Technical Centre for Agricultural and Rural Cooperation (CTA)         |
| Drmarianeira   | Maria Neira (WHO)                                                     |
| Drtedros       | Tedros Adhanom Ghebreyesus (WHO)                                      |
| Eib            | European Investment Bank (EIB)                                        |
| Elyxyak        | UN digital Ambassador                                                 |
| Eriksoelheim   | Erik Solheim (UNEP)                                                   |
| Esa            | European Space Agency (ESA)                                           |
| Eu_commission  | EU Commission                                                         |
| Eu_mare        | EU Maritime Affairs and Fisheries Directorate-General                  |
| Euclimateaction| EU Directorate-General for ClimateAction                              |
| Europarl_en    | European Parliament                                                   |
| Faoclimat      | FAO Climate Change News                                               |
| Faoespanol     | Food and Agriculture Organization (FAO)                               |
| Faoforestry    | FAO Forestry Department                                               |
| Faoknowledge   | FAO Knowledge                                                         |
| Faonews        | Food and Agriculture Organization (FAO)                               |
| Fmarcellesi    | Florent Marcellesi (EU)                                               |
| Gcf_news       | Green Climate Fund (GCF)                                               |
| Gemreport      | Global Education Monitoring Report                                     |
| Globalcompact  | Global Compact                                                        |
| Globalgoalsun  | UN Sustainable Development Goals                                       |
| Grazianodasilva| José Graziano da Silva (FAO)                                          |
| Greens_climate | Stop Climate Change Campaign of Greens/EFA in the EU Parliament       |
| Helenclargundp | Helen Clark (UNPD)                                                    |
| Iaeaorg        | International Atomic Energy Agency (IAEA)                             |
| Icimod         | International Centre for Integrated Mountain Development (ICIMOD)     |
| Iclei          | Local Governments for Sustainability (ICLEI)                          |
| Iea            | International Energy Agency (IEA)                                     |
| Iea_oecd       | International Energy Agency (IEA)                                     |
| Ifadnews       | International Fund for Agricultural Development (IFAD)                |
| Ifc_org        | International Finance Corporation (IFC)                               |
| Ilo            | International Labour Organization (ILO)                                |
| Iom_mecc       | International Organization for Migration (IOM)                         |
| Twitter handle | Name | |
|----------------|------|---|
| Ipcc_ch        | International Panel on Climate Change (IPCC) |
| Irena          | International Renewable Energy Agency (IRENA) |
| Irinabokova    | Irina Bokova (UNICEF) |
| Isostandards   | International Organization for Standardization (ISO) |
| Jefdsachs      | Jeff Sachs |
| Jimkim_wbg     | Jim Yong Kim (WB) |
| Junckereu      | Jean-Claude Juncker (EU) |
| Kentpage       | Kent Page (UNICEF) |
| Ldcchairunfccc | Least Developed Countries Group (LDC) Chair |
| Lpaa_live      | Lima-Paris Action Agenda (LPAA) |
| Mac_europa     | Miguel Arias Cañete (EU) |
| Marialenasemedo| Maria Helena Semedo (FAO) |
| Marossefovic   | Maroš Šefčovič (EU) |
| Martinezsoliman| M. Martinez-Solimán (UN) |
| Momentum_unfccc| Campaign of the UNFCCC Secretariat |
| Ndepartment    | NDC Partnership |
| Nordenen       | The Nordic Council and Nordic Council of Ministers |
| Oecd           | Organisation for Economic Co-operation and Development (OECD) |
| Onu            | United Nations (UN) |
| Onu_es         | United Nations (UN) |
| Onu_fr         | United Nations (UN) |
| Onuinfo        | UN Info |
| Onumedioamb    | UN Environment Programme (UNEP) |
| Onuweb         | United Nations (UN) |
| Pespinosac     | Patricia Espinosa (UNFCCC) |
| Pnud           | UN Development Programme (UNDP) |
| Pnud_es        | UN Development Programme (UNDP) |
| Pnudperu       | UNDP in Peru |
| Pnuma          | UN Development Programme (UNDP) |
| Ramsarconv     | Wetlands Convention |
| Refugees       | United Nations High Commissioner for Refugees (UNHCR) |
| Rkyte365       | Rachel Kyte (WB) |
| Sdgaction      | UN SDG Action Campaign |
| Sdgmediazone   | SDG Media Zone |
| Secgen         | Unofficial Account of the Secretary General of the UN |
| Seforallorg    | Sustainable Energy for All |
| Thecvf         | Climate Vulnerable Forum (CVF) |
| Thegef         | Global Environment Facility (GEF) |
| Ucenerpu       | EU in Peru |
| Un             | United Nations (UN) |
| Un_carbonmechs | UN News on Carbon Mechanisms |
| Un_climatemtalks| UN Framework Convention on Climate Change (UNFCCC) |
| Un_news_centre | UN Multimedia News Service |
| Un_pga         | President of the UN General Assembly |
| Un_spokesperson| Office of the Spokesperson for the UN |
| Un_women       | UN Women |
| Unarabic       | United Nations (UN) |
| Unbonn         | UN in Bonn |
| Unccd          | UN Convention to Combat Desertification (UNCCD) |
| Undp           | UN Development Programme (UNDP) |

