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## **What explains collaboration in high and low conflict contexts? Comparing climate change policy networks in four countries**

**Abstract:** Explaining collaboration between actors involved in policy processes is crucial for understanding these processes and their outcomes. The policy science literature has advanced several hypotheses explicating what enables or hinders collaboration. However, only a handful of studies compare these factors across different policy contexts. This paper investigates the role of beliefs and influence in shaping collaboration under conditions of high and low conflict by estimating Exponential Random Graph Models using network survey data on the climate policy domains in four countries. Results show that both beliefs and influence are associated with the formation of collaboration ties in the high conflict contexts of South Korea and the US, whereas neither are significant in the low conflict contexts of Sweden and Switzerland. By considering the level of conflict, our findings provide a more nuanced understanding of when beliefs and influence shape collaboration patterns

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## Introduction

The 2015 Paris Agreement is a watershed in the development of international climate policy. However, the success of the agreement requires country-level action from all signatories. Countries, on their own accord, must adopt national policies to reduce their own greenhouse gas (GHG) emissions, and they do so with different levels of ambition. The differences in national climate policies are often explained in the literature by referring to macrolevel economic and political structures, such as a country's dependency on fossil fuels, its vulnerability to climate change, its wealth or its administrative capacity (Fisher, 2006). From this perspective, climate policy leaders tend to be those countries that stand to gain from adopting climate change mitigation policies (Creutzig & He, 2009; Nemet, Holloway, & Meier, 2010) or are highly vulnerable to the effects of climate change (Tubi, Fischhendler, & Feitelson, 2012). In contrast, laggard countries tend to be highly dependent on fossil fuels and have high levels of GHG emissions per capita. This interest-based perspective may partly explain the differences between countries' levels of climate policy ambition (Sprinz & Vaahtoranta, 1994).

National policies are first and foremost formulated and implemented by domestic policy actors, each with their own resources, values, interests, and beliefs (Fisher, 2004). Research has shown that these actors—public authorities, scientific institutions, civil society, and business groups—often collaborate with others to maximize their influence over policy decisions (Berardo & Lubell, 2019; Fisher & Leifeld, 2019; Ingold & Fischer, 2014; Ostrom, 2010). Network scholars seek to explain how these different types of organizations exert political influence by actor-level characteristics, such as their policy beliefs (Henry, 2011; Ingold, 2011; Kukkonen, Ylä-Anttila, & Broadbent, 2017; P. Wagner & T. Ylä-Anttila, 2018), their stock of social capital (Berardo & Scholz, 2010) or their power resources, like reputation (Fischer & Sciarini, 2015; Ingold & Leifeld, 2014).

Manifold studies in the public policy literature have developed hypotheses to investigate what explains collaboration in climate policy processes (e.g., Gronow, Wagner, & Ylä-Anttila, 2020; Ingold & Fischer, 2014; P. M. Wagner & Ylä-Anttila, 2018) and other policy domains (e.g., Parsons, 2018; Weible, Heikkila, Ingold, & Fischer, 2016). In this study, we focus on the significance of beliefs and influence as explanations for collaboration. We do so because the evidence for their significance to date is mixed.

At the same time, we control for a number of other factors, such as reciprocity and transitivity, which are both discussed in context of trust as important resource for social capital (Berardo & Scholz, 2010; e.g., DeLeon & Varda, 2009; Henry, Lubell, & McCoy, 2011). Reciprocity has consistently been found to be an important determinant of collaboration ties and, in fact, ties in most social networks. Policy actors, like social actors in general, thus have a tendency to reciprocate social ties (Goldstein, Pevehouse, Gerner, & Shibley, 2001; Goldstein & Pevehouse, 1997; Gouldner, 1960). In addition, trust increases when actors have collaboration partners in common, thus the trust to a third actor arises based on an actor's direct contacts ("transitivity" e.g., Henry et al., 2011).

While the effect of reciprocity and transitivity is widely understood, there is considerable disagreement in the literature about the role that beliefs and influence play in determining collaboration. Researchers guided by the Advocacy Coalition Framework have argued that actors collaborate with those holding similar policy beliefs (Ingold, 2011; Jasny et al., 2018; Matti & Sandström, 2011; Sabatier & Jenkins Smith, 1993). In contrast, those drawing on the Resource Dependency Theory (Pfeffer & Salancik, 1978) have argued that influence is a sought-after resource in policy processes, and hence, policy actors will seek to collaborate with influential actors (Calanni, Siddiki, Weible, & Leach, 2015; Fischer & Sciarini, 2015).

The literature has provided mixed results—some of the studies referenced above have found that beliefs are important while influence is not, and others have come to the opposite conclusion. This has led some scholars to argue that these differences could be explained by the differing contexts in which collaboration occurs. Weible, Heikkila, and Pierce (2018) argue that beliefs are only likely to be associated with collaboration in high conflict contexts. Calanni et al. (2015) have argued that beliefs are likely to be associated with collaboration in high conflict contexts and that influence drives collaboration in low conflict contexts. Likewise, Gronow et al. (2020) find that both belief similarity

and influence explain collaboration in Finland's conflictual climate policy domain, while in Sweden the public authorities play the central coordinating role.

