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The Evolution of Political Networks:

Evidence from the European Union

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Abstract

This study tests key propositions from network theory and signaling theory regarding the formation of political ties. Signaling theory posits that political actors are more likely to form a relationship if they have similar policy preferences and therefore explains variation in network ties with an individual-level variable. Network theory predicts that the likelihood of a tie between two actors depends on the presence of certain relationships with other actors. For instance, two actors are more likely to form a tie if they share many transitive linkages with other actors. Network theory therefore explains the occurrence of ties with characteristics of the network in which those actors are embedded. We examine the evolution of cooperation networks in the European Union since its enlargement to 27 members as a testing ground for these propositions. Our data consist of a unique combination of actors' policy positions and their network relations over time.

Word count: 8,480

The Evolution of Political Networks: Evidence from the European Union

Why are some pairs of political actors more likely to form enduring relations than others? This question is central to understanding the workings of any political system in which actors vie for influence over policy outcomes (Heclo 1978; Laumann and Knoke 1987; Knoke et al. 1996). Informal network relations are particularly pertinent in international policymaking, the focus of this study, where policymakers must accommodate a broad range of demands from different states if their agreements are to be complied with (Fearon 1998). This requires that state representatives build effective channels of communication through which they can exchange information and policy demands with other states. Likewise, at the domestic level, policymakers face the challenge of coordinating significant numbers of governmental and non-governmental actors. Networks have been heralded as a new mode of governance to solve collective action problems that are prevalent in such situations (Bardach 1998; Feiock and Scholz 2010).

Two broad explanations of political actors' network relations have been advanced (König and Bräuninger 1998; Carpenter et al. 2004; Berardo and Scholz 2010). First, signaling theory posits that actors seek ties with others who hold similar policy preferences (Austen-Smith 1993; Ainsworth 1993). Signaling theory was developed to explain interest groups' attempts to lobby each other and decision makers. Like contacts involving interest groups, contacts between decision makers during negotiations also entail communication with a view to solving policy problems and persuading other decision makers to alter their behavior. According to signaling theory, similar policy preferences imply the existence of congruent cognitive frameworks regarding relevant policy problems. Strong ties between likeminded

actors mean that networks reinforce differences among actors and mobilize bias within the system, thereby weakening the potential that networks have to solve collective action problems.

Second, network theory holds that characteristics of the larger network within which actors are embedded constitute the mechanisms that affect the likelihood that those actors will form ties with each other (Coleman 1988; Putnam 1993; Schneider et al. 1997; Burt 2005). For instance, some network models posit that the presence of many transitive relations between two actors strengthens the social trust they have in each other. This in turn increases the likelihood that a cooperative relation will develop between them. Other characteristics of the network, such as the presence of facilitating and reciprocal links, also feature in network-based explanations of political ties.

We test propositions from network and signaling theories using Snijders' (2005; Snijders et al. 2010) stochastic actor-based model of network evolution. This model allows us to examine whether the networks we study change over time in line with the theoretical propositions. Another attractive feature of this modeling approach is that it deals appropriately with the interdependencies among observations. Since our observations are the presence or absence of ties within ordered pairs of political actors, standard statistical techniques would be inappropriate.

We examine network relations in the Council of Ministers of the European Union (EU), which is a pertinent testing ground for the theoretical propositions. The Council is the most powerful decision-making body in the EU, which is the most extensive form of international cooperation in existence. The Council is the quintessential example of international policymaking where state representatives attempt to reach collectively binding agreements with each other. It is exactly the type

of political arena in which informal relations among political actors are salient. EU member states are diverse in terms of wealth, population sizes, domestic regulatory regimes and administrative cultures. Finding agreement therefore often requires protracted discussions in which state representatives communicate their policy demands and listen to those of others. Students of decision-making in the Council emphasize the importance of informal cooperative norms of behavior above formal procedural rules. For instance, although it is often possible for a decision to be taken with the support of a supermajority of member states, voting is rare and the norm is for discussions continue until a consensus is reached.

Our study combines two of the largest and most detailed datasets on EU Council decision-making that have been assembled. The first dataset contains information on the relations between each pair of member states' representatives in each of the Council's main sub-committees at three time points, before and after the 2004 and 2007 enlargements (Naurin and Lindahl 2010). The second dataset holds information on the policy demands of each of the member states on 125 of the most contentious legislative proposals to be debated in the EU during the past decade (Thomson 2011). The following section gives a synopsis of the Council of Ministers and highlights the relevance of cooperation ties between member states.

Decision-making in the Council of Ministers of the EU

Legislative decision-making in the European Union takes place in the context of inter-institutional negotiations involving the European Commission, the European Parliament (EP) and the Council of Ministers. The Council of Ministers is at the centre of the decision-making process examined here. The Council is divided into

sectoral Councils composed of national ministers from the relevant policy areas. For example, national ministers for agriculture meet in the Agriculture Council and national ministers for finance meet in the Economic and Finance Council (Ecofin). Below the ministerial level, many committees prepare ministers' decisions. The Committee of Permanent Representatives (Coreper) sits at the top of this committee structure. Coreper meets in two configurations: as Coreper I composed of the deputy permanent representatives to deal with social and economic matters and as Coreper II composed of states' ambassadors to deal with financial and foreign policy matters. Below this, there are many working groups composed of officials from each country. These officials are either based in their member states' permanent representations to the EU or in relevant national ministries. Legislative proposals are passed up and down the Council hierarchy during the decision-making process. Lower level committees may pass an issue they were unable to resolve upwards. Ministers may agree the general contours of a settlement and instruct lower level committees to work out the details. Our study examines network relations among member states' representatives at the level of Coreper (specifically Coreper I) and five working groups in a range of policy areas. Most of the substantive policy work is done at the working group level.

The formalities of decision-making in the Council include the allocation of voting rights among member states. The requirement that proposals must be approved by supermajorities, and in some policy areas unanimously, compels member states to build broad coalitions to enact policy change. Strong cooperation networks are essential to building such coalitions. Differences among states' population sizes are reflected in a system of supermajority voting called qualified majority voting (QMV), which now applies to most policy areas the EU deals with. In some particularly

sensitive policy areas, the Council must approve bills unanimously. According to QMV large states receive more votes than small states but small states are overrepresented relative to their population sizes. The QMV system and numbers of votes held by the member states were changed after the 2004 and 2007 enlargements, but the principle of regressive proportionality was kept.