(continued)
Table A1. (Continued)

| Twitter handle     | Name                                                                 |
|--------------------|----------------------------------------------------------------------|
| Undp_india         | UNDP India                                                           |
| Undpclimate        | UNDP Climate                                                         |
| Undplac            | UNDP in Latin America and the Caribbean                             |
| Unep               | UN Environment Programme (UNEP)                                      |
| Unepasiapacific    | UNEP Asia/Pacific                                                   |
| Unepfr             | UN Environmental Programme (UNEP)                                   |
| Unesco             | UN Educational, Scientific and Cultural Organization (UNESCO)       |
| Unesconow          | World Press Freedom Conference                                       |
| Unfcc              | UN Framework Convention on Climate Change (UNFCCC)                  |
| Unfccwebcast       | UNFCCC Webcast                                                      |
| Ungeneva           | UN Office at Geneva (UNOG)                                           |
| Unhabitat          | UN Habitat                                                          |
| Unhumanrights      | UN Human Rights Office                                              |
| Unicef             | UN Children’s Fund (UNICEF)                                         |
| Unicef_france      | UN Children’s Fund (UNICEF)                                         |
| Unicef_uk          | UN Children’s Fund (UNICEF)                                         |
| Uninindia          | UN in India                                                         |
| Unisdr             | UN International Strategy Disaster Reduction (UNISDR)               |
| Unisgeneva         | UN Office at Geneva                                                 |
| Unredd             | UN-REDD Programme                                                   |
| Unvolunteers       | United Nations Volunteers (UNV)                                     |
| Voicesofyouth      | Voices of Youth                                                     |
| Wbclimatechange    | World Bank Climate Change                                           |
| Wbg_climate        | World Bank Group Climate                                            |
| Wbsustaindev       | World Bank Sustainable Development                                  |
| Wfp                | World Food Programme (WFP)                                          |
| Who                | World Health Organization (WHO)                                     |
| Wmo                | World Meteorological Organization                                   |
| Wmonews            | World Meteorological Organization                                   |
| Worldbank          | World Bank                                                          |
| Worldbankafrica    | World Bank Africa                                                   |
| Worldbanklac       | World Bank Latin America and Caribbean                              |
| Worldbankwater     | World Bank Water                                                    |
| Yjadot             | Yannick Jadot (EU)                                                  |
Table A2. Results of the pooled ERGM for mentions and replies