These mixed results come mostly from single case studies on highly conflictual subsystems, and discussions of these findings in relation to other single case studies (Calanni et al., 2015; Parsons, 2018; Weible et al., 2018). This is certainly a valid and useful approach in policy studies, but comparative research is necessary to understand the relationship between contextual factors, such as the level of conflict in a policy subsystem, and the factors that are argued to drive collaboration. To date, only a handful of studies pursue a comparative approach, and these focus on how institutional characteristics (i.e., the technicalities of a political system) are associated with political actors' collaboration (e.g., Brandenberger & Metz, 2018; Fischer & Sciarini, 2015; Henry et al., 2011; Ingold, Fischer, & Cairney, 2017) or compare the drivers of collaboration in a policy subsystems over time (Ingold & Fischer, 2014). Despite several scholars arguing that the level of conflict in a subsystem has effects on what drives collaboration, systematic comparisons of several cases differentiated by the level of conflict are lacking.

In this paper, we address this research gap by comparing the effects of policy beliefs and influence on collaboration in low and high conflict policy subsystems. We compare two low conflict cases, Sweden and Switzerland, with two high conflict cases, South Korea and the United States. The cases were selected to take a step determining the contextual conditions under which beliefs and influence shape collaboration and those under which they do not. This way, we contribute to theory building in the emerging comparative public policy literature.

We investigate the role of beliefs and influence in shaping collaboration patterns by estimating Exponential Random Graph Models (ERGM) using data collected by surveying the policy actors in the climate change policy domains in the four countries. Our results show that both belief similarity and influence are associated with the formation of collaboration ties in the high conflict contexts of South Korea and the US and that they are not in the low conflict contexts of Sweden and Switzerland. The findings suggest that both belief similarity and influence affect collaboration in high conflict contexts but not in low context ones.

### **Drivers of Collaboration in Low- and High-Conflict Policy Contexts**

In what follows, we discuss how the policy science literature has explained collaboration in policy processes with different levels of conflict. Specifically, we consider two drivers of collaboration: belief similarity and influence as a resource used to exercise political power.

#### *Belief Similarity*

How actors give meaning to problems shapes how they evaluate different policy ideas or measures. This affects how they interact with others and the collaborative relationships that they forge. Policy-relevant beliefs are often argued to be the "principal motivator" or the "causal driver" of political, as they build the foundation upon which policy choices are made (Weible, Sabatier, & McQueen, 2009, p. 122). The theory of belief similarity (or belief homophily) contends that policy actors identify allies (or foes) based on beliefs and form stable, collaborative relationships with those with similar beliefs to their own. They do so to try to get decisionmakers to design policies and make choices that correspond with their preferences. Pooling resources with likeminded actors makes it likelier that policies will correspond with these preferences. Belief similarity is regularly argued to be the primary explanation for collaboration in policy networks, especially by authors guided by the Advocacy Coalition Framework (ACF e.g., Calanni et al., 2015; Pierce, 2011). Policy beliefs, then, are the "glue" that hold actors together and form the basis upon which enduring and trustful relationships are built.

However, not all researchers have found that collaboration always depends on belief similarity. In the Swiss climate policy subsystem, belief similarity was found to be a driver of collaboration in times of higher conflict, during decision-making, but not in times of lower conflict, when major decisions have already been made and the policy phase had to do with policy implementation (Ingold & Fischer, 2014). In the highly conflictual hydraulic fracturing policy subsystems in New York, Colorado, and Texas, policy beliefs have been found to be more important drivers of collaboration than influence (Weible et al., 2018). In addition, a comparison of Finnish and Swedish climate policy networks found that belief similarity explains collaboration only in the more conflictual case of Finland but not in the consensual case of Sweden (Gronow, Ylä-Anttila, Carson, & Edling, 2019).

We hypothesize that collaboration ties are likely to be formed between those with shared beliefs in conflictual contexts, but not in consensual ones (Weible et al., 2018). This is because conflict is more likely to encourage or drive actors to engage in some form of collective action (Lodge & Matus, 2014). Collaborating with those with similar beliefs makes it easier for actors to push for the policy measures that they support and to pursue their shared objectives (e.g., Ingold, 2011; Matti & Sandström, 2011). Therefore, we hypothesize:

*Hypothesis 1a: In high conflict policy contexts, policy actors are likely to collaborate with those with similar policy beliefs to their own*

The other side of the argument is that in low-conflict contexts, beliefs are less likely to be associated with collaboration ties (Weible et al., 2018). For example, during a low conflict phase of a policy process, the salience of beliefs decreases and their role in shaping collaboration ties reduces. Actors are more likely to agree on key issues (i.e., the general level of belief similarity is higher) because the debate over policy design has ended. Based on these considerations, we put forward the following hypotheses.