The informal norms that structure decision-making in the Council also compel member states' representatives to form cooperative ties with each other. It is often remarked that the Council attempts to reach a consensus, even when QMV is formally required, and that actual votes are rare (e.g. Hayes-Renshaw and Wallace 2006: Chapters 10-11). Member states generally go to great lengths to avoid the disagreement outcome. Although there have been high-profile cases in which certain member states attempted to block legislative proposals, this is unusual behavior, and the norm is for member states to engage constructively in negotiations. Another important feature of Council decision-making is that member states' policy positions are diverse in the sense that there are only weak tendencies for certain member states to take similar positions; instead, states tend to coalesce on an issue by issue basis. These features of the Council put a premium on listening and responding to the concerns of minorities that could be outvoted if the voting rules were applied legalistically. Applying these behavioral norms requires that Council members cultivate effective channels of cooperation among themselves.

Figure 1 depicts a cooperation network in the policy area of agriculture, which illustrates some of the variation to be explained in this study. The data collection procedure will be described in more detail below. Briefly, each member state representative was asked to list the other states with which he or she most often cooperates. The arrow from a first member state to a second member state indicates

that a representative of the first state said that he or she cooperates with second state when forming a common position on agricultural issues. The figure shows that France and Germany are central to the network. Large states generally tend to receive more incoming ties than smaller states, although Spain and Italy receive relatively few incoming ties in the agricultural network considering their size. Some smaller states, such as Denmark and Austria in this case, receive relatively large numbers of incoming ties. There is considerable variation in the occurrence of cooperation ties, both in this policy area an in other policy areas and over time. This is the variation we aim to explain.
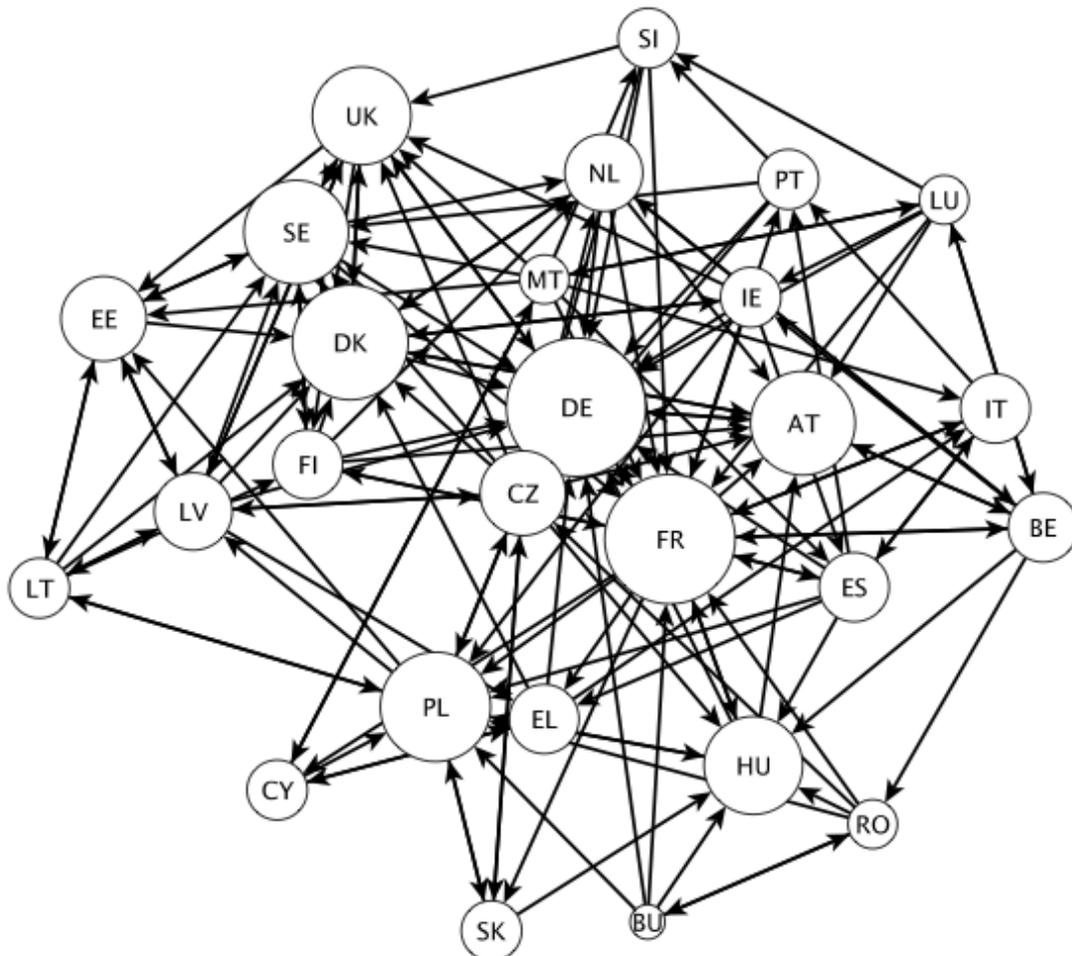

Figure 1 The cooperation network among EU member states' representatives in agriculture in 2009
Note: An arrow from state A to B indicates that A reports cooperating with B. The locations of the nodes are based on stress minimization, while the size is determined by the in-degree centrality of the member state (the number of other member state representatives who mention it as a cooperation partner). Graph produced with Visone. AT: Austria; BE: Belgium;

BU: Bulgaria; CY: Cyprus; CZ: The Czech Republic; DK: Denmark; EE: Estonia; FI: Finland: FR: France; DE: Germany; EL: Greece; HU: Hungary; IE: Ireland; IT: Italy; LV: Latvia; LT: Lithuania; LU: Luxembourg; MT: Malta; NL: The Netherlands; PL: Poland; PT: Portugal; RO: Romania; SI: Slovenia; SK: Slovakia; ES: Spain; SE: Sweden; UK: The United Kingdom.

Explanations of cooperation ties

Our explanation of cooperation ties focuses on actors' policy preferences and characteristics of the network in which they are embedded. In this respect, our theoretical concerns are similar to those of König and Bräuninger (1998), Carpenter et al. (2004), Thurner and Binder (2009) and Berardo and Scholz (2010). The size and direction of the effect of policy preferences compared to network characteristics have strong implications for the impact of cooperation ties on decision outcomes. If, for instance, actors tend to cooperate with others who hold similar preferences, then the effects of network ties may reinforce existing preferences, which may mean that the network has little effect on decision outcomes. By contrast, if actors frequently have ties with others with whom they disagree, network relations may be channels through which disagreements are played out and eventually resolved.

