Network Ties, Social Capital, and Multilateral Cooperation*

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Abstract

What enables states to act collectively in multilateral fora? Each decision takes place within a broader set of interactions in international society that are shaped by power relationships and embedded within overlapping institutional commitments. Some states are highly connected, while others are isolated. Our goal is to identify these distinct social roles and assess their impact on collective action. We construct cooperation networks of defense alliances and intergovernmental organization (IGO) co-memberships from 1961 to 2014 as a measure of ties between states that build trust and reciprocity analogous to social capital at the individual level. Using a dynamic blockmodel, we identify latent groups of states with similar tie-formation profiles. These groups capture the social roles – highly connected versus isolated – that describe the position of states in cooperation networks. The model estimates the latent groups while accounting for shared interests that also lead them to form ties. We then test how group membership affects voting in the United Nations General Assembly (UNGA). States embedded in dense communities characteristic of high social capital exhibit greater voting cohesion on controversial resolutions across issue areas, whereas isolated states fail to coordinate. This pattern is strongest for defense alliances and IGO co-memberships; trade networks do not display the same property. In comparison with other groups, the voting cohesion among some members of the high density cooperation networks approaches that of members of Cold War alliance blocs, or members of small multilateral clubs such as the OECD or the AU. Our broader network-based measure provides a comprehensive perspective on the value of social capital for multilateral cooperation. These findings highlight the social foundations of multilateralism by demonstrating how cooperation networks support cohesive decision-making on critical issues.

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1 Introduction

Terms like "the West" or "the Global South" classify states by more than geography. The West extends beyond NATO to include states linked by capitalism, globalization, or democracy, while the Global South combines traditions of non-alignment with shared development interests. Although these groupings have no clear borders or formal membership rules, they illustrate the multidimensional ways in which states coordinate. Few states act alone, and their partners often extend well beyond their immediate neighbors. From nuclear proliferation to economic development, groups of states work together to advance shared interests.

What shapes the structure of international society? While anarchy makes cooperation difficult, states nonetheless coordinate extensively through information exchange and international institutions (Keohane, 1984; Axelrod and Keohane, 1986). Much of the existing literature emphasizes state-level conditions that facilitate cooperation, yet network approaches demonstrate how ties formed through international organizations generate broader patterns of interdependence among states (Cao, 2009; Hafner-Burton and Montgomery, 2006; Kinne, 2013a). Sociological approaches and the English School similarly argue that international society is constituted through patterned diplomatic interactions among states that create enduring relational structures (Bull, 1977; Adler and Pouliot, 2011). Sustained cooperation can give rise to distinct communities within international society, as captured by Adler and Barnett's theory of security communities (Adler and Barnett, 1998). These communities are underpinned by trust and socialization: generalized trust can enable coordination under anarchy (Rathbun, 2011), while repeated interaction within international institutions can further socialize states and stabilize cooperative behavior (Johnston, 2007). Building on these insights, we examine how participation in international agreements generates groups capable of coordinated collective action in multilateral fora.

We draw on the concept of social capital, defined as networks and norms of reciprocity that en-

able collective action. Although social capital originates at the individual level, it can aggregate into community-level behavior (Coleman, 1988; Putnam, 2000). We contend that, just as local communities with higher social capital act collectively, communities of states embedded in dense networks develop trust and reinforce cooperation at the international level. Moving beyond regional or institutional classifications commonly used in prior research, we identify communities of states empirically using network structure, allowing us to capture the social foundations of multilateral coordination.

Our analysis focuses on defense alliances and international organization memberships as key forms of cooperation. Using a dynamic mixed membership blockmodel (Olivella et al., 2022), we identify the social roles of states within these networks and then assess their influence on collective action. For the analysis of the behavioral impact of social capital, we examine voting in the United Nations General Assembly, which is an important forum for states to act on global issues. Our network modeling allows us to compare cohesion across groups, holding the similarity of individual state preferences and the broad shared interests between states in each community at comparable levels. We show that states embedded in denser networks vote with greater cohesion on controversial issues, while isolated states fail to coordinate. The effect is strongest in defense alliances and IGO co-memberships, which are more strongly associated with the trust and reciprocity central to social capital. We then benchmark our results against individual geopolitical and institutional categories, showing that dense network groups exert a similar substantive effect. Yet not all network ties are equal, for we do not see any cohesion among groups defined by ties within a network of preferential trade agreements. The higher levels of trust surrounding commitments on defense and generalized cooperation may be more conducive to social capital formation than would occur through economic commitments.

In an era when multilateralism faces new challenges, it is more imperative to re-examine the sources of cooperation. Our research offers leverage to understand broader systemic changes. By placing mul-

tiple commitments among a large number of states into a single theoretical framework, we aggregate an important sphere of interactions among states. This contributes to research on socialization at the international level (Johnston, 2001; Davis, 2025). Our empirical model of network analysis shows the possibility to predict which states are more likely to work together. This can reveal where shifts in ties in one forum could have implications for cooperation in other forums or issues. In the current period of heightened geopolitical rivalry, attention focuses on the great powers. Yet the alignment of other states is harder to observe and may be changing in different ways. Through looking back at the last fifty years of international cooperation, we hope to develop tools that may prove useful for future efforts to map the realignment that may take place now.

2 Social Capital and Collective Action

Multilateral institutions provide forums in which states with shared goals and agreed decision-making procedures can interact, but they do not solve the core problem of how states coordinate collective action on specific policies. In domestic politics, political parties play this role by organizing competing preferences, structuring coalitions, and advancing coherent legislative agendas; a similar function is partially fulfilled by party groups in the European Parliament. At the international level, however, no equivalent partisan structure exists. In the absence of international political parties, states form shifting coalitions based on economic interests, regional ties, cultural affinity, or geopolitical alignment. Although states hold identifiable ideological preferences that shape their behavior in multilateral institutions (Voeten, 2021), shared interests or ideology alone are insufficient to overcome the well-known barriers to collective action (Olson Jr, 1971). We argue that coordination emerges through trust and institutional ties among states. These ties create communities that function as informal counterparts to political parties, providing structure for international cooperation.

The challenge of collective action is central to understanding political organization. From local villages to global governance, actors struggle to establish rules for behavior that will provide public goods beneficial to the community. Some research emphasizes information and incentives, while others highlight the role of trust in shaping cooperation (Ostrom, 2000). This opens a broader agenda: the key question is not only whether cooperation is possible in a given environment, but also why some actors or communities succeed more than others.

Variation in outcomes can be explained by social capital, which refers to forms of social organization that provide resources for collective action through networks and reciprocity norms. These resources arise from the structure of relations among actors Coleman (1988). Where social capital is strong, voluntary coordination becomes possible. As Putnam notes, social capital "improves the efficiency of society by facilitating coordinated actions" (Putnam et al., 1994). He gives the example of rotating credit associations: members contribute to a common pool that is distributed to one participant on a rotating basis. The puzzle is why individuals choose to participate rather than take the money and run. Putnam argues that an underlying stock of social capital facilitates the cooperation because it makes people trust that others will not defect. A large body of research further suggests that by fostering collective action, higher levels of social capital are associated with greater voter turnout and stronger economic performance (Putnam et al., 1994; Fukuyama, 1996; Abrams et al., 2011; Atkinson and Fowler, 2014; Whiteley, 2000; Knack and Keefer, 1997; Lins et al., 2017).

At the international level, policies ranging from environmental protection to collective security require collective action among states to provide global public goods, yet the absence of common governance structures makes cooperation especially challenging. Classic accounts frame interstate cooperation as a Prisoner's Dilemma, in which iterated interaction and shared expectations are necessary to sustain cooperation over time (Keohane, 1984; Axelrod and Keohane, 1986). The logic of diffuse reciprocity

underlying these functional theories connects directly to the concept of social capital, as repeated interaction allows states to adjust expectations about future behavior. Constructivist approaches similarly emphasize that ongoing exchanges constitute formative processes that shape state identities, norms, and views of appropriate conduct (Wendt, 1992; Johnston, 2001).

Central to both perspectives is trust. As Rathbun (2011) argues, generalized trust produces "anarchical social capital" that enables leaders to commit to multilateral cooperation. Trust can be generated through multiple pathways, including expectations of reciprocity developed through repeated cooperation (Axelrod and Keohane, 1986), costly signals of trustworthiness such as military restraint and international agreements (Kydd, 2005), and socialization through sustained interaction within international organizations (Johnston, 2001). Diplomatic practice further builds trust at the leader level, as direct engagement shapes perceptions of credibility and reliability (Yarhi-Milo, 2013), while everyday diplomatic practices reinforce norms of reciprocity and cooperation (Adler and Pouliot, 2011). Beyond diplomacy, trust may also emerge through interdependent security practices, such as military procurement decisions that signal shared strategic orientations (Adler and Barnett, 1998, p. 54). Empirical evidence supports the centrality of trust: publics with higher levels of generalized trust are more supportive of multilateral security institutions (Rathbun, 2012), while treaty exit erodes trust and reduces future willingness to cooperate (Schmidt, 2025). Taken together, this literature highlights trust and repeated interaction as forms of social capital that underpin sustained multilateral cooperation.

3 Social Capital in Dense Cooperation Network Communities

Despite its importance, social capital remains an unobservable and ambiguous concept. Social capital consists of relational ties among individuals that facilitate collective outcomes through mutual trust (Coleman, 1988). It refers to the intangible features of individuals and communities that support co-

operation, which makes it difficult to measure and inherently endogenous in its formulation (Paldam, 2000).

We address this challenge by using densely connected communities in international cooperation networks as a proxy for social capital. This approach builds on research that measures variation in social capital at the individual level through the density of interpersonal networks and voluntary associations. In his classic study, Putnam et al. (1994) illustrates regional differences in Italy by comparing the prevalence of voluntary organizations, such as choral groups, in the North and South.[1] When a group of states is densely connected, it forms a community of trust based on willingness to undertake voluntary cooperation. These communities resemble societies made up of individuals. We attribute social capital arising from the density of institutionalized ties, and expect it will lead to greater ability to coordinate for collective action in multilateral fora.

Our approach takes a network perspective on international relations. This recognizes the interdependence of decisions among states. Network relationships among states have been found to influence conflict levels (Hafner-Burton and Montgomery, 2006; Greenhill and Lupu, 2017; Olivella et al., 2022). In particular, we are interested in how the institutional ties binding states together reflect and reinforce relationships with a broad significance for cooperation. Kinne (2013b) writes, "international cooperation is governed by endogenous network influences; the creation of international agreements and institutions directly affects the cooperative efforts of others." Building on this insight and applying a newly developed network model, we map the network of ties among states.[2]

Among the various types of ties between states, which better captures social capital? There are lay-

[1] Other works have also used the density of associations and social networks to proxy social capital and studied its impact on political organization (Coleman, 1988; Berman, 1997; Paxton, 2002; Satyanath et al., 2017, e.g.). These studies include findings where association density was correlated with political action, but differ in whether it supported or undermined democracy within the specific context of historical examples.

[2] Where Kinne focuses on bilateral agreements, we allow both bilateral and multilateral agreements to enter our network. He applies a stochastic actor-oriented model, we apply the dynamic mixed membership block model regression. We explain more detailed differences between the two methods in the Research Design and Methods section.

ers of ties that bind states together. The first is recognition. In the international system, the most basic rights of sovereignty are often contested and compromised (Krasner, 1999; Buzan, 2017; Greenhouse and Davis, 2020; Barkin, 2021). The establishment of diplomatic relations represents a formal agreement with legal standing and rights. Through the exchange of embassies governments open channels of communication that can support subsequent cooperation. We conceive of this as a baseline dyadic measure of a tie that increases the possibility of other institutional relationships.

In a second level, states form ties that serve specific goals to deepen cooperation. We refer to these as cooperation networks. Defense pacts and joint membership in IGOs are widespread and will be the focus of our study. One could expand the range of institutional ties to include investment treaties, environmental cooperation, and other integration agreements. Through the separate analysis of networks within each type of agreement, we allow their community structure to differ and can model the interests that promote the formation of institutional ties. Then we analyze how these ties form a network of states that are connected to each other.