*Hypothesis 1b: In low conflict policy contexts, policy actors are not more likely to collaborate with those with similar policy beliefs to their own.*

### *Influence as Resource for Political Power*

Scholars drawing on Resource Dependence Theory (RDT) (c.p. Pfeffer & Salancik, 1978) have argued that involved in policy processes seek to collaborate with influential actors. By tapping into the resources and connections of influential actors, they may be able to increase their political power and achieve their policy goals (Calanni et al., 2015; Heaney, 2014; Henry, 2011). Influence is an important resource for obtaining political power because it can help to control and shape policy designs and choices (Laumann & Knoke, 1987). Influential actors are desirable collaboration partners because they can support coordination and information exchange, often between loosely connected or opposing groups. Policy actors can become influential, for example, when they have many bridging ties and thus possess brokerage potential that can be of use in getting deals done. The risk hypothesis of the ecology of games framework contends that actors that are centralized brokers are particularly important in contexts when a major political decision has already been taken and it is in the process of being implemented (Berardo & Scholz, 2010).

In low conflict policy contexts coordinating policymaking between different groups and actors at different governance levels is a critical task (Matti & Sandström, 2011, 2013; Weible et al., 2018). Policy actors considered influential by many others may serve as the main contact point for those trying to engage in a policy process. These influential actors, which could be either formal decision makers or those in structurally significant network positions (Fischer & Sciarini, 2015; Ingold & Leifeld, 2016), can coordinate and facilitate the distribution of information. Collaborating with these actors creates “a centralized bridging structure capable of efficient information transmission for coordinating

policies, even without any government mandate” (Berardo & Scholz, 2010, p. 632). Put differently, in low-conflict contexts actors are more likely to collaborate with influential actors to ensure the efficient and low-cost transfer of information than they are to join forces with like-minded or trustful alters (strong ties). Based on these considerations, we put forward the following hypothesis:

*Hypothesis 2a: In low conflict policy contexts, policy actors are likely to form collaborative ties with influential actors.*

In contrast, in conflictual contexts the risk hypothesis of the ecology of games framework states that bonding social capital, not influence, is the most important driver of collaboration (Berardo & Scholz, 2010). Bonding capital manifests itself as reciprocated, trustful, and enduring relationships between actors, often based on shared values and policy beliefs. In conflictive policy contexts, there is a high risk of defecting from common commitments and therefore the credibility of collaboration partners is more important than their level of influence in the policy subsystem. Reciprocal relationships decrease the level of defection by increasing the likelihood and costs of punishment in a collective action situation. Consequently, credible commitments between collaboration partners can evolve based on growing knowledge about each other’s expected, shared attitudes, or common values (Axelrod, 1984; Putnam, 1993). Thus, instead of reaching out to influential actors, in conflictive contexts it is more important to collaborate with those that you know well, for example, based on a long common history and/or shared views. Hence, we argue:

*Hypothesis 2b: In high conflict policy contexts, policy actors will show no preference to form collaborative ties with influential actors*

### **Case Selection**

We test our hypotheses using climate policy network data collected in four countries. Our comparative design leads us to select two cases where the climate policy subsystem at the time of data collection was in a state of low conflict, Sweden and Switzerland, and two subsystems where conflict was high, South Korea and United States. This does not mean that no conflict whatsoever would have been present in Sweden and Switzerland. Rather, policymaking in most cases is marked by at least some degree of conflict, and this degree of conflict should be seen as a continuum on which our two country pairs, at the time of data collection, fall close to opposing ends. Nor do we intend to claim that the degree of policy conflict would be a country-level phenomenon that would not vary between different policy domains or over time. Despite Sweden and Switzerland being usually classified as consensus democracies, policy conflicts do, of course, exist in these countries as well. A case in point is the climate policy process in Switzerland, which has had its moments of relatively high conflict, for example around mid-1990s, and moments when conflict has been low, such as the period that we focus on in this study (Ingold & Fischer, 2014). One key determinant of changes in the level of conflict over time, according to previous research, is the phase of the policymaking process, with decision-making phases often being more conflictual than implementation phases (Bardach, 1977; Torenlid & Thomson, 2003). In the following section, we describe the climate policy context in each country at the time of data collection and Table 1 presents simple descriptive information on the four cases.

In Sweden, climate change policy making has long been marked by a low level of conflict. Earlier research has found that there are no significant coalitions of policy actors opposing one another (Gronow et al., 2019), and generally a strong consensus exists on the need for ambitious climate policy (Zannakis, 2009). This consensus has made Sweden a leader in environmental policy in general (Sarasini, 2009), and specifically in the field of climate change (Karapin, 2016). At the time of data collection in 2015, the Cross-Party Committee on Environmental Objectives worked on updating the national climate strategy, reaching a broad consensus between six parliamentary parties in 2016. The

goal set by the strategy is for Sweden to “have net zero emissions by no later than 2045, of which emissions reduction in Sweden is to account for at least 85 per cent” (The Swedish Ministry of the Environment, 2016).

In Switzerland, the climate change policy domain was in a low conflict phase at the time of data collection. Over time, the Swiss climate policy domain has seen times of both high and low conflict. Earlier research has found opposing pro-ecology and pro-economy advocacy coalitions, which have disagreed over policy initiatives in several decision-making moments over the years (Ingold, 2011; Ingold & Fischer, 2014). However, when our data collected in 2011/2012 policy actors were engaged with the implementation of the CO2 Act—the piece of Swiss climate legislation. The major decision to put this act in place had recently been taken, and the policy domain was experiencing a relatively low-conflict phase of policy implementation (Ingold & Fischer, 2014; Kammerer, 2018).