Policy preferences as explanations of political ties

Policy preferences feature prominently in some explanations of network ties. The basic proposition from signaling theory is that two actors are more likely to form a tie if their preferences are more congruent (Carpenter et al. 2004: 224-5). Signaling theory examines interest groups' decisions to initiate influence attempts and elected representatives' decisions to receive such influence based on, among other factors, the congruence between interest groups and representatives' interests (Austin-Smith and

Wright 1992; Austen-Smith 1993; Ainsworth 1993). The game played between interest groups and representatives is defined by interest groups' aim of maximizing their influence on policies and representatives' aim of identifying policies that maximize their chances of reelection. Ainsworth's (1993) model focuses on the costs that lobbyists incur when convincing representatives that their interests are aligned to those of representatives' constituents. Austin-Smith and Wright's (1992) model examines how representatives select the lobbying attempts that congrue with their constituents' interests. Interest groups have incentives to engage in counteractive lobbying to convince decision makers who hold different preferences from theirs, at least under certain conditions (Austin-Smith and Wright 1992). But decision makers always prefer to receive information from lobbyists whose preferences are similar to theirs. Signaling theory therefore features the actions of both senders and recipients of information in its explanation of network ties between actors. This has also been theorized as the supply (from interest groups) and demand (from representatives) sides of systems of interest group access (e.g. Baumgartner and Jones 1993; Mahoney 2004; Eising 2007)

Several studies of lobbying support the basic proposition from signaling theory that similar preferences increase the likelihood of a network tie. Bauer et al.'s (1972) seminal study, for instance, found that lobbyists were more likely to support legislators with similar preferences to theirs. Although there are exceptions, this general pattern of friendly lobbying has also been found in many other studies (Kollman 1997; König and Bräuninger 1998; Carpenter et al. 2004). In the US context, tight relations among like-minded interest groups, legislators and executive agencies have been termed "iron triangles" or "advocacy coalitions" (Sabatier 1988).

Studies of interest groups are relevant here to the extent that they highlight the relevance of similarities between actors' preferences to explaining the occurrence of ties. Our focus on ties between decision makers in committees is distinct in that all of the actors we consider have at least some voting power. Nonetheless, contacts among decision makers also take place in settings with imperfect information, where the actors hold different levels of information regarding the consequences of different policies in response to a policy problem. One important signal regarding the trustworthiness of information from other committee members is the extent to which those members had congruent preferences on similar issues in the past.

A theory of the causal link between preferences and network ties must consider the possibility that actors' preferences are endogenous. Actors may discover their preferences during their interactions with other actors, instead of entering into those interactions holding clear preferences. Moreover, if the ultimate purpose of political communication is to influence other actors, then the congruence between actors' expressed policy preferences may be a consequence, rather than a cause of network ties. A related consideration concerns the role of preferences in unstructured decision situations. Preference-based explanations may be less applicable in poorly structured decision-making situations in which the actors in the system position themselves differently on issues that emerge at different time points or are on the agenda simultaneously. At the extreme, if actors do not know their own or other actors' policy preferences, they cannot possibly form ties on the basis of those preferences. The possibility that actors' policy preferences are endogenous has a strong implication for our research design. Our measure of actors' policy positions must be independent of our measures of actors' network ties. We meet this

requirement by using measures of actors' policy agreement in the years prior to the time point at which we measured their network relations.

Since we are interested in the effect of the level of agreement between two actors' policy preferences on the likelihood that they form a tie, it would be inappropriate to control for characteristics of member states that cause congruence between their policy preferences. Previous research indicates that the strength of member states' domestic regulation and their net budgetary positions with respect to EU expenditures have significant effects on the similarities between their policy preferences on at least some issues (e.g. Thomson 2011: Chapter 6). Most of the new member states that joined in 2004 or 2007 share some similar characteristics that result in similar policy positions on some issues. Consequently, it would be inappropriate to control for these variables when estimating the effect of similarity in policy preferences on network ties.

Network characteristics as explanations of political ties

Social capital theory holds that certain social structures strengthen trust among the actors in a network (Coleman 1988; Putnam 1993; Schneider et al. 1997). These are dense structures in which actors are connected to each other via multiple paths. These links are more than just channels through which actors send information. These network structures also support mechanisms for actors to monitor and sanction each other in the event of behavior that violates social norms and creates collectively sub-optimal outcomes. Burt (2005) refined and formalized concepts from social capital theory with a view to identifying measurable aspects of social capital, notably the concepts of bridging and bonding social capital. Bridging ties are ties that connect

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otherwise unconnected sets of actors, even filling structural holes. Bonding ties connect otherwise connected sets of actors with new reinforcing links. Berardo and Scholz (2010) argue that such bonding ties help provide credible commitments in high-risk cooperation dilemmas.

Reciprocity. We expect to observe that actor *i* is more likely to cooperate with actor *j* if *j* cooperates with *i*. For social capital theorists, reciprocal ties are a salient characteristic of networks with high levels of social capital (e.g. Coleman 1999; Putnam 1993). Similarly, reciprocity is one of the main organizing principles of international relations identified by neoliberal institutionalism that enable states to overcome collective action problems (Axelrod and Keohane 1985; Axelrod 1984). By definition, reciprocal patterns of cooperation build mutual dependencies between the actors involved. Reciprocally connected actors become, at least to some extent, mutually dependent on each other for the supply of information and other forms of cooperation. Such mutual dependencies create benefits that would be lost if one of the two parties were to dissemble, which has the effect of lengthening the shadow of the future.