Defense treaty allies share a commitment to cooperate over the most important goal of protecting national security. Joint security production requires a high level of trust and close social ties between partner states. Otherwise, security cooperation would be too risky. A state only joins defense alliances when it believes it faces very low risks of opportunism (Leeds, 2003; Lake, 1999). In a policy area with low transparency, states must trust that their counterparts will not take advantage of the defense agreement for their own benefit (Kinne, 2018). Defense alliances not only build on trust and social networks but also reinforce them. In the case of defense alliances, the agreement to defend another country against an attack creates interest in mutual strength and solidarity. This can support cooperation on other issues when an ally favors liberalizing trade among allies more than with rivals (Gowa, 1994; Mansfield and Bronson, 1997). It also gives rise to social interactions. Allies frequently participate in

routine meetings, joint military exercises, and demonstrations of unity, which credibly signal resolve (Kertzer, 2016). These social interactions go beyond reinforcing shared security interests to create a more general "moral convention that promises should be kept" (Snyder, 2007).

Similarly, joining IGOs requires high levels of trust between states. Membership often entails long-term commitments under conditions of uncertainty. Theories of international institutions emphasize that IGOs help to overcome collective action problems and reduce uncertainty by providing arenas for information exchange, monitoring, and socialization that strengthen shared expectations of cooperation (Keohane, 1984; Johnston, 2001). According to Rathbun (2011), generalized trust must precede the decision to enter into these agreements. Furthermore, the accession process tends to favor groups of like-minded states whose shared interests and values can sustain cooperation (Davis, 2023). Following accession, repeated interaction through regular meetings and expectations of future cooperation further reinforce trust, while membership itself serves as a marker of status within communities defined by shared association (Gray, 2013; Hooghe et al., 2016; Davis, 2023).

Other institutional ties will also promote exchange of information and commitments, but they may vary in the reliance on trust. For example, exchanges of benefits occur frequently and continuously in trade, with shorter time horizons. The involvement of business actors adds more layers to the interaction as firms serve as stakeholders with incentives to monitor and uphold commitments. These conditions support self-enforcing agreements based on reciprocity, but according to a logic of credible retaliation rather than trust (Bagwell and Staiger, 1999). In their important study of preferential trade agreements as a network structure, Hafner-Burton and Montgomery (2009) contend that the process of trading through these agreements generates social capital among members, but they emphasize that network centrality matters for structural dependence and bargaining leverage to reward and punish other states rather than as a channel for group-level trust. In comparative perspective, ties formed through trade agreement

networks may exhibit a weaker correlation with trust than those formed through defense treaties or shared membership in intergovernmental organizations.

The position of states in cooperation networks gives rise to groups with three distinct social roles: connected states, intermediaries, and isolated states. Connected states are embedded in dense within-group networks, where repeated interaction and overlapping institutional ties generate high levels of social capital. Intermediaries, by contrast, maintain ties to many different states but lack dense connections within any single group, limiting their capacity to consolidate cooperation. Isolated states are weakly embedded in cooperation networks; their sparse and shallow ties provide few opportunities for sustained interaction or the development of trust.

We expect the gains from collective action to accrue primarily to the group of connected states. When states are densely linked through ties rich in social capital, they form communities characterized by shared trust and overlapping commitments. Each institutional tie provides a forum for interaction, similar to a bowling club in Putnam's account, and the connected group resembles a society with high associational density. Within such communities, ongoing interaction reinforces trust and reciprocity, lowering the barriers to agreement and enabling members to coordinate and present unified positions on critical issues. The group of isolated states, by contrast, lack the dense within-group ties that support social capital. With fewer interactions and weaker expectations of reciprocity, they face greater obstacles to coordination and are less able to act collectively. We hold weaker expectations for intermediaries: although their bridging ties may facilitate information flow across groups, the absence of dense within-group ties limits their capacity to sustain collective action.

This logic leads to the following hypothesis:

Hypothesis: *State groups with dense within-group ties will achieve higher levels of collective action on critical issues.*

We measure collective action using voting behavior in the United Nations General Assembly (UNGA). The UNGA is the main forum in which a large number of states regularly vote on issues of international concern (Voeten, 2000). UNGA resolutions strengthen international norms, serve as principles for other treaties (Mesquita and Pires, 2023), and shape public attitudes (Shelef and Zeira, 2017). Voting in the UNGA, especially on important and controversial resolutions, can therefore have real-world consequences. Each roll-call vote presents an opportunity for states to act collectively by taking the same position, either in support of or opposition to a resolution. Voting cohesion within groups of states therefore captures their capacity to coordinate and advance collective action on critical global issues.

We argue that relational ties within networks shape states' capacity to cooperate in ways not captured by shared interests alone. While underlying interests remain an important driver of voting behavior and may correlate with the density of ties among states, network-based social capital provides an additional source of coordination that is not confined to particular policy domains. Our empirical strategy accounts for interest-based explanations by ensuring that similarity in state characteristics is comparable across communities and by examining group dynamics across different types of issues. If cohesion within a community simply reflected shared interests, it would be expected to vary by issue. Social capital, by contrast, supports more generalized cooperation. We therefore expect communities formed through dense defense ties to exhibit voting cohesion beyond security issues, and communities defined by IGO co-membership to display cohesion on security-related votes.

4 Research Design and Methods

Our empirical analysis consists of two parts. First, we analyze the structure of defense alliance, IGO co-membership, and trade agreement networks, identifying the social role of each state in these three networks on an annual basis. Substantively, a social role captures a state's probability of forming ties with different states in a given year. Using a mixed membership blockmodel regression, we estimate the latent group that categorize states with similar patterns of tie formation, and we estimate the probability for a state to be a member of each latent group. Taken together, states' mixed memberships across latent groups allow us to identify connected states characterized by dense within-group ties.

Second, we evaluate collective action across these groups by analyzing voting cohesion among states in the United Nations. Using logit regressions with two-way fixed effects for year and country-level heterogeneity, we examine the effect of latent group membership probabilities on UNGA key votes. This allows us to test our hypothesis that states with dense within-group ties display higher voting cohesion on critical issues.

4.1 Modeling Network Structures and the Formation of Latent Groups

Our main analysis focuses on the defense alliance and IGO co-membership networks formed by 200 countries from 1961 to 2014.[3]. The nodes in the network represent states, and the ties between them capture the existence of defense alliance pacts or a high level of shared IGO co-memberships. We use defense alliance data from the Alliance Treaty Obligations and Provisions Project (ATOP), which codes all defense pacts signed during this period (Leeds et al., 2002). For IGO membership, we use data from Davis and Pratt (2021) based on the Correlates of War (COW) International Organizations Dataset (Pevehouse et al., 2004). For IGO co-membership, a tie is coded between two states in a given year if the

[3]This choice is based on the availability of state-level covariates *MIDS* and *log(CINC)*.

number of IGOs they jointly belong to is greater than the median number of shared IGO memberships across all state pairs in that year. We allow the networks to change every year. Both the defense alliance network and the IGO co-membership networks are undirected and unweighted, so *Defense Alliance*$_{ijt}$ takes 1 if there is a defense pact between state i and j in year t and takes 0 otherwise. Similarly, *IGO Co-membership*$_{ijt}$ equals 0 or 1 as an indicator of whether the pair has high shared memberships in a given year. We also analyze the trade agreement network as a comparison, using data from the Design of Trade Agreements (DESTA) Database (Dür et al., 2014).[4] A tie exists between two states if they have a trade agreement in a year.

Our research question concerns how states' positions within systems of institutional cooperation shape their subsequent collective behavior. Cooperative ties and the trust surrounding them are inherently interdependent across pairs of states. States' choice to trust and cooperate with another state depends on their broader connections, so that addressing this question requires a modeling strategy that explicitly captures network structure while yielding interpretable summaries of states' cooperative roles. We therefore model cooperative ties as networks in which edges represent sustained institutional cooperation. Our goal is to identify the tie-formation patterns of states in these networks over time and to link them to behavior in the UNGA.

A wide range of network models has been applied in international relations, each emphasizing different aspects of interdependence. Exponential Random Graph Models (ERGMs) (Robins, 2014; Cranmer and Desmarais, 2011) capture how local structural dependencies like reciprocity or transitivity shape tie formation, while Stochastic Actor-Oriented Models (SAOMs) model how networks evolve as actors ad-

[4]The DESTA Database includes all agreements that have the potential to liberalize trade. Partial scope agreements thus are included as soon as they liberalize at least some trade, whereas framework agreements (with very few exceptions), trade and co-operation agreements, etc. are excluded. See `https://www.designoftradeagreements.org/media/filer_public/e2/46/e246b1d6-0992-4bdc-905d-26cb93a9f7fe/desta_codebook_02_00.pdf`. The DESTA database documents the new trade agreements signed as well as states' withdrawal from them. We check whether each state dyad still has any trade agreements between them each year.

just ties in response to incentives and constraints (Kinne, 2013b, 2016; Chyzh, 2016; Kinne and Bunte, 2020). Latent space models explain tie formation based on affinity between dyads (Ward et al., 2013). These approaches are especially valuable for studying micro-level dynamics of tie formation and diffusion. However, they are less well suited for our purposes because they do not directly summarize the system-level cooperative roles that emerge from patterns of institutional cooperation.[5] This gap has led scholars to adopt system-level methods that classify states based on their positions within the broader network.

One prominent system-level approach is community detection, which partitions networks into groups with denser ties within groups than between them. Such methods have been used to identify blocs in diplomatic exchange networks (Renshon, 2016), UNGA voting (Macon et al., 2012), trade (Beardsley et al., 2020), and international cooperation more broadly (Edgerton, 2024). Community detection is useful for describing camps or clusters in the international system, but it does not distinguish among qualitatively different social roles. States that are tightly embedded in a cohesive group, largely isolated states, and states that span multiple clusters can all be assigned to the same community. As a result, community assignments may conflate fundamentally different patterns of network embeddedness. Related summary measures such as centrality are also widely used in international relations, but they capture how connected a state is overall rather than to whom it is connected, and they do not distinguish among factions or roles.

To address these limitations, we estimate a dynamic mixed-membership stochastic blockmodel with covariates (dynMMSBM) (Olivella et al., 2022). This model is particularly well-suited to our research question because it identifies latent groups in a substantively interpretable way. In the model, each latent group is characterized by a tie-formation profile: a set of probabilities governing the likelihood of

[5]Chaudoin et al. (2015), for example, uses spatial models to capture interdependence between states' actions, but such models do not summarize the structure of cooperative relationships at the network level.

forming ties with members of each group, including itself. States assigned to the same group share a tie-formation profile that acts as a summary of their cooperation pattern. We interpret group membership as describing the social roles for connected, intermediary, or isolated states.

In addition, the model allows us to address observable sources of homophily and dyadic dependence. Shared interests and common state characteristics may simultaneously shape network connections and cooperation in multilateral fora. We include dyadic covariates to control for observable interest-based factors, such as trade flows and geographic distance, while isolating the influence of network structure. Monadic covariates measure common sources of homophily that may drive grouping patterns, including regime type and economic size. Examining the explanatory power of these monadic covariates also allows us to compare how the degree of in-group similarity varies across groups.

Formally, the outcome variable Y_{pqt} equals 1 if state p has a defense alliance pact, IGO co-membership tie, or trade agreement with state q in year t, and 0 otherwise. The model assumes that each state has a mixed membership over latent groups at each point in time, which define social roles. Higher probabilities of tie formation within a group are interpreted as evidence of latent social capital embedded in multilateral cooperation networks. Within a connected group, any particular state is likely to form ties with all other group members. As these membership probabilities evolve dynamically, states' social roles may change over time. Monadic covariates explain variation in group membership, while dyadic covariates account for observable factors affecting tie formation between pairs of states. Conditional on these dyadic covariates, the blockmodel component captures systematic patterns of interaction that remain unexplained.

In short, the dynMMSBM enables us to: (1) identify dense, isolated, and mixed-role patterns of cooperation; (2) track how these roles evolve over time; (3) account for dyadic covariates that might otherwise confound the relationship between cooperation and UNGA voting; and (4) assess whether

observable state characteristics explain group membership. A full technical specification of the model is provided in Section A.1.