When we collected data in South Korea, the climate change policy domain was highly conflictual. The Framework Act on Low Carbon Green Growth was subject of heated political contestation. Green and left actors and the media heavily the law for its toothlessness (Jung-Hwan & Yun, 2011; Yun, 2010), resulting in a conflictive public debate between the pro-environment (NGOs and civil society groups) and the pro-economy coalition, which consisted of governmental actors and business groups (Yun, Ku, & Han, 2014).

**Table 1. Cases**

Country	Sweden	Switzerland	South Korea	United States
Source	COMPON	Ingold Survey Data	COMPON	COMPON
Year	2014	2011/2012	2010	2010
Number of Organisations (Response rate)	69 (70%)	52 (88%)	80 (83%)	64 (64%)
<i>Business Actors</i>	22 (73%)	19 (90%)	26 (84%)	19 (56%)
<i>Civil Society</i>	17 (52%)	15 (94%)	16 (73%)	19 (86%)
<i>Public Authorities</i>	21 (91%)	13 (87%)	26 (93%)	15 (50%)
<i>Scientific Organisations</i>	9 (69%)	5 (100%)	12 (80%)	11 (79%)
Policy Context	Consensus-building in the Cross-Party Committee on Environmental Objectives	Implementation of the CO <sub>2</sub> -Act	Public controversy over the Framework on Low Carbon Green Growth	Conflict over and failure to pass the Clean Energy and Security Act
Level of Conflict	Low	Low	High	High
References	Author(s)	Ingold and Fischer 2014	Yun, Ku, and Han 2014	Jasny, Waggle, and Fisher 2015

In the United States, the climate policy arena is well known for being contentious; to date, the US Congress has been unable to pass any legislation that addresses the issue (see Jasny, Waggle, &

Fisher, 2015). This paper uses data collected from the top policy actors working on climate change in the United States in 2010, during President Obama's first term, when U.S. climate policy developments were rather lively. This period of time is known for some successes in the climate arena: there was a substantial increase in mandatory fuel economy standards for vehicles; for the first time, the House of Representatives passed a climate bill, (the American Clean Energy and Security Act, also known as the Waxman-Markey bill); and 10% of the \$787 billion of the Recovery Act funds were earmarked for energy efficiency and renewable energy projects (Broadbent et al., 2016; Galli & Fisher, 2016).<sup>1</sup> At the same time, the Senate failed to produce a companion bill to the Waxman-Markey bill, which halted the legislation, which was expected to be signed by President Obama.<sup>2</sup> Moreover, the denialist countermovement was stepping up its efforts to block all climate-related policies (Dunlap, McCright, & Yarosh, 2016). In other words, the climate policy arena in general and during our period of data collection in particular can be as being conflictive.

### **Research Design and Models**

In all four countries, the national climate change policy network includes the 50–100 actors that participate in the making or influencing [of] the collectively binding policy decisions (Knoke, 1994, p. 280) related to climate change. This includes those that hold key roles in the political subsystem, such as actors elected to national parliaments, government departments, state, and any significant economic, social, or other political non-state actors as well as those that are known to be influential by experts with a knowledge of the subsystem (Laumann, Marsden, & Prensky, 1983).

In Korea, the policy network actors were identified using a three-stage process. First, three national newspapers were to identify the most prominent actors involved in national climate policy. Second, renowned climate specialists emailed us their evaluation of the relative importance of the actors identified in the first stage. Third, a meeting was held with six climate policy specialists to determine which actors they believed should be targeted for the questionnaire survey. They concluded that there were 96 actors in the national climate change policy network. In Sweden, a preliminary list of actors was compiled based on previous research and on the author's knowledge of the country's climate policy arena. This list was then presented to Swedish experts on climate policy who suggested some additions and omissions. The final list included 99 actors. In the USA, we first created a list of all the actors who participated in climate change-related hearings in the US Congress during the two sessions prior to data collection. We then added to this list all of the registered lobbyists named in the March 2009 "Climate Change Lobby" inventory compiled by the Center for Public Integrity.<sup>3</sup> This expanded list was then cross-referenced with a roster of all US that participated in COP-15 in Copenhagen in 2009. We then ranked each actor on the list according to how often they were included within hearings, international negotiations, and on lobbyist registries. The 100 most active actors on the list make up the US climate policy network. In Switzerland, the network boundaries were determined using the positional, decisional, and reputational approach (for more details on the data set see Ingold & Fischer, 2014; Knoke, 1994, p. 280). Semi-guided interviews were conducted in winter 2011/12 after the Federal Parliament approved the revision of the CO<sub>2</sub>-Act. Overall, 52 actors were identified and interviewed. Interviews were complemented with an in-depth analysis of the actors' statements during a consultation procedure in 2010 to identify further important actors and to code the policy belief variables.