|                          | Estimate | CI               |
|--------------------------|----------|------------------|
| Edges                    | −3.63    | [−4.03; −3.09]   |
| Reciprocity              | 1.78     | [1.65; 1.97]     |
| Actor type (alter)       |          |                  |
| Business                 | −0.31    | [−0.52; −0.14]   |
| NGO                      | −0.10    | [−0.37; 0.02]    |
| State actor              | −0.02    | [−0.23; 0.10]    |
| Media                    | −0.21    | [−0.45; −0.08]   |
| Research                 | −0.50    | [−0.91; −0.38]   |
| Transnational            | −0.26    | [−0.34; −0.11]   |
| Others                   | 0.01     | [−0.35; 0.22]    |
| Actor type (ego)         |          |                  |
| Business                 | 0.32     | [0.03; 0.52]     |
| NGO                      | 0.30     | [0.12; 0.41]     |
| State actor              | 0.02     | [−0.33; 0.30]    |
| Media                    | 0.20     | [−0.05; 0.47]    |
| Research                 | 0.25     | [−0.11; 0.69]    |
| Transnational            | 0.39     | [0.19; 0.71]     |
| Others                   | 0.56     | [0.12; 1.42]     |
| Homophily                |          |                  |
| Business                 | 0.97     | [0.73; 1.30]     |
| NGO                      | 0.29     | [−0.13; 0.58]    |
| State actors             | 0.55     | [0.40; 0.80]     |
| Media                    | −0.49    | [−1.20; 0.45]    |
| Research                 | 1.37     | [0.61; 2.11]     |
| IOs/IPAs                 | 0.57     | [0.43; 0.75]     |
| Transnational            | 0.07     | [−0.83; 0.34]    |
| Others                   | −0.05    | [−0.27; 0.39]    |
| Followers                |          |                  |
| Alter                    | 0.01     | [0.01; 0.03]     |
| Ego                      | −0.01    | [−0.02; −0.00]   |
| Difference               | −0.01    | [−0.02; −0.01]   |
| Betweenness (alter)      | 0.31     | [0.26; 0.35]     |
| Weighted degrees         | −0.51    | [−0.95; 0.33]    |
| Indegree                 |          |                  |
| Outdegree                | −4.11    | [−5.33; −2.89]   |
| Transitivity             |          |                  |
| gwesp.fixed.0.2          | 0.88     | [0.84; 0.99]     |
| gwdsp.fixed.0.2          | −0.08    | [−0.15; −0.04]   |

Notes: CI = confidence interval; *0 outside of the confidence interval.
Table A3. Results of the pooled ERGM for retweets

|                        | Estimate | CI             |
|------------------------|----------|----------------|
| Edges                  | −3.58    | [−3.93; −3.15] |
| Reciprocity            | 2.06     | [1.96; 2.15]   |
| Actor type (alter)     |          |                |
| Business               | −0.41    | [−0.53; −0.28] |
| NGO                    | −0.32    | [−0.54; 0.03]  |
| State actor            | 0.03     | [−0.25; 0.15]  |
| Media                  | −0.25    | [−0.39; −0.07] |
| Research               | −0.28    | [−0.51; −0.05] |
| Transnational          | −0.31    | [−0.39; −0.12] |
| Others                 | −0.06    | [−0.43; 0.28]  |
| Actor type (ego)       |          |                |
| Business               | 0.19     | [0.07; 0.34]   |
| NGO                    | 0.21     | [0.13; 0.36]   |
| State actors           | 0.07     | [−0.94; 0.40]  |
| Media                  | −0.19    | [−0.37; 0.06]  |
| Research               | 0.35     | [0.12; 0.67]   |
| Transnational          | 0.47     | [0.26; 0.94]   |
| Others                 | 0.54     | [0.31; 0.69]   |
| Homophily              |          |                |
| Business               | 0.50     | [0.24; 1.04]   |
| NGO                    | 0.41     | [0.17; 0.64]   |
| State actors           | 0.38     | [0.22; 1.22]   |
| Media                  | 0.57     | [0.33; 0.69]   |
| Research               | 0.72     | [0.55; 0.98]   |
| IOs/IPAs               | 0.41     | [0.33; 0.56]   |
| Transnational          | −0.06    | [−0.94; 0.22]  |
| Others                 | −0.06    | [−0.14; 0.49]  |
| Followers              |          |                |
| Alter                  | 0.01     | [−0.10; 0.02]  |
| Ego                    | −0.01    | [−0.42; −0.00] |
| Difference             | −0.00    | [−0.01; 0.10]  |
| Betweenness (alter)    | 0.06     | [−0.00; 0.46]  |
| Weighted degrees       | −0.53    | [−1.45; 0.49]  |
| Indegree               |          |                |
| Outdegree              | −4.11    | [−5.13; −2.72] |
| Transitivity           |          |                |
| gwesep.fixed.0.2       | 1.15     | [0.97; 1.26]   |
| gwdsp.fixed.0.2        | −0.08    | [−0.15; −0.05] |

Notes: CI = confidence interval; *0 outside of the confidence interval.