We use the model to identify three latent groups, a choice guided by interpretability and model fit.[6] Adding more latent groups produces groups with similar structural characteristics and states will shift constantly between them, indicating that the additional group is not meaningful.[7] We incorporate both monadic and dyadic covariates to explain the formation of cooperation networks. At the state level, we use variables *log(GDP)* and *log(GDP per capita)* to measure their economic development.[8] We incorporate the variable *log(CINC)*, which is the logged Composite Index of National Capability, to measure power and national capability.[9] The conflict propensity of a state may also affect its likelihood of signing cooperative agreements. We create a variable to measure militarized interstate disputes *MIDS*, the number of military conflicts a state engages in each year.[10] The variable *polity2* is the Polity score that measures regime type.[11] In the defense alliance network, we account for whether a state is a UN member and add a dichotomous variable *UN*. In the trade agreement network, we include membership in the WTO or GATT as an additional monadic covariate.

We also consider factors at the dyad level that could affect the likelihood for any pair of states to sign an agreement. First, we consider whether two states have formal diplomatic representation. The dichotomous variable *diplomatic representation* indicates whether two states have diplomatic represen-

[6]We incorporate two Markov states in the model, allowing the relationship between monadic covariates and group membership to evolve over time. In both the defense alliance and IGO co-membership network models, the majority of observations fall into the first Markov state. Models with a single latent state yield substantively similar results.

[7]We show the result for the defense alliance network with four groups in Figure B13 in the Appendix. Kenya, as an example, illustrates this point.

[8]GDP and GDP per capita data are from the World Bank's World Development Indicators (WDI), retrieved from `https://databank.worldbank.org/source/world-development-indicators`.

[9]CINC data are from the Correlates of War (COW) Composite Index of National Material Capabilities (v6.0) dataset and measure a state's share in the world across the following components of power: total population, urban population, iron and steel production, energy consumption, military expenditure, and military personnel (Singer et al., 1972).

[10]MIDS data are from the monadic version of the Correlates of War (COW) Militarized Interstate Disputes (MIDs) dataset (Palmer et al., 2022)

[11]The Polity scores are from the Polity5 Project, retrieved from `https://www.systemicpeace.org/polityproject.html`.

tation ties at the level of charge d'affaires, minister, or ambassador in a given year.[12] Second, in the IGO co-membership and trade agreement network model, we also control whether two states are in the same *defense alliance*. In the defense alliance and IGO co-membership network, we account for whether two states have a *trade agreement*. Additionally, we account for the *distance* between two states, and the variable *contiguity* measures whether two states are contiguous. *colonial dependence* captures whether two states have ever had colonial dependence relationships (one state being a colony of the other). The variable *log total trade* is the logged total trade flows between two states each year.[13] Finally, the dyadic variable *MIDS* measures whether two states are in a military conflict with each other.[14]

4.2 UNGA Key Votes Data and Model

The second part of our empirical analysis focuses on how latent group memberships in the two cooperation networks correlate with collective action. According to our hypothesis, we expect to see more unified action by latent groups with denser in-group ties, especially in the defense alliance and IGO co-membership networks. We use cohesion on key votes in the UNGA to measure collective action.[15] These votes are on the most controversial resolutions where there was not a clear majority decision.[16] We focus specifically on controversial votes because these are the cases where active collective action is most likely to show up. We also conduct robustness checks with all votes and with those identified as important by the US, and the results remain consistent.[17] We classify votes as "Approval" and "Non-Approval," the latter including voting "No," "Abstain," or "Absent." There are 4956 votes in total, with

[12] Data on diplomatic representation are from the Diplomatic Representation Database (DDR) (Moyer et al., 2021, 2022).

[13] Distance, contiguity, colonial dependence, and total trade data are from the CEPII Gravity Database (Conte et al., 2022).

[14] MIDS data are from the dyadic version of the Correlates of War (COW) Militarized Interstate Disputes (MIDs) dataset (Palmer et al., 2022)

[15] UNGA voting data is from Voeten (2013).

[16] A vote is controversial if both the proportion of Approval/Non-approval is below the median level of majority vote share in the dataset.

[17] Votes important to the US are those identified as important by US State Department report Voting Practices in the United Nations. The data is also from Voeten (2013).

2643 controversial votes and 381 important votes according to the US in our analysis.

After estimating the network models, we will obtain a state's mixed membership vector in each year for each network separately. To understand how membership in the latent groups affects voting in the UNGA, we estimate the correlation between the estimated probability of a state being in a latent group and whether it votes with the majority of group members in the following year.

We examine whether being in the same group influences countries' voting patterns on controversial issues. Our goal is to analyze (1) whether latent group membership makes states vote together with their group and (2) how the effect of group membership depends on the density of ties within the group. The unit of analysis is country-vote-group. The dependent variable is whether a state voted with the group majority in a vote. We define the group majority vote as the majority vote of states with the highest probability of being in this group (compared to the two other groups). For example, if a state has a 60% probability of being in Group 1, a 10% probability of being in Group 2, and a 30% probability of being in Group 3, then we count its dichotomous group membership as Group 1 and include its vote when calculating Group 1's majority vote. For each country-vote observation, we exclude this country when calculating the majority vote. The dependent variable is a dichotomous variable that takes the value 1 when a state's vote matches the majority of the group and 0 otherwise.

The independent variable is a state's estimated probability of being in each group, lagged by one year. Since each state's probability of being in Groups 1, 2, and 3 sums to 1, we exclude Group 3 from the model to avoid perfect collinearity, and it serves as the baseline. We interact membership probabilities with the corresponding group indicators to explore how latent groups moderate their effects. In this way, the model allows group-specific effects of the membership probability variable.

Since the dependent variable is dichotomous, we run a logit model with country and vote level fixed effects, as shown in equation (1). Here, i denotes country, j denotes latent groups, and v denotes vote.

Each country-vote observation is expanded into three country-vote-latent group observations. P_{ijv} is the membership probabilities of state i in the corresponding group j the year before vote v . $G1_j$ and $G2_j$ are indicators of whether this country-vote observation is for Group 1 or Group 2. Both of them take 0 when the observation is for Group 3.

$$\begin{aligned} P(\mathrm{Y}_{ijv} = 1) = \text{logit}^{-1}[\, & \beta_0 + \beta_1 \cdot \mathrm{P}_{ijv} + \beta_2 \cdot \mathrm{G1}_j + \beta_3 \cdot \mathrm{P}_{ijv} \times \mathrm{G1}_j \\ & + \beta_4 \cdot \mathrm{G2}_j + \beta_5 \cdot \mathrm{P}_{ijv} \times \mathrm{G2}_j \\ & + \alpha_i + \gamma_v] \end{aligned} \tag{1}$$

5 The Structure of International Cooperation Networks

In this section, we introduce the network model results on the three networks. The goal of this model is to estimate the latent group structure of the cooperation networks, as well as the mixed membership of each state in these groups over time. Given the tie-formation pattern of each latent group, each state's mixed membership reflects its social role.

5.1 The Defense Alliance Network

Figure 1 illustrates the estimated structure of the defense alliance network. The left panel (a) shows the estimated blockmodel. Group 3 is the largest with 52.3% of all state-year observations. It is followed by Group 1 (28.6%) and Group 2 (19.1%). The right panel (b) plots the dynamic change in aggregate membership in the latent groups. Over time, the aggregate membership probabilities for Groups 1, 2, and 3 remain relatively stable.

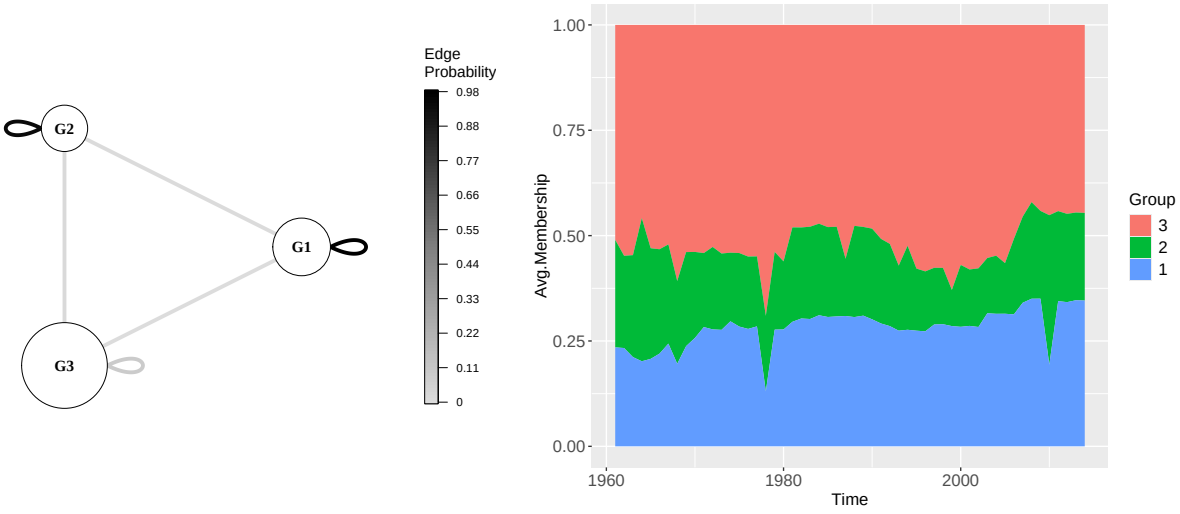
In the global defense alliance network, states within Group 1 are most likely to sign defense pacts with each other after accounting for dyadic covariates (any two states in Group 1 have a 98.5% proba-

bility of forming a tie with each other). These are mostly the US and its closest allies in Latin America and Europe. Table A1 shows the list of countries that are most likely to be in the three groups.[18] For example, the US, the UK, Chile, and Argentina often instantiate Group 1. The US and the UK are NATO members, while Chile and Argentina are both non-NATO allies of the US. Importantly, states like the UK and Argentina are identified as being in the same group because they share dense defense ties with common partners, even if they do not have direct defense ties. This helps us detect a community of states cooperating in the network. Group 2 states have a slightly lower probability (94.5%) of signing defense pacts within the group.[19] States that are also active in signing defense pacts but are outside of the small circle of US allies, such as Saudi Arabia, Egypt, Russia, and Algeria, are often in Group 2. Finally, Group 3 identifies a group of isolated states in the defense alliance network. Their probability of having defense ties with others in the group is only 9.2%, and they are also very unlikely to establish defense ties with states in the other two groups. Ukraine, Switzerland, China, and India are examples of Group 3 members.[20] The overall structure of the global defense alliance network is highly segregated. Groups 1 and 2 are closed clubs, and the probability for states to share defense ties between the two groups is extremely low (0.4%).

The dense within-group ties of Groups 1 and 2 satisfy the conditions for the social role of connected states with high social capital to support coordination within their community. Group 1 states primarily form alliances with other Group 1 members, producing a dense and internally cohesive cluster. Group 2 states likewise concentrate their ties within their own group, forming a separate dense cluster that is largely disconnected from Group 1. Together, these patterns indicate two distinct alliance communities characterized by strong in-group ties and minimal cross-group connections. In contrast, Group 3 states

[18] For interpretation purposes, we only list countries that have an average population larger than 5 million.
[19] Note this probability is after accounting for dyadic covariates.
[20] We show the mixed membership of eight states over time as examples in Figure A1 in the Appendix.

are largely isolated, forming few alliances overall and thus are less likely to develop the social capital that facilitates coordination among the other groups.



(a) Blockmodel (b) Aggregate membership

Figure 1: Network Structure and Latent Memberships in the Defense Alliance Network

Note: In Panel (a), the nodes (circles) represent the three latent groups. The size of the nodes indicates the groups' membership size. The edges between the nodes represent the estimated probability a state from one group forms a defense pact with nodes from the other group. Panel (b) shows the average membership proportion in the three latent groups from 1961 to 2014.

The monadic covariates show the characteristics of states in the same latent group. Table 1 presents the effect of monadic covariates on group membership. The estimates are from a Dirichlet regression, where the coefficients represent the changes in the probabilities of being in a group relative to other groups as the covariates change. Therefore, each coefficient should be interpreted relative to the estimates of the same predictor in the other two groups, rather than by its absolute value or direction. The most powerful predictor of group membership is the logged CINC score. Comparing three coefficients for the CINC score across groups, we find states with high national capability are the most likely to be in Group 1 and least likely to be in Group 3. UN membership is also a strong predictor. UN members are most likely to be in Group 1 and least likely to be in Group 3. However, when taking into account all covariates, the effect of CINC and UN membership on predicted mixed membership probability is indistinguishable

from zero. We visualize the marginal effect of them on group membership in Figure A2 in the Appendix. The other covariates are even less strong to predict group membership with large standard errors relative to the estimates. This confirms that the similarity of states within the same latent group is comparable. Social roles in dense groups are not proxies for similar underlying characteristics.