Information about each country's network and their response rates are presented in (Table 1). Data were collected between 2010 and 2014, beginning soon after the Copenhagen conference failed to deliver a binding Post-Kyoto agreement. The period covers a time when many countries were less enthusiastic about climate action and when the international community was taking steps negotiating the Paris Agreement. We handled missing data in two ways. First, we removed all non-respondents as we had no information about their network ties or policy beliefs. Second, we recoded instances where respondents did not state their opinion on a specific policy idea as neutral

(see Supporting Information C). This decision was taken because it is not possible to use the ERGM attribute methods with missing data.

The formation of collaborative ties between actors participating in policymaking processes can be shaped or influenced by the relationships among other policy actors. As such, when investigating what might explain collaboration patterns in policy networks it is necessary to take an approach that accounts for relational dependence. Simple OLS regression models are unsuitable for this task as the interdependent nature of network data violates the assumption of the independence of relations among observations required by these models. ERGM can overcome this problem (Robins, Snijders, Wang, Handcock, & Pattison, 2007). ERGMs assume that networks are formed and shaped by stochastic processes and enable researchers to investigate if a network's structure is a function of individual covariates, dyadic variables (edge covariates), and endogenous network sub-structures. A well-specified ERGM includes exogenous covariates and endogenous network variables that jointly produce a network that is isomorphically like the observed network. ERGMs are fit with a Monte Carlo Markov Chain maximum likelihood estimation procedure. This is a stochastic approximation process that enables us to simulate a set of possible networks and the probability distributions over them, allowing us to estimate the parameters of the variables in our models. The statistics drawn from the distributions of networks simulated are used to measure the standard errors associated with each parameter. The parameter estimates can be tested using a Wald test to see if they are statistically significant. We run our models using the package from the *statnet* suite of packages available for the statistical language R (Hunter, Handcock, Butts, Goodreau, & Morris, 2008). For further details on all variables, their meanings, data source, role in research design, and name of respective terms, please consult the Supporting Information: A Research Design and Variables.

#### *Dependent Variable*

We run separate models for each of the four countries. The dependent variable in the model for each country is their national climate change collaboration network. These data were collected by presenting each respondent with list of all the other actors in their national climate policy network and asking them to indicate which of them they collaborate with regularly. We constructed collaboration networks by transforming the data into  $n \times n$  adjacency matrices, coding a value of 1 for the presence of a collaboration tie and a value of 0 for the absence of a tie. Collaboration ties are directed in that an actor  $i$  may indicate that they collaborate with actor  $j$ , while actor  $j$  does not indicate that they collaborate with actor  $i$ .

#### *Independent Variables*

In the US, Korea and Sweden, national research teams identified the most salient climate policies being discussed in their case country and used a survey instrument to ask respondents (using a -point Likert scale) about their opinions on these policies. Information about the policy ideas and data on the distribution of responses are supplied in Section C of the Supporting Information. The Swiss policy beliefs data differs to that of the other countries in that actors' policy positions were collected using data-to-text coding. Researchers used policy documents and statements as they were produced in the context of a public consultation procedure held in 2009 about the revision of the Swiss CO2 Act (FOEN, 2009). Researchers coded whether a policy actor rejected (-1), supported (+1), or was neutral (0) a policy position on policy objectives (i.e., high CO2 emission reduction targets) and specific policy instruments (i.e., CO2 tax on motor fuels, voluntary agreements, a voluntary levy on gasoline). To achieve the greatest comparability as possible across the four countries, the Swiss policy data-to-text data and the data collected in Sweden, South Korea, and United States were all converted into -point Likert scales. In cases where an actor did not indicate an opinion on a policy issue, their response was coded as neutral. We construct the belief similarity variable to test H1a and H1b (Belief similarity) (McPherson, Smith-Lovin, & Cook, 2001) using a method described by Leifeld and Schneider (2012).

The Likert responses to the policy questions are used to create a dissimilarity matrix for each country by calculating the Manhattan distance between the responses of each pair of actors.<sup>4</sup> The values in the cells of the dissimilarity matrix are then subtracted from the maximum similarity value. This resulted in a matrix for each country, in which the similarities in the policy beliefs of each pair of actors is represented as a value, with higher values indicating more similar policy beliefs. A positive significant parameter estimated associated with the belief similarity variable indicates that policy actors are more likely collaborate with those with more similar policy beliefs.

We model political influence (H2a and H2b) using data generated from the survey question that asked respondents to name the actors that they believed to be influential in national climate politics in their country. Each actor is assigned a quantitative attribute variable that measures their level of influence. The values assigned to each actor is the sum of the number of times that they are named as being influential by all the other actors in the network (Fischer & Sciarini, 2015). A positive and significant parameter estimate indicates that policy actors tend to collaborate more often than would occur by chance with those with higher influence scores.

### *Exogenous and Endogenous Controls*

Much of the policy network literature that focuses on collaboration investigates the role of different actor types and actor characteristics (Hamilton & Lubell, 2018; Ingold & Varone, 2012; Varone, Ingold, & Jourdain, 2017). Public authorities (i.e., government departments, administrative agencies, and political parties) often hold a considerable amount of decision-making power. This means that they remain attractive collaboration partners (Ingold & Leifeld, 2016), particularly in highly policy areas where state actors are also involved in international negotiations (Fischer & Sciarini, 2013). We include a variable to model actor type homophily (McPherson et al., 2001), that is, the tendency for actors of the same type to form collaboration ties. We classified the actors into four different categories: public authorities (government departments, administrative agencies, and political parties) scientific private sector actors and civil society.