Our next two expectations are based on Carpenter et al.'s (2004: 227) point of departure: "Following a long tradition in network analysis (Fernandez and Gould 1994; Holland and Leinhardt 1971; Wasserman and Faust 1994), the key social structural unit we use to measure the impact of the social structure on the ties between two actors is the *triad*". Berardo and Scholz (2010: 636) also note that the triad is the simplest structure with which to model bridging and bonding elements of social capital. When considering the likelihood of a link between actors *i* and *j*, we examine all possible third actors (each referred to as "actor *h*"). We examine whether the presence of certain links between these third actors and actors *i* and *j* affect the

likelihood of a link from *i* to *j*. We distinguish between facilitating links and transitive links as depicted in Figure 2.
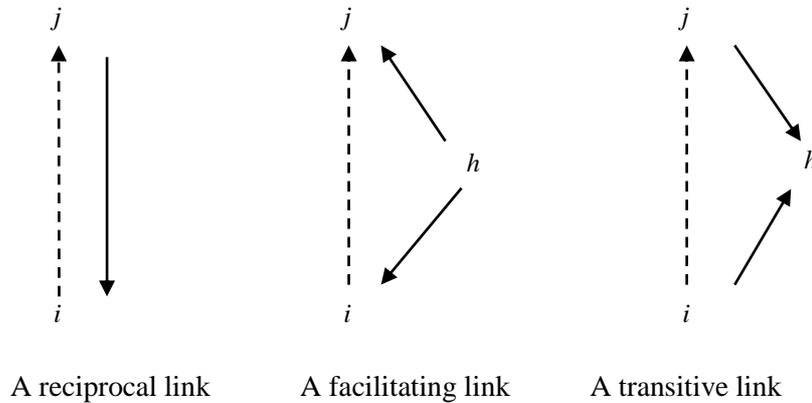

A reciprocal link   A facilitating link   A transitive link

Figure 2 Reciprocal, facilitating and transitive links between member states *i* and *j*

Facilitating links. We expect to observe that actor *i* is more likely to cooperate with actor *j* if *i* and *j* are in similar structural positions with respect to third actors. For instance, there may be many third actors that cooperate with both *i* and *j*. Facilitating links may reduce the costs of cooperation between *i* and *j*. Facilitators may also provide a "common frame of reference" to *i* and *j* on policy matters (Carpenter et al. 2004: 228). Likewise, if there are many actors in the network with which both *i* and *j* are not linked, this may also promote a common frame of reference, since both will be insulated from the influence of the same third actors. This argument suggests that the presence of facilitators, or more generally similarity between actors in their structural positions, affect actors' policy positions. As mentioned above, since we are interested in the effects of both preferences and network structures, our measures of actors' policy positions should be taken before the time point at which we observe the network ties.

Transitive links. Our expectation is that actor i is more likely to cooperate with actor j if there are more third actors with transitive links that connect i to j. Actor h provides a transitive link from i to j if both i and j cooperate with h (Figure 2). The importance of transitivity has long been observed in friendships at the individual level (Davis 1967; Hallinan 1974; Holland and Leinhardt 1971), which formalizes the common wisdom that "friends of friends are friends". Like reciprocal ties, ties that are embedded within transitive links increase the dependencies between the actors involved. This dependency increases the possibility of sanctioning non-cooperative behavior. For instance, actor i can cooperate with actor j in the knowledge that it (i) could report misbehavior on the part of j to h. Since j also cooperates with h, it is likely that j derives some benefit from cooperating with h, and therefore wishes to avoid such sanctioning behavior. A related argument concerns the trustworthiness of information flowing from j to i, which presumably conditions actor i's decision to cooperate with j (Carpenter et al. 2004: 230; Berardo and Scholz 2010: 636). If actor i cooperates with h, this implies that i is satisfied with the information it receives from h. If, as is the case in a transitive link, j also cooperates with h, this implies that j is also satisfied with the information it receives from h. This positive evaluation by j of h may increase the trust that i has in the information provided by j, since it implies that j's standards regarding the quality of information are at least as high as i's standards. Consequently, this increases the likelihood of cooperation.

The above expectations regarding the effects of reciprocal, facilitating and transitive links encapsulate a view of network ties seen through the lens of social capital theory. Carpenter et al. (2004) also put forward an alternative informational efficiency model from which they derive the opposite predictions for facilitating and transitive links. They argue that if actors i and j are already connected by facilitating

or transitive links, then adding a relation from i to j is superfluous in terms of the efficient flow of information. From this perspective, the occurrence of facilitating and transitive links between i and j would reduce the likelihood of a link between i and j.

Our analyses also include the effects of the total numbers of outgoing ties held by actor i (outdegrees) and the number of incoming ties held by actor j (in-degrees). These are standard effects included in almost all network models (Snijders et al. 2010: 47). We noted earlier that there is a tendency for larger member states to attract more incoming ties, although there were some exceptions to this pattern. Since it is plausible that population size at least partly causes the number of in-degrees of an actor, and we are interested in the effect of actor j's in-degrees, we do not control for population size in our models.

Research design

The research design brings together the datasets from two recent major studies of decision-making in the European Union. The first study examined the network relations between each pair of member states in the main subcommittees of the Council at three time points: 2003, 2006 and 2009 (Naurin and Lindahl 2010). The second study focused on decision-making on the major controversial legislative proposals in the period 1998-2008 (Thomson et al. 2006; Thomson 2011). Part of that second study involved describing the policy positions of each of the member states on the issues raised by each of the selected legislative proposals. Connecting these datasets allows us to test preference and network-based explanations of network ties. More details of the procedures followed in these two studies can be found in the

publications cited above. Here, we give a summary of the main points that are relevant to the present study.

Measuring cooperation networks

Information on the network relations among member state representatives was obtained through a survey of officials from the representations of all member states to the EU in Brussels. Three surveys were conducted, in 2003, 2006 and 2009, which therefore gives data from both before and after the enlargements in 2004 and 2007. All representatives in eleven selected committees and working groups in the Council were approached for the interviews. Six of these committees are included in the present study due to data limitations (referred to in Table 1). Both a high-level committee and lower-level working groups were included, involving a broad range of policy areas, such as economic policy, internal market, agriculture, foreign and security policy, environment, and justice and home affairs. In order to facilitate comparisons over time the sample of working groups was kept as similar as possible in the three rounds. The interviews were conducted by telephone after the interviewees had been contacted with a letter, which explained broadly the purpose of the project and the types of questions addressed There was a high response rate in all three rounds: 81 percent in 2003, 84 percent in 2006 and 86 percent in 2009. In total, 618 member state representatives were interviewed: 130 in 2003, 231 in 2006 and 257 in 2009.

In all three surveys, the following question was asked:

Which member states do you most often cooperate with within your working group, in order to develop a common position?