Predictor	Group1	Group2	Group3
(Intercept)	4.027 (1.017)	5.025 (1.017)	7.040 (1.017)
log(GDP)	-0.014 (1.017)	-0.017 (1.017)	0.050 (1.017)
log(GDP per capita)	0.018 (1.017)	-0.042 (1.018)	-0.258 (1.017)
log(CINC)	7.578 (1.017)	5.853 (1.017)	4.137 (1.017)
polity2	0.032 (1.017)	-0.028 (1.017)	-0.010 (1.017)
MIDS	-0.036 (1.017)	0.022 (1.017)	-0.027 (1.017)
UN	-5.231 (1.017)	-5.788 (1.018)	-7.300 (1.018)

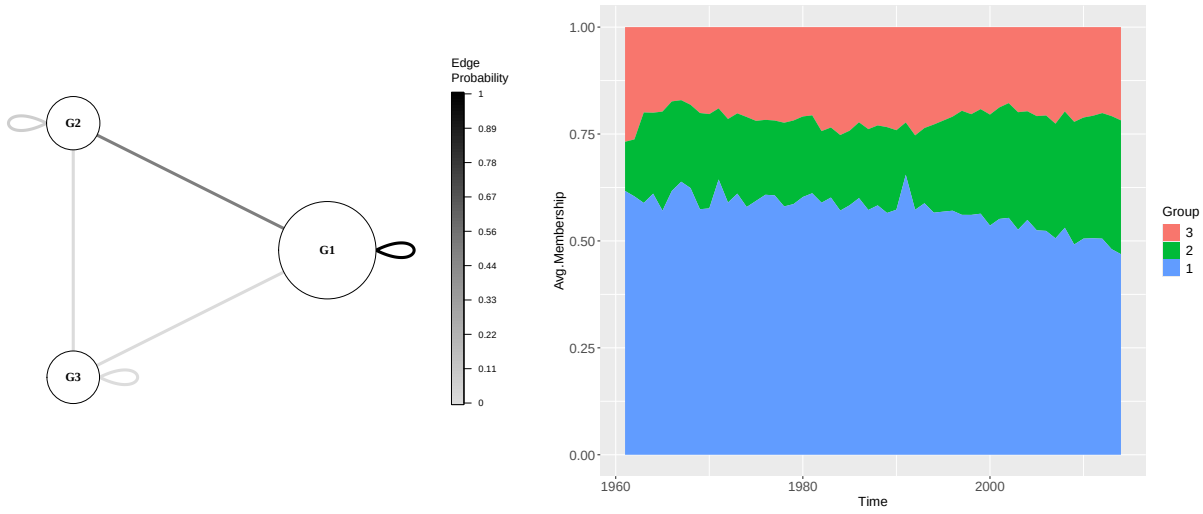
Table 1: Monadic Covariates in the Defense Alliance Network

Note: The model was in the first latent state for over 98% of the time, so we report coefficient estimates in this state. The estimates are coefficients of a Dirichlet regression, and standard errors are in parentheses.

Finally, the dyadic covariates control for reasons that two states sign a defense pact beyond their latent group memberships. Figure A3 presents the estimated effects of these covariates. Other forms of institutional ties such as trade agreement and diplomatic representation have a stronger effect on the probability of defense tie formation than other dyadic measures like trade flows, distance, or shared conflict involvement. In the network modeling context, however, our primary goal is to identify latent groups based on defense ties after controlling for these factors that shape tie formation.

5.2 The IGO Co-membership Network

Figure 2 shows the estimated structure of the IGO co-membership network. The left panel (a) shows the estimated blockmodel. Group 1 is the largest group, while Groups 2 and 3 have similar proportions of membership. The right panel (b) plots the dynamic change in aggregate membership in the latent groups. The proportion of membership in the three groups remains relatively stable over time.



(a) Blockmodel (b) Aggregate membership

Figure 2: Network Structure and Latent Memberships in the IGO Co-membership Network

Note: In Panel (a), the nodes (circles) represent the three latent groups. The size of the nodes indicates the groups' membership size. The edges between the nodes represent the estimated probability a state from one group forms an IGO co-membership tie with nodes from the other group. Panel (b) shows the average membership proportion in the three latent groups from 1961 to 2014.

In the IGO co-membership network, states within Group 1 are most likely to have strong IGO ties with each other (with a 99.9% probability) after accounting for dyadic covariates. Similarly, Table A2 shows the list of countries that are most likely to be in the three groups.[21] Group 1 includes states like Australia, Japan, Canada, Argentina, and Morocco. Group 2 states have a low probability (7.16%) of joining many IGOs with others in the group after considering the dyadic covariates. However, they have a moderate probability to join IGOs with Group 1 states (50.4%). Countries including Ukraine, Russia, Azerbaijan, Kazakhstan, and Nepal often instantiate in Group 2. Finally, Group 3 identifies a group of the most isolated states in the IGO co-membership network. Their probability of having IGO ties with others in the group is only 0.01%. They also have a nearly zero probability of connecting with the two other groups. Countries like North Korea, South Sudan, and Tajikistan are often in this group.

States in Group 1 occupy a role characterized by dense within-group connections, as they actively

[21] For interpretation purposes, we only list countries that have an average population larger than 5 million.

form ties with one another. States in Group 2 assume an intermediary role: they maintain some links to Group 1 but remain too weakly connected to be incorporated into that community, and they rarely form ties with other Group 2 members. Group 3 again consists of states that are largely isolated within the network. As a result, Group 1 constitutes a cohesive community associated with high levels of social capital, whereas Groups 2 and 3 occupy more peripheral or isolated positions with relatively low social capital.

Table 2 presents the effects of monadic covariates on group membership. The strongest predictor is the logged CINC score: states with higher national capability are most likely to be assigned to Group 2 and least likely to be assigned to Group 1. However, Figure A2 in the Appendix shows that the marginal effect of the logged CINC score on predicted mixed-membership probabilities is negligible. Overall, monadic covariates play a limited role in sorting states into latent groups. As in the defense alliance network, states within each latent group exhibit similar values on these basic measures of state characteristics.

Predictor	Group1	Group2	Group3
(Intercept)	-6.691 (2.425)	0.025 (2.435)	2.976 (2.435)
log(GDP)	0.305 (2.388)	-0.105 (2.436)	-0.275 (2.435)
log(GDP per capita)	-0.109 (1.761)	0.131 (2.435)	0.193 (2.435)
log(CINC)	-4.220 (2.524)	7.196 (2.435)	6.114 (2.435)
polity2	0.044 (2.439)	-0.006 (2.435)	-0.008 (2.435)
MIDS	-0.093 (2.439)	-0.002 (2.435)	0.033 (2.435)

Table 2: Monadic Covariates in the IGO Co-membership Network

Note: The model was in the first latent state for over 98% of the time, so we report coefficient estimates in this state. The estimates are coefficients of a Dirichlet regression, and standard errors are in parenthesis.

Finally, Figure A5 shows the effects of dyadic covariates. The strong predictive effect of defense alliances on tie formation in the IGO co-membership network is consistent with existing research that emphasizes geopolitical alignment as a force underlying IGO membership (Davis and Pratt, 2021; Davis,

2023). As in the defense cooperation network, institutional ties such as preferential trade agreements and diplomatic representation also exert strong positive effects. By contrast, the positive association between conflict involvement and tie formation runs counter to expectations in the literature (Donno et al., 2015). Our primary interest is in the latent groups revealed by IGO co-membership ties after accounting for these observable factors that shape dyadic cooperation.

5.3 The Trade Agreement Network

We conduct the same analysis on the trade agreement network for comparison and present results in the Appendix. Figure A6 shows the estimated structure of the trade agreement network. Here, we also identify two groups of states that are closely connected within the group. States in Group 1 are most likely to sign preferential trade agreements with each other. They are highly diverse, but are mostly large developing countries. Table A4 shows the list of countries that are most likely to be in the three groups. Group 1 includes states like Mexico, India, Brazil, and Egypt. Group 2 states also have a very high probability to sign trade agreements with others in the group. They are mostly European countries and their partners. For example, France, Germany, the UK, and Zambia often instantiate in Group 2. Group 3 identifies a group of isolated states in the trade agreement network, although they have some probability of signing trade agreements with states in Groups 1 and 2. Notably, major trading states including the United States, China, and Japan appear in group 3, which reflects their overall lower probability of preferential trade agreement ties within the trade network. As in the analysis of the other cooperation networks, the marginal effect of monadic covariates suggests that similarity of states within each latent group is comparable.[22]

Both groups 1 and 2 exhibit dense within-group ties that could plausibly generate social capital.

[22] See Table A3 and Figure A2. Figure A7 shows the effect of dyadic covariates.

However, our discussion of the types of ties associated with social capital suggests that trade relationships may provide fewer resources toward social capital than those embedded in the latent groups identified in the defense and IGO networks. To evaluate our hypotheses and compare differences across networks, we therefore turn to an examination of behavioral outcomes.

6 Latent Group Memberships Explaining Collective Action

This section examines how membership in latent groups corresponds to varying levels of voting cohesion in the UN General Assembly. The analysis tests our argument that latent groups characterized by dense within-group ties generate social capital that facilitates collective action in multilateral fora. These dense communities provide repeated opportunities for interaction and trust-building, creating conditions for coordinated voting that are largely absent among more weakly connected states. By contrast, states in latent Group 3, which have weak ties within the group, are expected to exhibit more fragmented voting behavior given lower social capital and reduced coordination capacity. In addition, we assess whether these relationships vary between the issue areas of the UNGA resolutions and between the three types of cooperation networks.

6.1 Group Solidarity for UNGA Votes

We begin by examining how membership probabilities influence states' propensity to vote with their group's majority in the UN General Assembly. As described earlier (see subsection 4.2), the analysis uses logistic regression with vote-level fixed effects. To focus on position-taking in issue areas where coordination is most consequential, the sample is restricted to controversial votes, defined as those with divided outcomes. Figure 3 reports the estimated marginal effects for each latent group.[23]

[23] Because the model is nonlinear, we report average marginal effects computed across all observations in the dataset.

Figure 3(a) demonstrates that a higher probability of belonging to Group 1 in the defense alliance network significantly increases the likelihood of voting with the majority of Group 1 members. The magnitude of the effect is nontrivial: moving a state's membership probability in Group 1 from 0 to 1 increases its probability of voting with the group majority by approximately 3%. While this effect may appear modest, it is substantively meaningful in the context of controversial votes. For instance, among 33 controversial votes, this translates into a group member shifting its vote on an issue to align with the majority. Membership in Group 2 also raises the probability of alignment, though the effect size is smaller than that for Group 1. By contrast, membership in Group 3 decreases the likelihood of voting with the majority.