We include a variable to model actor type homophily (McPherson et al., 2001), that is, the tendency for actors of the same type to form collaboration ties. We classified the actors into four different categories: public authorities (government departments, administrative agencies, and political parties) scientific private sector actors and civil society. We include a term to control for the differences in each actor types' propensity to form collaboration ties, which ensures that we separate the node-level effects from the dyad-level effects of homophily (Hunter et al., 2008).

Collaboration based on perceived influence is present when an "actor *i* tends to collaborate with *j* if *i* deems *j* influential in the policy process" (Cranmer, Leifeld, McClurg, & Rolfe, 2017, p. 244). Thus, perceived influence measures whether actors tend to see their own collaboration partners as influential. To control for this tendency, we include an  $n \times n$  adjacency matrix of the influence attribution network in our model. The rows and columns are the actors in the network and each cell  $i, j$  contains the value 1 if actor *i* cited actor *j* as being especially influential and a 0 if not. A significant and positive parameter estimate associated with this variable indicates that policy actors collaborate with those that they perceive to be influential.

Finally, we include five additional variables to control for network structure. The first of these is the edge term, which represents the baseline propensity for ties to be formed in a network. Second, we include a term to capture the tendency for actors in policy networks to reciprocate ties (Reciprocity). Third, we include the Geometrically Weighted Edge-wise Shared Partner (GWESP) term to models triadic closure. It captures how often two directly tied actors are also indirectly tied to one another through a third actor (Hunter, 2007). Positive and significant estimates for these terms indicate that collaborative ties are reciprocated and form transitive relationships. Fourth, we include the geometrically weighted out-degree term (Outdegree) to control for the distribution of outgoing ties. Finally, we include the two-path (Twopath) term to control for the number of actors connected via a third actor. The geometrically weighted terms, the Outdegree and GWESP terms, include decay

parameters to control for the impact of additional counts of the same network structure (e.g., an additional closed, transitive triad) to the corresponding network statistics.

## Results

Table 2 presents the parameter estimates for the ERGMs for each of the four countries. By inspecting the AIC, the BIC, and the log likelihood measures, we see that the models presented in Table 3 have the best fit to the data.<sup>5</sup> We also perform a goodness of-fit test on the four full models to investigate how well they replicate network configurations that exist in the data but that are not included in our models (Supporting Information E).

Our results show that belief similarity is significant and positive in US and Korea and that there is no significant relationship in Switzerland and Sweden. Thus, as expected, belief similarity is associated with collaboration in the high-conflict (US and Korea) and not in the low-conflict policy contexts (Switzerland and Sweden). However, we find no evidence to support hypotheses 2a and 2b, concerning the role of influential actors.

In the conflictual cases of Korea and the US, actors with higher reputational influence scores are likely to be more popular collaboration partners than would occur by chance, whereas in low-conflict Sweden and Switzerland we find no relationship between these factors. This is to both of our hypotheses concerning influence, which stated that influential actors would either be popular collaboration partners in low conflict settings (H2a) or that influence would have no effect in high conflict cases (H2b). As expected, our perceived influence control variable is positive and significant in all cases. Actors thus tend to collaborate with those that they personally see as influential.

Public authorities receive less collaboration ties than would occur by chance in Korea, in Sweden they receive more, and in Switzerland and the US the results are insignificant. The results for the actor type homophily variable show different patterns of homophilous ties across the four countries. In the US, all actor types except public authorities have homophilous ties. In Korea, private sector actors and civil society form homophilous ties, while public authorities are less likely to collaborate with one another than would occur by chance. There are too few ties between scientific actors in Korea for the model to converge at a reliable parameter estimate, and as such, we remove the variable from our models. In Sweden, civil society and public authorities form homophilous ties, while the other actor types do not. Finally, results for Switzerland show that private sector actors and public authorities form homophilous ties. We remove those variables to test for homophilous ties among civil society and among scientific actors, as they also do not converge on reliable estimates for the same reason as above.

Finally, we turn to the estimates for the endogenous network statistics. In all four countries, we find that actors tend to reciprocate (Reciprocity) collaboration ties. This is not surprising considering that reciprocity is a well-established finding in the literature (Goldstein et al., 2001; Goldstein & Pevehouse, 1997; Gouldner, 1960). Moreover, across all countries, we find positive and significant parameter estimates for the GWESP term. In other words, pairs of actors that collaborate are also likely to be connected to one another indirectly through a collaboration tie with third actors. These results indicate a tendency triadic closure and the presence of bonding relations, regardless of the level of conflict or policy phase. These findings are again well in line with what the respective literature would predict. The Outdegree terms are negative and statistically significant in all countries, meaning that most of the actors in the four policy networks tend to have a similar number of outgoing collaboration ties. Finally, the two-path terms are negative and significant in all countries, indicating that pairs of actors that are not directly connected to one another do however tend to share common collaboration partners more often than would occur by chance. Bridging actors are therefore present regardless of the level of conflict or the policy phase.