On the basis of respondents' answers to this question, we identify the network relations between member states. The question posed focuses respondents' attention on direct contacts with people from other member states in their working groups. The respondents were only asked to mention the member states they cooperate with most often, not to give points or rank them in any way. Respondents were free to list up to ten other member states with which they cooperated.[1] Their answers revealed a pattern of directed cooperation relations for each committee, as introduced earlier in Figure 1.

Table 1 Descriptive statistics

Dependent variable	P				
Link from states i to j	.20				
Categorical independent variables		*Count/scale independent variables*	mean	s.d.	range
Link from states i to j	.19	i out-degree	4.86	2.19	1-12
Year of survey		j in-degree	4.18	2.91	0-16
2003	.06	Count of facilitating linkages	.86	1.19	0-9
2006	.40	Count of transitive linkages	.83	1.12	0-8
2009	.54	Proportion of policy agreement	.42	.21	0-1
Committee		between i and j			
Coreper I	.16				
Agriculture	.26				
Environment	.18				
Justice and Home Affairs	.16				
Competition	.16				
Taxation	.08				

Note: n=5,694. Observations are directed dyads of member states. P: Proportion of observations.

For each directed dyad of member states, we identified the number of third member states that displayed facilitating and transitive links with respect to the

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[1] Alternative procedures for collecting network data have strengths and weaknesses, some of which are specific to the context in which the network data are collected. The focus on relations that involve cooperation to form a common position is appropriate given that qualitative accounts of decision-making in the Council emphasize the prevalence of consensual and inclusive norms of behavior (e.g. Hayes-Renshaw and Wallace 2006). The possibility for respondents to give up to ten answers is appropriate given the considerable differences among member states in terms of bureaucratic capacity and interest in different policy areas. These differences mean that in any given policy area states may differ in their capacity and willingness to engage with a large number of cooperation partners.

member states in the ordered dyad in question. The counts of facilitating and transitive links range from 0 to 8 or 9 (Table 1).

Member states' policy positions

We construct measures of the similarity between each pair of member states' policy positions based on a study of decision-making on controversial legislative proposals in the period 1998-2008 (Thomson et al. 2006; Thomson 2011). For a selected 125 legislative proposals, a team of researchers held face-to-face semi-structured interviews with key informants to obtain information on the controversies raised by these proposals and EU actors' policy positions on these controversies.

Table 2 illustrates the information we draw from this study with the legislative proposal on sugar sector reform. This was the first important reform of agricultural policy that took place after the 2004 enlargement. Eleven semi-structured interviews were held with experts from the member states' permanent representations, the Commission and the European Parliament. The main controversial issue raised by this proposal was the size of the price cut, which would reduce EU subsidies for sugar production. Member states took six distinct policy positions on this issue, ranging from Poland's support for keeping the then current level of subsidy for sugar production, to Denmark, Estonia and Sweden's demand for a very large cut in the intervention price and level of subsidy. Other member states took positions between these alternatives.[2] The second issue in the sugar case is the extent to which producers

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[2] The original dataset from which we took this information includes key informants' judgments of the location of these alternatives on standardized policy scales, each of which ranges from 0 to 100. We do not use this information to construct our measures of policy agreement, but instead focus on the relative frequency of agreement. In doing so, we respond to the potential concern that the distances are not comparable in the sense that the same distance on two or more policy scales refers to different

should be compensated for the price cut. Member states that favored smaller price cuts tended to favor higher levels of compensation. Given a certain budget available for financial compensation, larger price cuts meant that a smaller percentage of producers' losses could be compensated. However, some member states called for an increase in the budget available for compensation, and compensation was treated as a separate issue in the discussions. Denmark and Sweden shared the same position on the issue of the price cut, while Denmark was more isolated on the issue of compensation. The third issue raised by the sugar sector reform concerned the sequencing of cuts in production quotas for different types of sugar. Although rather technical, this issue was the subject of considerable disagreement between some of the new member states on one side of the argument and most of the old member states on the other. The new member states favored cutting the so-called B-quotas before cutting the A-quotas. Without dwelling on the technicalities, a sequential cut would have benefited the new member states' sugar industries because of the types of quotas they held at that time; they wanted to protect their A-quotas.

The dataset contains detailed information on member states' policy positions on each of the 125 selected legislative proposals, like that summarized in Table 2. These 125 proposals raised 331 controversial issues, which were described in detail by key informants. Legislative proposals were selected according to three criteria: the time period, the type of legislative procedure and the level of political importance. Regarding the time period, legislative proposals were included if they were on the Council's agenda in the years 1999 and/or 2000, or were discussed for the first time in the Council after the 2004 enlargement. Legislative proposals introduced up to June 2008 were included in the post-2004 study. The selection consists of 69 legislative

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substantive differences between policy options. In addition, our coding decision means that our measures of policy agreement and network ties are all based on counts.

proposals from the EU-15 period (i.e. proposals that were on the Council's agenda in 1999 or 2000) and 56 from the post-2004 period. Concerning the decision-making procedure, the selected legislative proposals were subject to either the consultation or the codecision procedures, the two most commonly used procedures. Regarding political importance, the selection was restricted to proposals on which there was an indication of at least some political importance and controversy. Each proposal was mentioned in news services covering European affairs: *Agence Europe* in the EU-15 period or *Agence Europe* and *European Voice* in the post-2004 period. Furthermore, key informants had to identify at least one substantive disagreement between at least some of the actors. Directives, regulations and decisions were included in the EU-15 study, but decisions were excluded from the post-2004 part of the study. The effect of changing the news services and instruments in the post-2004 study was to focus the selection on more high-profile proposals. The policy areas represented most prominently in the selection are agriculture (twenty-six proposals), internal market (eighteen), Justice and Home Affairs (eleven) and fisheries (fourteen). However, many other policy areas are present too. This allows us to construct measures of the proportion of controversial issues on which each pair of member states share the same position in several different policy areas for which we have network data.

Information on controversial issues and actors' initial positions on these issues was collected in 349 semi-structured interviews with key informants. These interviews typically lasted between 60 and 90 minutes. The key informants were selected for their knowledge of the detail of the dossiers under investigation. Individuals with different institutional affiliations were interviewed. The 47 Commission officials interviewed were responsible for drafting the proposals and/or monitoring the subsequent discussions. The 236 officials from the permanent

representations were the responsible desk officers. The 45 individuals from the EP were either MEPs or their assistants. A further nine interviewees worked in the Council secretariat and twelve in interest groups.