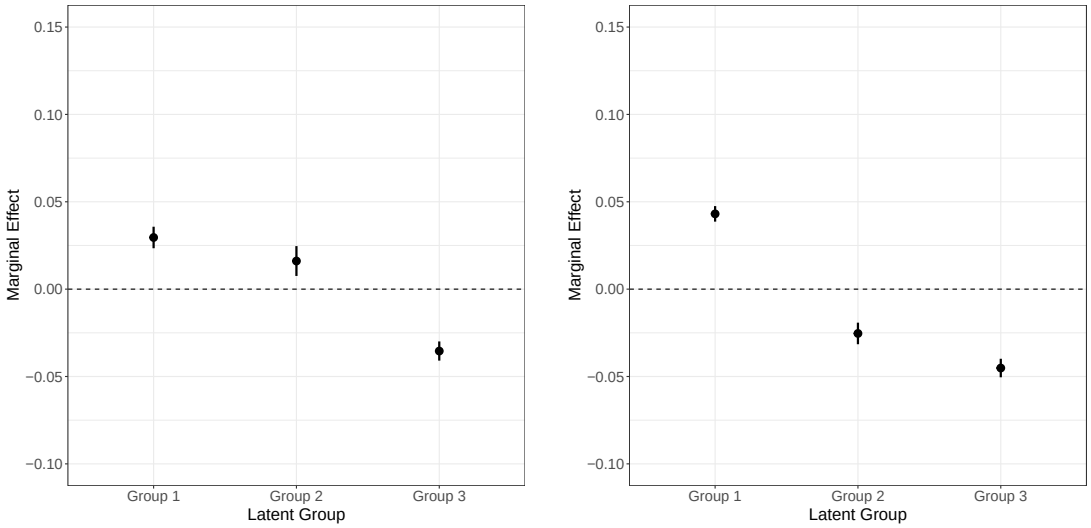
Figure 3(b) presents the effects of latent group memberships in the IGO co-membership network on UNGA voting. Membership in Group 1 exerts a significant positive influence on the probability of voting with the group majority, with an effect size even larger than that observed for Group 1 in the defense alliance network. This is likely because cooperation in IGOs requires trust across a broader range of issue areas than defense alliances. Moreover, IGO co-membership is a more institutionalized form of cooperation, which strengthens the social capital embedded in dense groups and amplifies their effect on voting alignment. By contrast, higher membership probabilities in Groups 2 and 3 reduce the likelihood of alignment with their respective group majorities. This divergence reflects structural differences between the two networks: whereas the defense alliance network contains two densely connected communities, the IGO co-membership network has only one. Nonetheless, the relatively higher level of interconnection in Group 2 makes it slightly more cohesive than Group 3. The isolated states that have low ties within the network show lack of coordination in their voting behavior. We also consider all votes and important votes identified by the US as an alternative set of key votes, and the results remain

the same.[24].

More densely connected communities in both the defense alliance and IGO co-membership networks exhibit greater solidarity in the UN General Assembly, as reflected in higher rates of bloc voting. This finding directly supports our hypothesis that dense within-group ties facilitate collective action on critical issues and is consistent with our broader argument that social capital functions as a key resource for coordination in multilateral fora. By controlling for dyadic covariates and showing that group membership varies little with basic state-level characteristics, the analysis attributes the explanatory power of latent groups to distinct social roles generated by network ties. Groups characterized by the social role of connected states—Group 1 and Group 2 in the defense network and Group 1 in the IGO network—display the highest levels of voting cohesion. In contrast, the isolated Group 3 states (and Group 2 in the IGO network) fail to act cohesively not because of divergent interests, but because they lack the social capital needed to translate shared preferences into coordinated behavior. To ensure that our finding is not driven by UN membership, we run the analysis again excluding the UN from the network, and the result remains the same.[25]

Next, we analyze whether network effects diffuse across different issues. This will reveal whether common interests are driving voting coherence among members of a latent group, as one would expect such interests to differ by issue. For example, based on narrowly defined interests, the defense network latent groups should exhibit higher alignment when voting on security issues than on economic issues, while the IGO co-membership network latent groups should show higher alignment for economic issues over security issues, as the majority of IGOs have an economic agenda. It is important to explore this possibility because if the effect is driven by agreement-defined shared interests, then it may have little to do with the underlying social capital. In contrast, evidence that latent groups act similarly across

[24] See Figure B1 and Figure B2.
[25] See Figure B11.



(a) Defense alliance network (b) IGO co-membership network

Figure 3: Latent Membership Probabilities and 2643 UNGA Controversial Votes

Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups.

issues would suggest that trust and social capital underlie voting cohesion. Such solidarity in voting across issues might arise when trust shared throughout a community supports generalized cooperation. We further focus on Middle East issues and find that the voting pattern persists when we exclude states with the highest stakes in the area.[26] This confirms that our findings are not driven by narrowly defined interests. States without strong interests in an issue can vote together based on the dense ties they share.

To perform this test, we subset the controversial UNGA votes by their issue areas. The issue area classifications are also from Voeten (2013) and are coded based on vote descriptions. Voeten (2013) classify six types of votes: Votes related to the Palestinian conflict, nuclear weapons and nuclear material, arms control and disarmament, colonialism, human rights, and (economic) development. For all issue areas, the votes span our entire analysis window (1962 to 2015). However, 34% of the controversial votes do not have coded issues, and collective security is missing from the categories. We therefore create another category, collective security, by searching keywords "security" and "aggression" in the vote de-

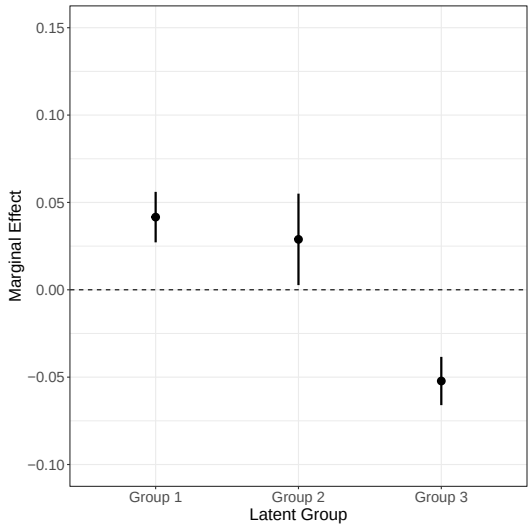
[26] See Figure B14.

scriptions. Figure 4 plots the effect of defense alliance network group memberships across issues.[27] The pattern we described above in the pooled controversial votes is consistent across almost all issue areas. The effect size is also highly consistent. Although the latent groups are based on defense cooperation, they have similar effects on human rights and economic development. States in the isolated Group 3, in contrast, are divided on all issues.

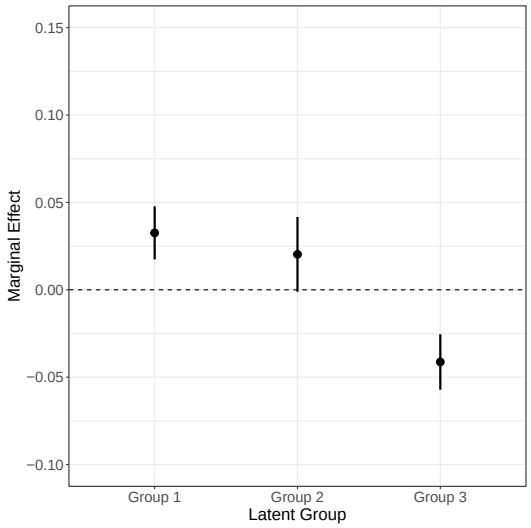
Similarly, Figure 5 shows that the effect of group membership in the IGO co-membership network extends across issue areas. Across all issue domains, only membership in Group 1—the densely connected community—consistently increases the likelihood that states vote with their group's majority. The persistence of this pattern across issues reinforces the interpretation that social capital generated by dense institutional ties is a central driver of coordinated state behavior.

Finally, we explore heterogeneity in which ties matter for collective action. We expect this relationship to be stronger when the cooperative tie is more closely linked to social capital. Compared to defense alliance and IGO co-membership cooperation networks, we expect the trade agreement cooperation network to be less correlated with social capital and therefore have less effect on UNGA voting. In the trade agreement network, Groups 1 and 2 are also densely connected. However, these dense connections are insufficient to produce cohesion on other issues. Figure B7 shows that membership in these groups has no effect on key UNGA votes. This null result holds for all issue areas, including economic development (see Figure B8). The differential impact of density in trust-based networks supports our argument about social capital. The lack of explanatory power from the trade network casts doubt on the possibility that all types of agreement are equal when it comes to building cohesion among large groups of states.

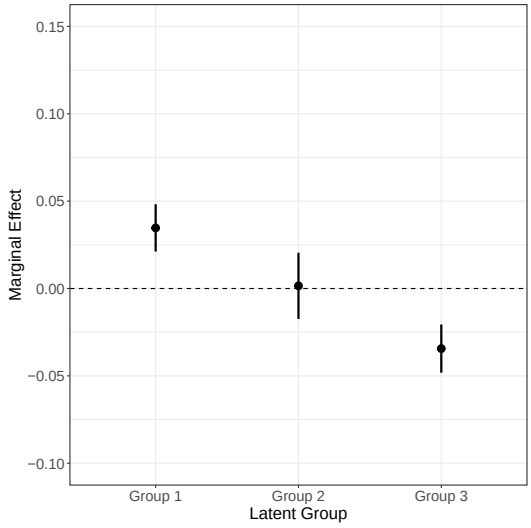
[27]To ensure that the results are not driven by the Palestinian conflict alone, we exclude votes on this issue from other categories. The results for colonialism-related votes are reported in Figure B3 in the Appendix, because colonialism votes are highly concentrated in the early decades and therefore not representative of broader cooperation.



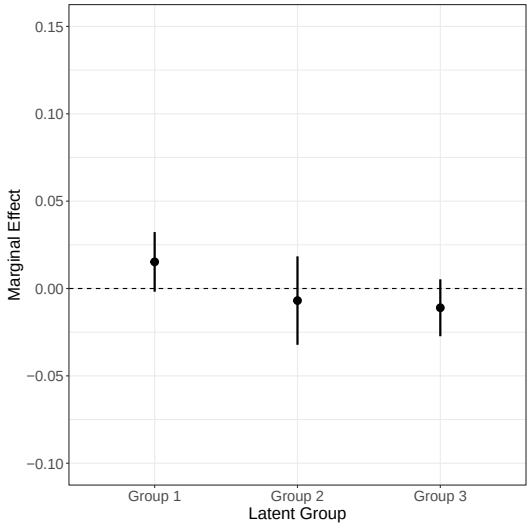
(a) Palestinian conflict (403 votes)



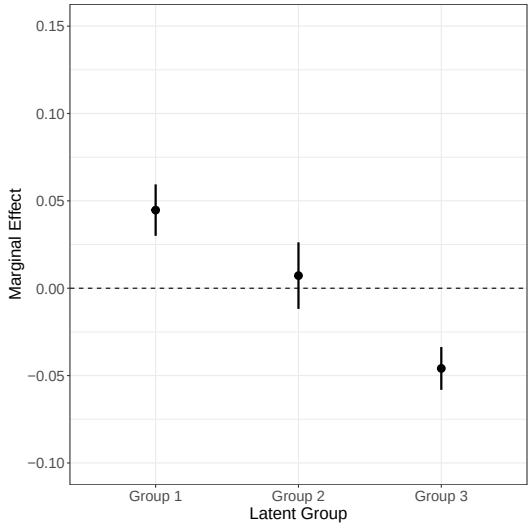
(b) Nuclear weapons and nuclear material (325 votes)



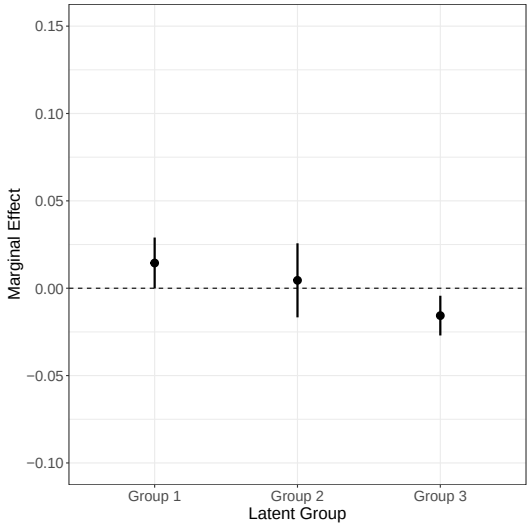
(c) Arms control and disarmament (391 votes)



(d) Collective Security (126 votes)

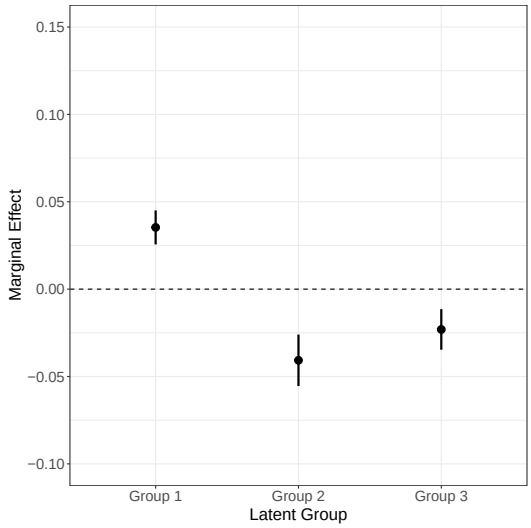


(e) Human rights (421 votes)