**Table 2. ERGM Results for all for countries (Parameter estimates with standard errors in parentheses)**

	Sweden	Switzerland	South Korea	USA
<i>Edges</i>	-3.33 (0.29) <sup>***</sup>	-3.68 (0.36) <sup>***</sup>	-2.90 (0.36) <sup>***</sup>	-4.26 (0.22) <sup>***</sup>
<b>Policy Beliefs</b>				
<i>Belief similarity (H1a and H1b)</i>	0.01 (0.01)	0.01 (0.03)	0.04 (0.01) <sup>***</sup>	0.05 (0.01) <sup>***</sup>
<b>Actor type Variables</b>				
<i>Pub Auth. Attracts</i>	0.37 (0.14) <sup>**</sup>	0.24 (0.31)	-0.30 (0.14) <sup>*</sup>	0.20 (0.12)
<b>Homophily Tests</b>				
<i>BUS Homophily</i>	0.14 (0.25)	0.90 (0.32) <sup>**</sup>	2.16 (0.29) <sup>***</sup>	0.90 (0.16) <sup>***</sup>
<i>CIV Homophily</i>	0.66 (0.19) <sup>***</sup>		1.92 (0.40) <sup>***</sup>	0.41 (0.16) <sup>**</sup>
<i>Pub Auth. Homophily</i>	0.95 (0.24) <sup>***</sup>	0.82 (0.35) <sup>*</sup>	-1.47 (0.30) <sup>***</sup>	0.26 (0.22)
<i>SCI Homophily</i>	0.33 (0.25)			1.20 (0.21) <sup>***</sup>
<b>Actor Type Activity Parameters</b>				
<i>Nodefactor BUS</i>		-0.13 (0.20)	-0.20 (0.14)	
<i>Nodefactor CIV</i>	-0.38 (0.16) <sup>*</sup>		-0.10 (0.15)	0.17 (0.10)
<i>Nodefactor Pub Auth.</i>	-0.30 (0.13) <sup>*</sup>	-0.42 (0.28)	1.21 (0.24) <sup>***</sup>	0.19 (0.12)
<i>Nodefactor SCI</i>	-0.01 (0.14)			-0.03 (0.10)
<b>Influence</b>				
<i>Perceived Influence</i>	1.41 (0.13) <sup>***</sup>	1.77 (0.21) <sup>***</sup>	0.44 (0.09) <sup>***</sup>	0.54 (0.08) <sup>***</sup>
<i>Reputational Influence (H1a and H1b)</i>	-0.00 (0.00)	0.00 (0.01)	0.05 (0.00) <sup>***</sup>	0.02 (0.00) <sup>***</sup>
<b>Endogenous terms</b>				
<i>Reciprocity</i>	0.88 (0.24) <sup>***</sup>	1.08 (0.33) <sup>**</sup>	0.97 (0.23) <sup>***</sup>	0.87 (0.16) <sup>***</sup>
<i>Outdegree</i>	-1.21 (0.28) <sup>***</sup>	-1.09 (0.40) <sup>**</sup>	-4.03 (0.21) <sup>***</sup>	-1.72 (0.24) <sup>***</sup>
<i>Two-paths</i>	-0.10 (0.01) <sup>***</sup>	-0.08 (0.02) <sup>**</sup>	-0.04 (0.01) <sup>***</sup>	-0.06 (0.01) <sup>***</sup>
<i>GWESP (1.0)</i>	0.76 (0.07) <sup>***</sup>	0.76 (0.11) <sup>***</sup>		0.90 (0.08) <sup>***</sup>
<i>GWESP (0.5)</i>			0.67 (0.11) <sup>***</sup>	
<i>AIC</i>	1967.11	872.12	2292.95	3033.40
<i>BIC</i>	20170.37	948.60	2394.22	3134.23
<i>Log Likelihood</i>	-967.56	-423.06	-1131.47	-1500.70

\*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

## Discussion and Conclusions

Overcoming complex policy problems like climate change requires that diverse policy actors engage in collaborative behaviour (Berardo & Lubell, 2019; Fisher & Leifeld, 2019; Ostrom, 2010). Investigating which factors explain collaboration in policy networks is therefore of paramount importance. The overwhelming majority of the studies that have investigated the determinants of collaboration in policy processes to date have examined single cases, resulting in a situation where further theory development can be achieved through comparative work. Several studies have examined the role of belief similarity and influence (i.e., reputational power) in explaining collaboration, with mixed results. Most case studies have found that belief similarity is the more important explanation of the two, but some authors have argued that it in low conflict policy contexts access into influential actors may be more important than beliefs in explaining collaboration (Matti & Sandström, 2011, 2013; Weible et al., 2018).