Table 2 Member states' policy positions on the sugar sector reform

Issue	Positions	Member states
Size of price cut	No cut (high subsidy)	PL
	"Much smaller cut" than proposed by the Commission	CY, EL, IT, ES
	"Smaller cut" than proposed by the Commission	FI, HU, IE, LV, LT, PT, SI
	Cut of 33%	AT, LU, NL
	Cut of 39%	BE, CZ, FR, DE, MT, SK, UK
	Cut of more than 39% (low subsidy)	DK, EE, SE
Amount of compensation for sugar producers	100% compensation	EL, HU, IT, LV, LT, PL, PT, ES
	"More compensation" than proposed by the Commission	AT, BE, FI, IE, SI
	60%	CZ, FR, DE, LU, NL, SK
	40%	MT, SE, UK
	Complete liberalization	DK
Merging of A and B quotas	Merge quotas then cut	AT, BE, DK, FI, FR, DE, EL, IE, IT, NL, PT, ES, SE, UK
	Cut B-quotas first, then A-quotas if necessary	CZ, HU, LV, LT, PL, SI, SK

Validity and reliability tests were conducted on the estimates provided by informants. These tests compared informants' judgments with information from Council and EP documentation, and compared judgments from different informants (Thomson et al. 2006). These tests show that of all the points of discussion raised in the Council, key informants generally focus on issues that are more controversial, and that are more difficult to resolve. Informants' estimates of actors' policy positions usually match information reported in Council documentation. When they differ, these differences are due to the fact that Council documents do not refer to initial policy positions, but to the decision outcomes actors were prepared to accept during

the course of the negotiations. König et al. (2007) also compared 31 point estimates provided by key informants from the Council with estimates from informants in the European Parliament and found that 30 match perfectly or almost perfectly.

Merging the two datasets

We identified six committees from the network study with which we could match at least some of the positional data from the decision-making study. First, Coreper I was included in all three waves of the network study, 2003, 2006 and 2009. Since Coreper I is a high-level coordinating committee, it deals with legislative proposals from all policy areas included in the decision-making study. Therefore, we matched the network relations in a given year with measures of policy agreement based on legislative proposals that were introduced in previous years. Specifically, we matched the 2003 network data with legislative proposals that were on the Council's agenda in 1999 and/or 2000. We matched the 2006 network data with legislative proposals introduced in the period 2003-2005. This timing obviously precludes the possibility that our positional data are influenced by the network data. The policy agreement measure is the proportion of controversial issues raised by the relevant set of legislative proposals on which the two member states in question took the same policy position.

The other five Council committees we include in this study are policy specific working groups. Network data from each committee in a given year were matched with legislative proposals from the relevant policy area in previous years. We included as many committees and years as possible, but were limited by the exclusion of some committees from some years of the network study and by the exclusion of

some policy areas from some years of the decision-making study. As well as Coreper I, the following five committees are included with network data on at least some years: 1) the working group on agriculture in 2003, 2006 and 2009[3]; 2) the working group on environmental policy in 2006 and 2009; 3) the working group on taxation in 2003, 2006 and 2009; 4) the working group on Justice and Home Affairs (Article 36 committee) in 2006 and 2009; and 5) the working group on competition from 2006 and 2009.[4] The merged dataset contains 5,694 observations (ordered dyads of member states) for which we have information on all relevant explanatory variables. Table 1 contains descriptive statistics for our variables of interest.

The Model

Snijders' (2005; Snijders et al. 2010) model of network evolution focuses on changes in actors' outgoing ties. In this model each actor decides whether or not to change an outgoing relationship by creating or dropping a tie. The model estimates a range of effects on actors' decisions, including effects associated with network structures such as those depicted in Figure 2, and characteristics of egos (i.e. the actors taking the decisions to create or dissolve links), alters (i.e. the actors to which egos consider linking), and dyads (i.e. pairs of actors). Our key variable, policy agreement, is a characteristic of dyads. The odds that actor i will change its outgoing ties is estimated by the so-called objective function, which is a function of the network as perceived by

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[3] The network study actually includes two related agricultural working groups, the special committee on agriculture and the agriculture working group, which contain very similar network ties. We merged the data from these two agricultural committees.
[4] The decision-making study did not include environmental proposals of relevance to the 2003. The network study did not include justice and home affairs or competition in 2003. The network study also included several other committees for which no relevant positional data from the decision-making study were available, such as the working group on security issues. These network data were excluded from the present study.

actor i. Actors optimize their objective functions in the sense that they have a higher probability of forming ties that increase the value of their objective functions. Actors perform this optimization while being constrained by the effects included in the model, the changes made by other actors, and by random effects. The interdependencies between actors' decisions are part of the simulation procedure discussed below. The objective function for actor i with respect to j is defined as:

$$f^{net}(x_{ij}) = \sum_k \beta_k^{net} s_{ijk}^{net}(x_{ij}) + \beta_k d_{ijk}(x_{ij}) + \varepsilon^{net} \qquad (1)$$

Where x_{ij} is a tie from actors i to j, and takes a value of 1 for the presence of a tie and 0 for the absence of a tie; β_k is the number of parameters to be estimated; s_{ijk}^{net} are the structural network characteristics to be estimated, in particular the effects of reciprocity, facilitating links and transitive links; d_{ijk} is the characteristic of the dyad of which we want to estimate the effect, policy agreement; and ε^{net} is a stochastic error term. Stochastic error is due in part to actors' limited knowledge regarding the network structures surrounding them.