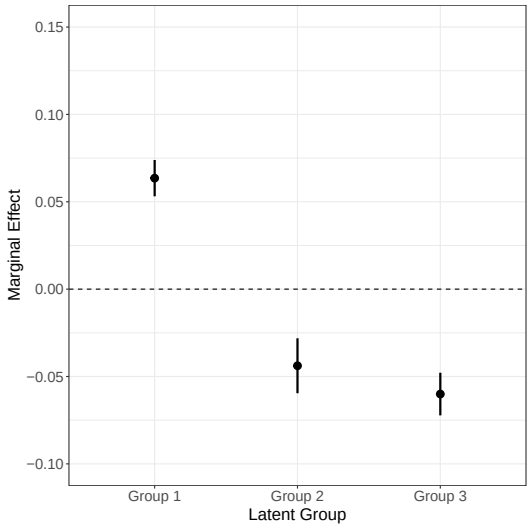


(f) Economic development (351 votes)

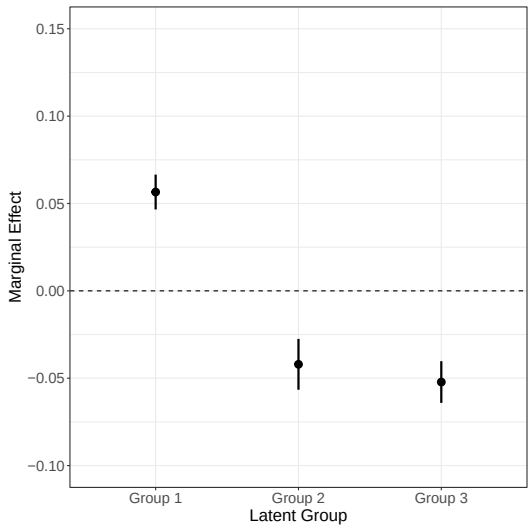
Figure 4: Defense Alliance Network: Latent Membership Probabilities and Controversial UNGA Votes



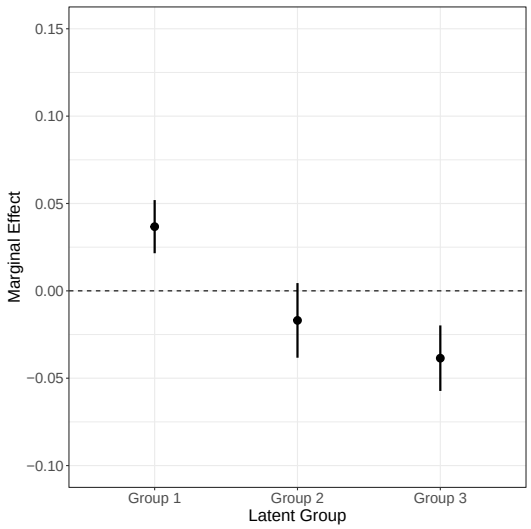
(a) Palestinian conflict (403 votes)



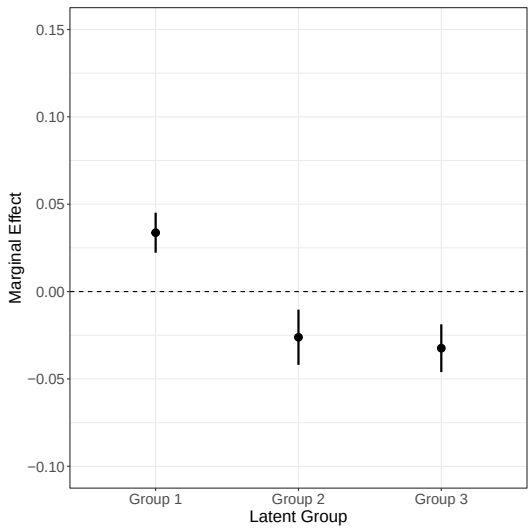
(b) Nuclear weapons and nuclear material (325 votes)



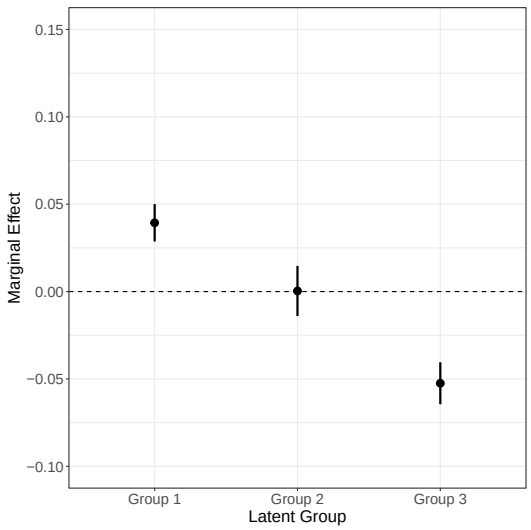
(c) Arms control and disarmament (391 votes)



(d) Collective Security (126 votes)



(e) Human rights (421 votes)



(f) Economic development (351 votes)

Figure 5: IGO Co-membership Network: Latent Membership Probabilities and Controversial UNGA Votes

6.2 Comparing Network-Based Groupings to Benchmark Categories

In order to validate our results, we compare the estimates from our models based on latent group memberships to the estimates from models based on more conventional measures of cooperation. First, we compare the effect of group membership in the defense alliance network to the effect of bilateral alliances.[28] Specifically, we compare the three latent groups identified in the blockmodel to three security coalitions: US allies, USSR/Russia allies, and all other countries. The models to estimate the impact on UNGA voting are the same, except for the way group labels are defined. We analyze the pre-Cold War period (pre-1988) and the post-Cold War period (post-1994) separately.[29]

Figure 6 shows that the latent group membership and observable alliances reveal similar direction of effect. The strong alliance commitments in the US and Soviet blocs respectively show solidarity in UN voting, similar to how the dense within-group ties of latent group 1 and 2 achieve solidarity. If anything, the latent groups exhibit higher level of cohesion. Moreover, our approach more clearly highlights the fragmentation within the isolated group. Latent group 3 shows less cohesion relative to the benchmark comparison group of states outside the US and Soviet alliance bloc where estimates are small and weak significance.[30] This gap becomes larger in the post–Cold War era, when the geopolitical divide between the US and Russia softened.

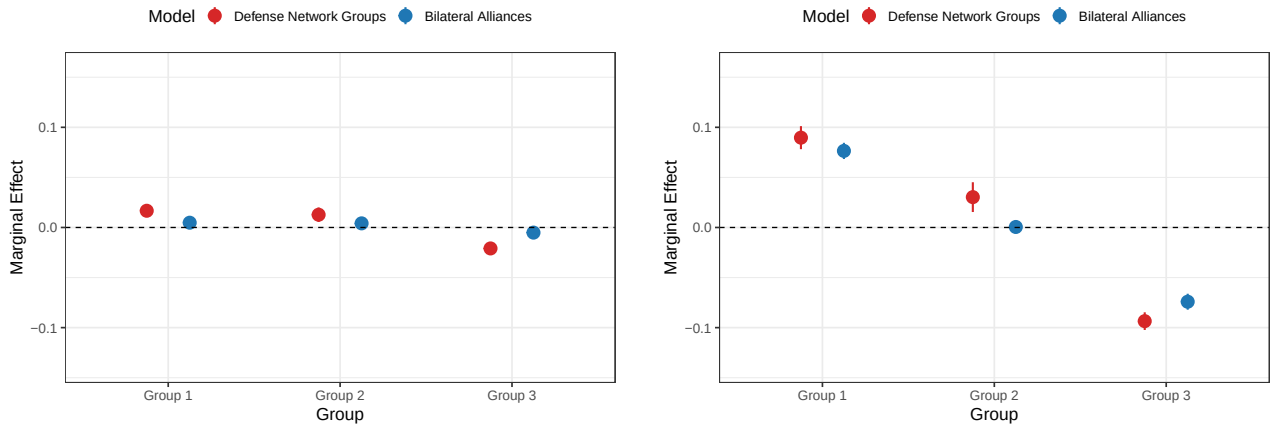
Table 3(A) compares the Proportional Reduction in Error (PRE) between our model and classifications based on US allies vs USSR/Russia allies. PRE quantifies the improvement in prediction accuracy

[28]To compare, we dichotomize group membership by assigning each country-year the group that it has the highest probability of being in. For computational reasons, we no longer exclude a state itself when calculating the majority vote of a group, but this does not affect the results.

[29]To ensure a fair comparison, we exclude the transitional period between 1988 and 1994 from our analysis. The benchmark model based on US vs USSR/Russia alliances is specifically constructed to capture Cold War alignments and their dissolution, and thus is designed to capture this transition period. In contrast, our latent group model is designed to uncover long-term structural blocs in defense cooperation, which is not comparable to the benchmark model during this period. Including this period would therefore bias the comparison in favor of the benchmark, overstating its relative performance (indeed, if we run the model for 1988-1994, the benchmark model has a much larger effect).

[30]Figure B4 and Figures B5 in the Appendix show that this advantage is consistent across issue areas.

relative to the baseline, where all states vote with the global majority. Our model achieving a higher PRE suggests that it better predicts voting behavior.



(a) Cold War votes (1888)

(b) Post-Cold War votes (632)

Figure 6: Defense Alliance Group Membership and UNGA Controversial Votes

Note: The y-axis is the effect of dichotomous latent group membership or bilateral alliance on a state's probability of voting with the majority in that group. The x-axis is the three groups. The nodes represent point estimates, and the error bars are 95% confidence intervals. For defense alliance network groups, groups 1 to 3 are ranked according to the probability of their in-group tie formation (high to low). For US/USSR-Russia alliance classification, group 1 includes all US allies, group 2 includes USSR/Russia allies, and group 3 includes all other countries. CW refers to the Cold War period (pre-1988). Post CW refers to the post-Cold War period (post-1994).

For the IGO co-membership network, we compare the effect of group membership in our network to the effect of important single IGO membership. Specifically, we conduct two sets of comparisons: (1) We compare our three latent groups to members of the European Union (EU and EEC), members of the African Union (AU and OAU), and all other countries; and (2) We compare our three latent groups to members of the OECD, members of the SCO or BRICS, and all other countries. Figure 7 presents the results.[31] Unlike the defense alliance network, the results indicate that EU membership has a stronger effect on UNGA voting. OECD and SCO/BRICS membership also has a stronger effect than membership in a dense IGO network group. Group 1 in our network, which has a high probability of forming in-group ties, has an effect comparable to membership in the African Union. On some issues (nuclear weapons,

[31]Note that the effect estimated here is marginal, and does not represent raw cohesion within groups. For example, the raw level of cohesion within the EU group is very high.

Table 3: Proportional Reduction in Error (PRE) by Grouping Strategy

Panel A: Defense Network	
Grouping	**PRE**
Defense Network Latent Groups	**0.215**
US Allies / USSR-Russia Allies / Others	0.169
Panel B: IGO Co-membership Network	
Grouping	**PRE**
EU Members / AU Members / Others	0.231
IGO Co-membership Network Latent Groups	**0.154**
OECD Members / SCO-BRICS Members / Others	0.150

Note: This table compares the predictive accuracy of different grouping strategies. Each model predicts how states vote on UNGA resolutions. The baseline assumes that states vote with the global majority on each resolution. The models improve upon this by assuming that countries in dense latent groups or predefined alliances/IGOs vote with their group's majority, while others follow the global majority. The PRE (proportional reduction in error) quantifies the improvement in prediction accuracy relative to the baseline. Higher PRE values indicate better predictive performance.

arms control, and economic development), its effect is also comparable to the OECD.[32] It is probably unsurprising that EU membership has a strong effect. However, our latent group captures another group of states that are not clearly defined as the EU (e.g., Australia, Argentina, India, Pakistan, Sweden), while also exhibiting considerable effect on solidarity that is comparable to the AU and OECD. Additionally, while EU/AU membership is overall helpful in predicting voting behavior, Table 3(B) shows that our measure outperforms OECD/SCO-BRICS in reducing overall prediction error because the latter only identifies two very small blocs.

[32]Figure B6 in the Appendix presents results in different issue areas.