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Our research was motivated by these conflicting results. We tested for the relationship between collaboration ties and both belief similarity and influence, in a comparative setting, selecting two high conflict and two low conflict contexts. As hypothesized, we found that belief similarity explains collaboration in the cases where policy conflict was high, US and Korea, and does not in Switzerland or Sweden, where the policy domain was in a state of low conflict. In contrast, Ingold and Fischer (2014) found that during an earlier, conflictive decision-making period beliefs were a significant driver for collaboration in the Swiss case. Thus, the fact that in our study beliefs were not associated with collaboration in Switzerland suggest the following interpretation: It is the policy phase of the domain that matters, not so much whether the political institutions of a country are consensual or not. Thus, if decision-making phases become conflictive enough, beliefs can end up segregating actors into opposing groups.

On influence, we found that it explains collaboration in the high-conflict climate policy domains of Korea and the US but not in low-conflict Sweden or Switzerland. These results suggest that the policy context does make a difference on how influence is related to collaboration, but in a way that is opposite to what some of the earlier research has argued (Calanni et al., 2015; Weible et al., 2018). We found that seeking access to influential actors is an important driver of collaboration in high conflict contexts, but not in low conflict ones. Thus, our results suggest that strategic concerns like seeking to collaborate with those who are influential can drive network formation in the same conflictual policy contexts where ideological concerns like belief similarity do. These findings align with other studies that find that both belief similarity and influence are associated with collaboration in high conflict settings (Gronow et al., 2019). One way to interpret these results is given by Henry (2011) who has argued that belief similarity is usually more important for explaining collaboration patterns than influence, but among those actors that hold similar beliefs, influential actors tend to be the most popular collaboration partners. Our results provide qualified evidence for this argument, by showing that this may be true at least when the policy domain in question is conflictual.

In contrast, perceived influence explains collaboration in all four policy networks. Actors thus tend to collaborate with those that they personally named as being influential. This finding speaks to the debate in the policy studies literature concerning the “devil shift” and the “angel shift” Sabatier, Hunter, and McLaughlin (1987) argued that policy actors often see their opponents as more powerful than they are in reality and they called this idea the “devil shift.”, Leach and Sabatier (2005) have proposed that policy actors may see their allies, rather than opponents, as more powerful than they really are. Our results on perceived influence point the “angel shift” playing a role in all four networks because in all the countries actors tend to see their own collaboration partners as influential.

Our main theoretical contribution is to show that belief similarity and influence are not mutually exclusive as explanations for collaboration. Rather, both can explain collaboration simultaneously, and they do so primarily in conflictive policy contexts. Our study is the first to compare determinants of collaboration in high and low conflict contexts using several cases selected specifically for this purpose.

While going beyond the existing literature consisting mostly of single case studies, this research design does, of course, have its limitations. First, although our response rates are similar or even higher to those of most other policy network studies, it is nevertheless possible that there is a degree of non-response bias. However, we are confident that the effect of non-response on the results is limited. The respondents to the US survey the country with the lowest response rate—represented the range of perspectives on climate change (Jasny et al., 2015, 2018). Second, showing that beliefs and influence explain collaboration in two conflictual cases and that they do not in two non-conflictual ones does not, obviously, constitute proof that this would always be the case. It does, however, offer stronger support for this hypothesis than any earlier research has. Future research comparing a larger number of cases could further test the generalizability of this claim, and possibly uncover the mechanisms through which the degree of conflict in a policy subsystem affects collaboration patterns.

There is a significant amount of literature on comparative climate change policy (Bernauer & Böhmelt, 2013; Dolsak, 2001; Harrison & Sundstrom, 2010; Kammerer & Namhata, 2018; Lachapelle & Paterson, 2013). But many scholars have pointed out that there is a lack of comparative work on drivers of collaboration in policy processes, not just in climate change policy making but across many policy domains, such as education or social policy (e.g., Brandenberger & Metz, 2018; Ingold et al., 2017; Weible et al., 2019). Our results support the calls for more comparative research on drivers of collaboration in networks across different contexts. Scholars have also suggested that there is a need for such comparative studies to pay more attention to not only the macro-institutional context of the countries studied, but also to the specific policy context—the characteristics of the particular policy domain at the time when the research is conducted. This could be pursued by studying developments in the same policy domain across different countries through the policy cycle from high conflict decision-making situations to low conflict implementation phases. Such studies would contribute to further development of established public policy theories by specifying the conditions under which different theories on collaboration hold.

## Notes

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1. <https://obamawhitehouse.archives.gov/the-press-office/2016/02/25/fact-sheet-recovery-act-madelargest-single-investment-clean-energy>; <http://www.wri.org/blog/2010/09/fact-sheet-us-climateaction-2009-2010>.
2. <http://www.wri.org/blog/2010/09/fact-sheet-us-climate-action-2009-2010>.
3. [http://www.publicintegrity.org/investigations/climate\\_change/](http://www.publicintegrity.org/investigations/climate_change/).
4. As a robustness check, we re-run all our models with a beliefs similarity variable that is constructed using only four of the most contested policy ideas in each country (see Supplementary Material C and D for further details).

5. In section B of the Supporting Information we present the results for nine different models for each country, where we add complexity sequentially to improve our understanding of the relationship between the variables constructed to test our hypotheses and the structure of the national collaboration networks. In Supporting Information Section D, we present the results for versions of the models where we use an alternative of the belief similarity variable.

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