The network effects are defined as follows.[5] We define reciprocity $s_{i\,reciprocity}^{net}$ as the number of reciprocated ties:

$$s_{i\,reciprocity}^{net}(x) = \sum_j x_{ij} x_{ji} \qquad (2)$$

The presence of facilitating links is defined by the structural equivalence between actors with respect to incoming ties:

$$s_{i\,in-equivalence}^{net}(x) = \sum_j x_{ij} z_{ij} \qquad (3a)$$

with

$$z_{ij} = \sum_{\substack{h=1 \\ h \neq i,j}}^{n} -\left| x_{hi} - x_{hj} \right| \tag{3b}$$

Transitive links are defined as transitive triplets:

$$s_{i\ transitivity}^{net}(x) = \sum_{j,h} x_{ij} x_{ih} x_{jh} \tag{4}$$

These are ordered pairs of actors (j,h) to both of which i is tied, while j is also tied to h. In addition to these effects derived from network theory, we also include out-degree density:

$$s_{i\ out-density}^{net} = \sum_{j} x_{ij} \tag{5}$$

The effect of out-degree density reflects the average tendency of actors to create ties to others in the network. Negative coefficients for out-degree density suggest a low expected odds (below 50%) of a link for a tie within a dyad of actors, whereas positive coefficients indicate high expected odds (above 50%) of a link. The final network effect included in the model is in-degree popularity:

$$s_{i\ in-popularity}^{net} = \sum_{j} x_{ij} x_{+j} \tag{6}$$

This final effect is also referred to as the popularity of alter effect. It is the sum of the in-degrees of the other actors to which i is tied. The effect represents the tendency for actors to choose other actors that are already popular cooperation partners in the network. Figure 1 illustrated that certain member states, particularly large ones, appear to be relatively attractive cooperation partners. This effect controls for this phenomenon. In-degree popularity has also been linked to the so-called Matthew effect (Price 1976), according to which actors who are frequently nominated by others in the network become increasingly attractive for potential partners in the network. The network evaluation function predicts the odds of a tie between actors i and j as the following ratio:

$$e^{f^{net}(x_{ij})} = \frac{\Pr(x_{ij} = 1)}{\Pr(x_{ij} = 0)} \qquad\qquad (7)$$

The estimation procedure deals appropriately with the inevitable interdependencies among observations that are inherent in network data. A standard frequentist model, such as a logistic regression, would fit the parameters based on the observed frequencies of ties within each ordered pair of dyads of states. While such an approach may detect the patterns that exist in the data, it would ignore the fact that ties between any two actors depend on the ties between those two actors and other actors in the network. Indeed, this is the essence of the propositions from network theory that we seek to examine. Snijders' stochastic model assumes that the process of network evolution unfolds in continuous time, and that the observed moments are snapshots of this process. The model draws observations of actors and moments randomly from the available observations. The model treats the first observation moment as a point of reference and focuses on how the network develops in subsequent observation moments. Therefore, the available observations from which the random draw is taken consist of those observations after the first observation moment or wave. The randomly selected actor decides to maintain or abolish and existing link or create a new link where none exists in line with the network evaluation function. This procedure is then repeated for another randomly selected actor. When the selected actors decide to change their outgoing ties, this leads to changes in the network structures that affect other actors' choices. The model assumes that the changing network is the result of a Markov process in which the current state of the network is a dynamic constraint on its development. This enables the model to estimate the set of coefficients that best fit the observed changes in the network over time. The model also includes a rate parameter that estimates the average number of changes that actors have to make between each of the observation moments to

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account for the observed differences in network structures between those moments. This is therefore an indication of how much the network changes between observation moments. For a more technical exposition of the estimation procedure we refer to Snijders (2005). Snijders van den Bunt and Steglich (2010) give an article-length non-technical introduction to the method.

Results

Table 3 reports the results of the stochastic actor-based network model for each of the six committees separately. The rate parameters are higher for the period between the first two observations, 2003-2006, than for the second two observations, 2006-2009. This means that the actors on average had to make more changes to their network ties during the first period than the second period to account for the observed networks. This is mainly due the fact that ten new member states entered the network in 2004.[6]

The main finding that emerges from these results is that the dynamics of network evolution differ between the lower-level working groups and the higher-level coordinating committee, Coreper. Lower-level working groups have network dynamics that are affected by reciprocity, transitivity and in-degree structural equivalence, of which facilitating linkages are part. Policy agreement has a weak effect at most on the development of network ties in working groups. By contrast, in the higher-level coordinating committee, network characteristics appear to have no

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[6] This is also reflected in low Jaccard indexes for the first period (.13, .25 and .13 for Coreper, Agriculture and Environment). The Jaccard index measures the amount of stability in the network (Snijders et al. 2010: 49). In general, social network analysts caution that low Jaccard indexes of below .30, which reflect a large amount of change, may indicate that the observation moments are too far apart. However, when there is reason to believe that this change is caused by a large number of newcomers between the observations lower Jaccard values are acceptable. We also conducted analyses excluding the observation moments associated with low Jaccard values and obtained similar results. Model convergence was satisfactory for all models, as indicated by low t-statistics.

effects on the development of the network. Meanwhile, policy agreement has a marked effect on the evolution of the network of this higher-level coordinating committee.

Table 3. Analysis of network dynamics in six Council committees

	Coreper I	Agriculture	Environ- ment	Taxation	Justice & Home Affairs	Compe- tition
Rate parameter 2003--2006	6.72 (2.39)	7.37 (1.52)	9.96 (2.80)	-	-	-
Rate parameter 2006--2009	4.90 (0.76)	1.26 (8.85)	6.38 (1.07)	8.62 (1.50)	7.02 (1.07)	10.59 (1.96)
State A's out-degree (density)	-2.49 (1.41)*	--1.70 (0.23)***	-1.91 (0.38)***	-2.37 (0.66)***	-3.36 (0.91)***	-2.59 (0.79)***
State B's in-degree (popularity)	0.26 (0.36)	0.11 (0.05)**	0.18 (0.12)	0.17 (0.12)	0.25 (0.14)*	0.15 (0.12)
Reciprocity: Link from B to A	0.09 (0.46)	0.47 (0.18)***	0.43 (0.28)	1.00 (0.35)***	0.21 (0.35)	0.59 (0.48)
Transitive linkages (Transitive triplets)	0.03 (0.31)	0.10 (0.04)**	0.20 (0.11)*	0.14 (0.08)*	0.15 (0.13)	0.27 (0.11)**
Facilitating linkages (in-structural equivalence)	0.58 (0.40)	0.14 (0.04)***	0.23 (0.11)**	0.18 (0.14)	0.38 (0.17)**	0.20 (0.16)
Proportion of policy agreement (0-1)	6.25 (1.97)***	1.19 (0.44)***	1.67 (0.48)***	0.36 (0.36)	0.44 (0.40)	-1.06 (0.94)

Note: Coefficients (standard errors in parentheses) from longitudinal SIENA analysis. For Coreper I, Agriculture and Environment, the network data are taken from 2003, 2006 and 2009. For Taxation, Justice & Home Affairs and Competition, the network data are taken from 2006 and 2009.
***: $p<.01$; **: $p<.05$; *: $p\leq.1$.