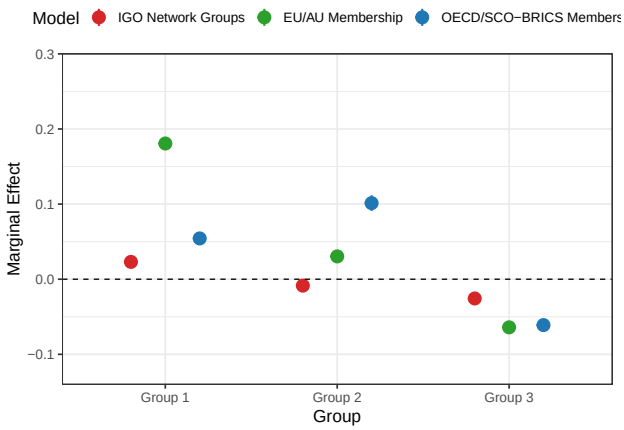


Figure 7: IO Group Membership and 2643 UNGA Controversial Votes

Note: The y-axis is the effect of IO group membership on a state's probability of voting with the majority in that group. The x-axis is the three groups. The nodes represent point estimates, and the error bars are 95% confidence intervals. For IO co-membership network groups, groups 1 to 3 are ranked according to the probability of their in-group tie formation (high to low). For classification based on EU/AU membership, group 1 includes EU members, group 2 includes AU members, and group 3 includes all other countries. For classifications based on OCED/SCO-BRICS membership, group 1 includes OCED members, group 2 includes SCO or BRICS members, and group 3 includes all other countries.

6.3 Alternative Explanations

In this section, we consider alternative explanations for our findings. By focusing on the interaction level of state behavior, we differentiate social roles from interests and power. These two dimensions will still be important, but here we address the concern that the social capital relationship could reflect one of these different logics of cooperation.

Hegemonic states can lead others through bribes and coercion that may steer behavior in tie formation and then within UN voting. We consider the role of the most powerful member in each group to evaluate how power dictates where states line up in the group structure. For the defense alliance network, one potential concern is that our dense groups are simply capturing US allies and Arab states. Closer examination shows that there is variation in how defense ties form the latent groups. At a descriptive level, the groups do not completely overlap with allies of the leading state, the US in Group 1 and Saudi

Arabia in Group 2.[33] In fact, 44.6% of country-year observations of US bilateral allies are not in Group 1, and more than 8% of Group 1 country-year observations are not direct US allies. For example, NATO ally Canada held partial membership in Group 2 for some years, as it did not have many defense ties with the US's major non-NATO allies (MNNA). Similarly, 51.6% of country-year observations of Saudi Arabia's bilateral allies are not in Group 2, and 55.4% of Group 2 country-year observations are not Saudi Arabia's direct allies. Figure B10 shows that the two dense groups identified by our model predict UNGA voting more effectively than the simple classification of US allies versus Arab states.

Given that the decision to form ties is based on national interest, there is also concern that the underlying economic and political characteristics of states drive the behavior we observe. There are several ways in which we address this possibility. We include common state-level characteristics such as income, democracy, and conflict involvement as monadic covariates, and find that these are not predictive of group membership. This indicates that there is no systematic homophily within groups. The states in dense groups are no more similar to each other than they are similar to states in the isolated group. Dyadic covariates likewise control for shared interests between state pairs. As an additional test, we replicate our voting analysis using two of the most common interest-based characteristics: income level and regime type. Figure B9 shows that neither characteristic produces consistent voting blocs. Among income groups, only entering the high-income state group increases the probability that states will vote together. When grouping by regime type, only autocracies and the mixed category (neither autocracy nor democracy) exhibited cohesion, while democracies were divided.[34] Surprisingly, our results indicate that non-democracy may contribute to common action within the UN. This is the opposite of expecta-

[33] We picked the US and Saudi Arabia because many Group 1 members are allies of the US, and many Group 2 members are allies of Saudi Arabia.

[34] For example, Indonesia, Bangladesh, Senegal, Comoros, and Namibia are among the democracies that least often voted with the democratic majority, whereas Ireland, Norway, Austria, Sweden, and Denmark were most likely to align with the democratic majority. We also tested alternative thresholds for dividing regime types, and the results remain unchanged. Note that this analysis does not control for other factors. It is intended only to show that our latent groups are not merely reproducing regime type clusters, and should not be interpreted as evidence about the causal effect of regime type on voting.

tions for a domestic level of social capital supported in democracies acting to build trust among states. Further analysis should explore what contributes to the pattern. For our argument, the key point is to emphasize that the social capital formed at the international level has a stronger influence on multilateral cooperation than state characteristics.

7 Conclusion

This paper contends that states accrue social capital through their participation in networks of cooperation built around high-trust agreements. Using a dynamic blockmodel, we identify groups of states with dense in-group connections through the analysis of cooperation networks formed around defense treaties and IGO membership. Our analysis of the evolution of the global defense alliance network and the IGO co-membership network from 1961 to 2014 allows us to categorize latent groups of states that exhibit high social capital through their dense interaction. By focusing on the similarity of tie formation, we can also characterize a group of states that are isolated and lack social capital. The model incorporates monadic conditions associated with group membership and dyadic conditions that support the formation of ties.

Based on mapping the concept of social capital to latent groups, we assess the impact of social capital on multilateral cooperation. For both networks, we find groups that exhibit high social capital and groups that has low social capital. Comparison of voting behavior in the General Assembly of the United Nations reveals distinct patterns based on group membership. In both networks, we find support for our hypothesis that states in densely connected groups are more likely to cooperate as a coalition that votes coherently on UNGA key votes. By examining the effect on UNGA key votes in different issue areas, we demonstrate that the effect is not explained by narrow shared interests. Indeed, voting cohesion of groups generated within the defense cooperation network holds as strongly for nonsecurity issues. Moreover, the effect size is substantial compared to using conventional geopolitical or institutional categories, such

as US vs Russia allies, OECD members, or the AU. However, not all agreements matter in the formation of social capital and we do not see a similar relationship arising from the network of states formed around trade agreements.

Our research demonstrates that social capital helps to explain how states act collectively in multilateral settings. A long-standing question within international relations has asked how states structure international society (Bull, 1977; Dunne and Reus-Smit, 2017; Davis, 2025). Research has shown that bilateral cooperation increases the probability of future bilateral tie formation (Kinne, 2013b), and exiting multilateral agreements can lower future cooperation (Schmidt, 2025). We extend on these insights to show how densely connected communities form around agreements and identify higher cohesion among the groups with dense ties. This represents a new approach to studying relationships among states. Some states are bound together, even without a formal agreement, through the trust shared within a community. This supports their collective action on a range of topics. Coalitions in multilateral forums could either advance or block an agenda, as we saw in our analysis of UN votes. More generally, this logic may contribute to understanding conditions that support effective multilateral cooperation. Gray (2018) highlights the wide variation in vitality across international institutions. Future research could explore whether shared trust binding the states that are members of the organization contributes to the vitality of the organization.

States sort into groups and categories when working together. However, the choice of who to align with is not easy given the complex interests and diverse issues. By sharing trust and social networks, states within a densely connected community can more easily adopt similar stances on international issues. Among isolated states, the lack of social capital inhibits their coordination on critical issues despite shared interests.

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Online Appendix:
The Structure of International Cooperation Networks

A Additional Tables and Figures for the Network Models

A.1 Model Details

Formally, the data generation process of dynMMSBM can be summarized as follows:

1. Node i's mixed membership in K latent groups at time t is

$$\pi_{it} \sim \sum_{m=1}^{M} \Pr(S_t = m \mid S_{t-1}) \times \text{Dirichlet}(\exp[(x_{it}^{\top}\beta_{km})]_{k=1}^{K})$$

   where S is the random state that the network is in at time t. $S_t \mid S_{t-1} = n \sim \text{Categorical}(A_n)$ and A is a transition matrix. x_{it} is a vector of monadic predictors, and β_{km} is a vector of monadic coefficients specific to group k in state m.

2. Given mixed memberships of p and q, for pair pq, p's group indicator when interacting with q at time t is modeled as $z_{pqt} \sim \text{Multinomial}(1, \pi_{pt})$. Similarly, $w_{qpt} \sim \text{Multinomial}(1, \pi_{qt})$

3. Given the membership of node p and q at time t when interacting with each other, the edge Y_{pqt} is modeled as:

$$Y_{pqt} \sim \text{Bernoulli}\left(\text{logistic}^{-1}\left(z_{pqt}^{\top}\mathbf{B}w_{pqt}^{\top} + \mathbf{d}_{pqt}^{\top}\gamma\right)\right)$$

   where $B_{K\times K}$ is the block model matrix that captures the probability of tie-formation between latent groups, and $\mathbf{d}_{pqt}$ is dyadic predictors with associated coefficients γ.

Therefore, the joint probability can be written as:

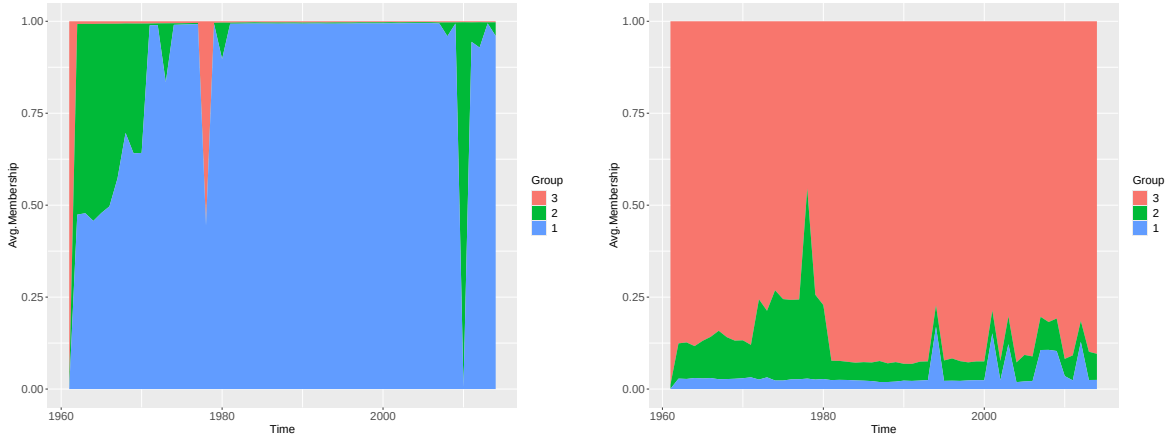
$$\begin{aligned}
&P(Y, \{Z, W, S\}, \Pi, A \mid \beta, \gamma, \mathbf{B}, \mathbf{D}, \mathbf{X}) \\
&= P(S_1)\left[\prod_{t=2}^{T} P(S_t \mid S_{t-1}, A)\right]\left[\prod_{t=1}^{T}\prod_{it\in V_t} P(\pi_{it} \mid X, \beta, S_t)\right]\prod_{m=1}^{M} P(A_m) \\
&\times\left[\prod_{t=1}^{T}\prod_{p,q\in V_t}[P(Y_{pqt} \mid z_{pqt}, w_{qpt}, \mathbf{B}, \gamma, \mathbf{D})P(z_{pqt} \mid \pi_{pt})P(w_{qpt} \mid \pi_{qt})]\right]
\end{aligned}$$