Consider first the effects of network characteristics on the development of the networks in the lower-level working groups. Reciprocity has a positive and significant effect in two of the five working groups: agriculture and taxation. In the working group that deals with agriculture the coefficient of .47 indicates that the odds that actor i will establish a new network tie another actor increases by 1.60 (i.e. $\exp(.47)$) if this tie is reciprocated. The outdegree effect of -1.70 indicates that the baseline odds that i creates a link with another randomly selected actor is .18 when all other variables, including reciprocity, equal zero. The odds that actor i will establish a new tie increases to .29 (i.e. $\exp(-1.70 + .47)$) when the tie is reciprocated.

Transitive links have (marginally) significant effects in four of the five lower-level working groups, all with the exception of the working group dealing with justice and home affairs. Of the working groups, the largest coefficient is found in the committee dealing with competition. This is an important committee that deals with many legislative proposals that are central to Europe's internal market. The coefficient of .27 means that every increase in the count of transitive ties between actors i and j increases the odds that actor i creates a tie with j by 1.31 (exp(.27)). Since the number of transitive links between any two actors in the network ranges from 0 to 8, this represents a maximum possible increase of 8.67 in the odds of observing a tie. The baseline odds of observing a tie in the competition working group increases from .08 (exp(-2.59)) when there are no transitive links connecting actors i and j to .65 (exp(-2.59+(8*.27))) when there are eight transitive links connecting the two actors. The effect is somewhat weaker but nonetheless substantively important in the other four committees mentioned above.

In-degree structural equivalence, of which the presence of facilitating links are part, also has a noteworthy effect on the evolution of network relations in three of the five working groups we study: agriculture, environment and justice and home affairs. Actors i and j are structurally equivalent when they have similar links with other actors in the sense that the same other actors mention (and refrain from mentioning) both i and j as cooperation partners. Pairs of actors with higher in-degree structural equivalence have higher odds of choosing each other as cooperation partners. The odds that an actor will form a tie increase by 1.46 (exp(.38)) with a one-unit increase in the measure of in-degree structural equivalence. The maximum number of facilitating links in the network is nine. So in the justice and home affairs committee,

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the baseline odds that an actor will form a tie increase from .03 (exp(-3.36)) to 1.06 (exp(-3.36+(9*.38))).

Policy agreement has a significant and positive effect on the formation of political ties in three of the six committees we examine: the high-level coordinating committee, Coreper, and two working groups, agriculture and environment. The effect of policy agreement is particularly large in the high-level Coreper committee. In the model referring to Coreper, the variable policy agreement ranges from a low of 0.20 to a high of 0.70. The baseline odds of a tie from i to j is .08 (exp(-2.49)). At the lowest observed level of policy agreement, this baseline odds is .29 (exp(-2.49+(6.25*.20))). At this highest observed level of policy agreement, this baseline odds increases to 6.59, meaning that actors are over six times more likely to form a tie than not.

Conclusions

Our findings demonstrate that network characteristics affect cooperative relations between political actors over and above the effects of policy agreement between those actors. We examined several mechanisms though which the patterns of relations in which actors are embedded affect their propensity to cooperate with others. The evidence indicated that in various policy-specific working groups of the Council, reciprocity, transitivity and facilitating links have significant positive effects on the likelihood of a tie. This means that under certain circumstances actor i is more likely to cooperate with j if 1) j cooperates with i (reciprocity) and 2) if there are many third actors who also cooperate with i and j (transitivity), and 3) if i and j are in a similar structural position regarding their incoming ties, such that there are many third actors

who say they cooperate with both *i* and *j* (facilitators) as well as third actors who say that they cooperate with neither *i* nor *j*. In addition, the evidence flatly contradicts the informational efficiency model of network ties in which actors form ties with otherwise unconnected others. From this perspective, the cooperative relations we observe are inefficient. This means that many of the cooperative relations we observe are unlikely to provide actors with information that they would not have in the absence of these relations.

Social capital theory provides the basic insight that relations which are inefficient from an informational perspective can bring significant benefits to the social system as a whole and its members (Coleman 1999; Putnam 1993). Social systems held together with dense networks of reciprocal and transitive ties have social capital that enable them to overcome collective action problems. Similarly, in neoliberal institutionalist theory, reciprocal ties create interdependencies that help states overcome collective action problems (Axelrod 1984). Actors who are embedded in reciprocal and transitive relations have opportunities to monitor and sanction their cooperation partners for dissembling. In systems with high levels of social capital, recalcitrant actors face retaliation by the severing of reciprocal links and/or links from third actors. Researchers in other contexts have arrived at similar conclusions regarding the effects of network structures on relations among interest groups and between interest groups and public agencies (e.g. Carpenter et al. 2004; Berardo and Scholz 2010). Our findings indicate that these relationships also hold for international decision makers in the most powerful legislative body of the European Union, particularly in policy-specific sub-committees of the Council.

Policy agreement between two actors positively affects the likelihood of a tie between them even after controlling for network characteristics. The positive effect of

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preference similarity is not widely present in the working groups of technical officials we examined, but is of a substantial size in the high-level coordinating committee staffed by more senior diplomats. Like our findings on network characteristics, several previous studies also found this pattern in other contexts, with respect to interactions among interest groups and between interest groups and public agencies (e.g. Bauer et al. 1972; Lauman and Knoke 1987; Koenig and Braunniger 1998; Carpenter et al. 2004). High-level committees generally deal with politically salient issues that are of substantial importance in their domestic arenas. These committee members are therefore exposed to more intense pressure, and their policy preferences are more stable. Our findings indicate that signaling theory is more applicable in these settings.

Our findings also have implications for understanding decision-making in the EU's most powerful legislative body, the under-researched Council of Ministers. Observers often note that there is a "culture of consensus" in the Council in which member states representatives attempt to accommodate other states' interests, even when the voting rules do not compel them to do so, and are often prepared to shift their initial policy positions. While this general observation is accurate and informative, our findings add nuance to this general insight. In particular, the finding that member states' network ties in policy-specific sub-committees are not (or at most weakly) affected by patterns of previous policy agreement means that states' representatives often cooperate with others who hold dissimilar policy positions on controversial issues. Therefore, cooperation networks do not strongly reinforce existing policy differences, particularly at the working group level where much of the important policy work gets done. Moreover, to the extent that member states are

bound together by reciprocal and transitive relations implies that the Council's political system has social capital that supports trust among its members.

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