A.2 Defense Alliance Network

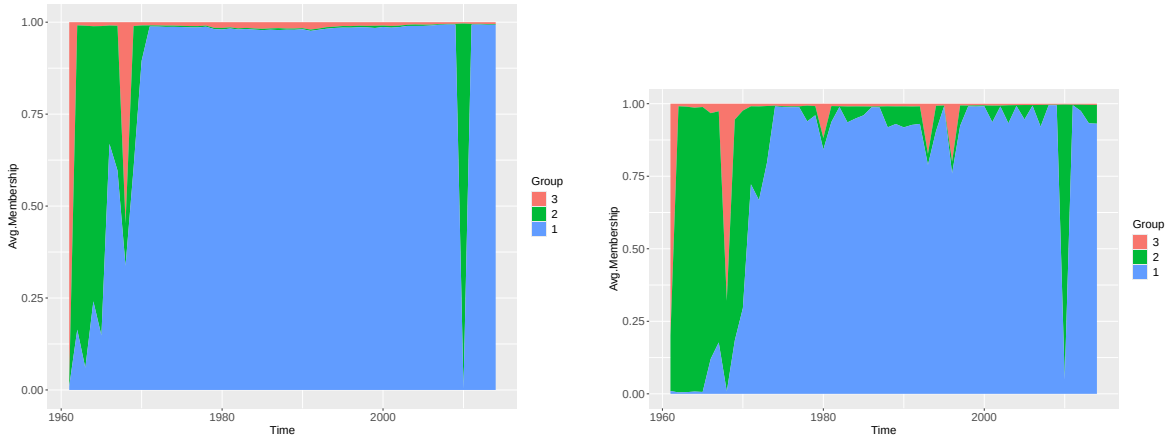
Group 1	Group 2	Group 3
Venezuela	Yemen	Ukraine
Ecuador	Saudi Arabia	India
Colombia	Iraq	Nepal
Chile	Sudan	Afghanistan
Guatemala	Algeria	Bangladesh
Honduras	Syria	Iran
Mexico	Tunisia	Uganda
Bolivia	Morocco	Sri Lanka
Haiti	Somalia	Burundi
Peru	Egypt	Myanmar (Burma)
Argentina	Senegal	Cameroon
Brazil	Burkina Faso	Vietnam
Dominican Republic	Niger	Tanzania
Belgium	Benin	Malawi
United States	Guinea	Malaysia
Netherlands	Ghana	Kenya
United Kingdom	Côte d'Ivoire	Congo - Kinshasa
Italy	Belarus	Zambia
Greece	Kazakhstan	Indonesia
Denmark	Russia	Angola
Turkey	Tajikistan	Cambodia
Czechia	Uzbekistan	Zimbabwe
Portugal	Azerbaijan	Cuba
France	Nigeria	South Sudan
Spain	Canada	Madagascar

Table A1: Defense Alliance Network: Countries with the Highest Membership Probability in Each Group

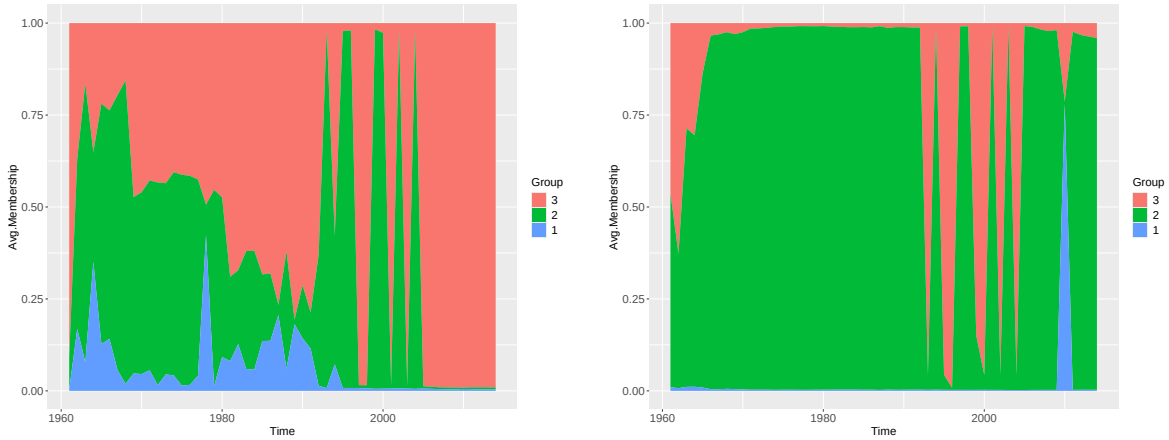
Note: This table shows the top 25 countries that most frequently instantiate membership in each latent group in the defense alliance network. We only include countries with an average population above five million.



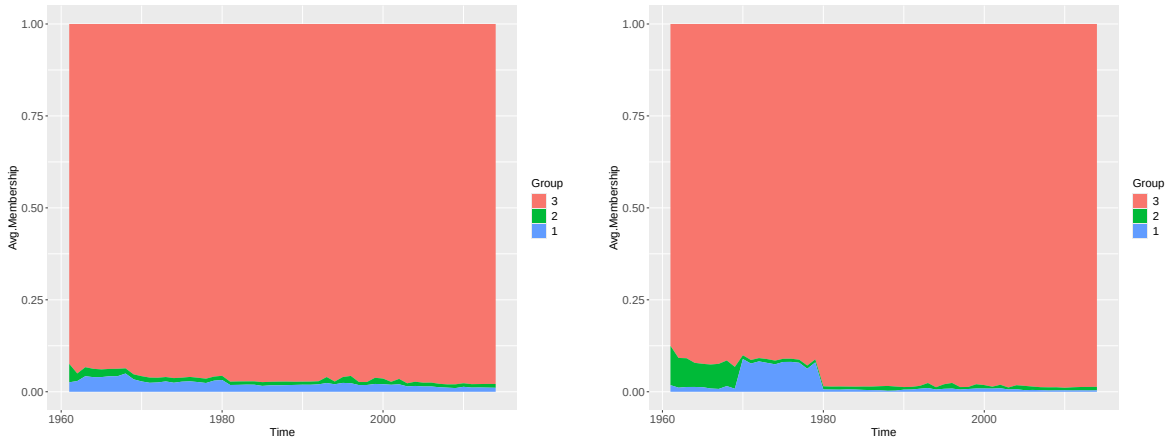
(a) US (b) China



(c) UK (d) France

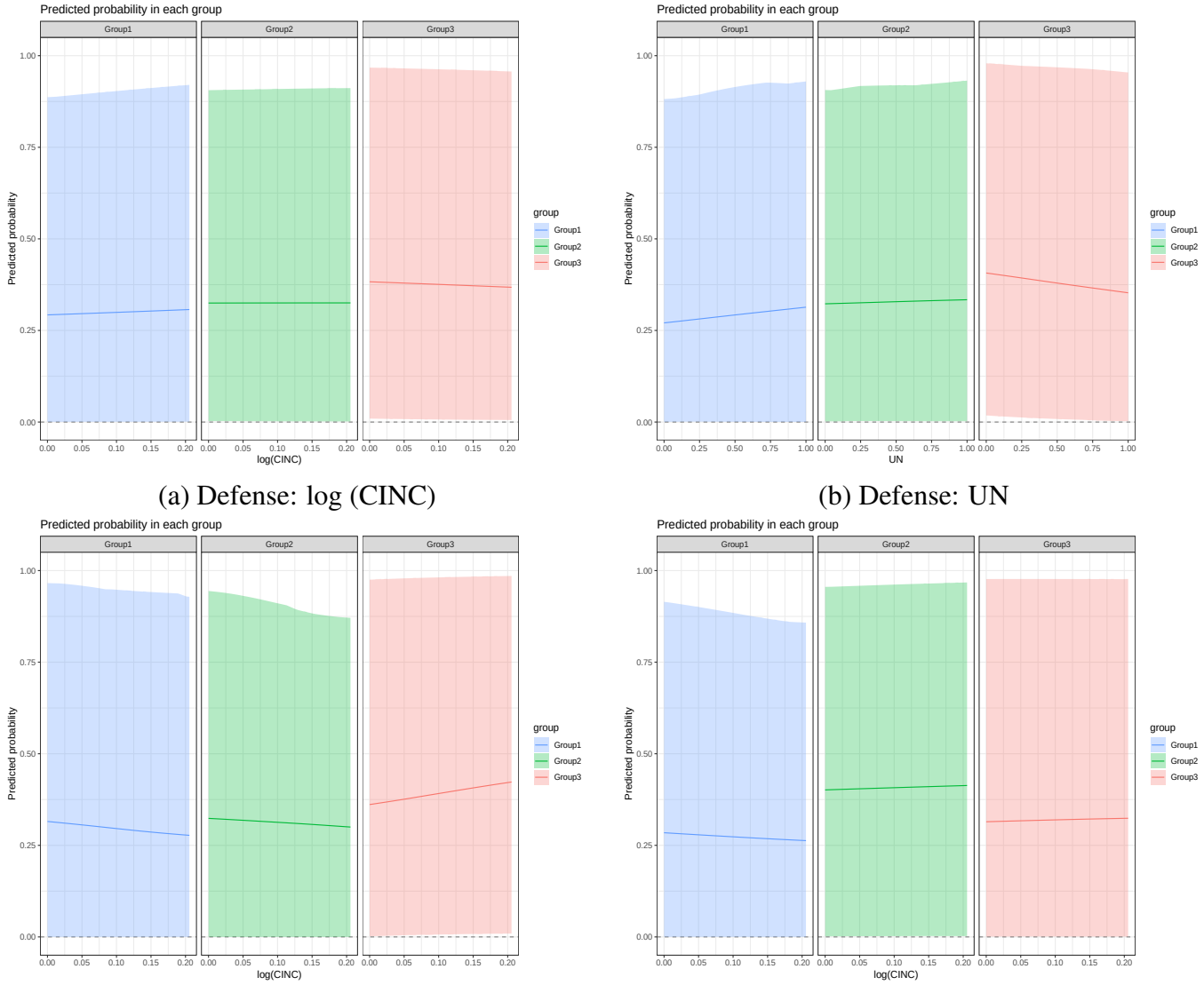


(e) Russia (f) Saudi Arabia



(g) India (h) Iran

Figure A1: Example States' Membership in the Defense Alliance Network



(a) Defense: log (CINC)

(b) Defense: UN

(c) Trade agreement: log (CINC)

(d) IGO co-membership: log (CINC)

Figure A2: Marginal Effects of Most Powerful Monadic Coefficients in the Three Networks

Note: The x-axis is the value of each covariate ranging from its minimum to the maximum in the data. The y-axis is the marginal effect of a one-unit covariate change on a state's membership probability in each latent group. One-unit is defined as 2% of the covariate's total range. The solid line is the average effect, and the shaded area is the 95% bootstrapped confidence interval.

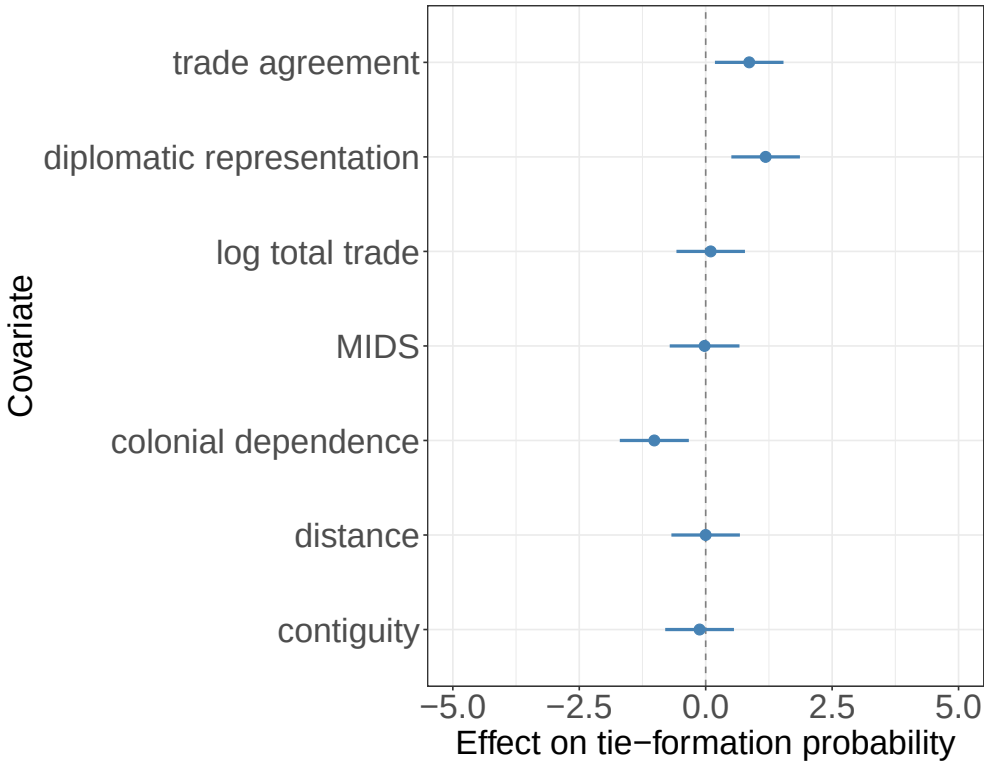


Figure A3: Dyadic Covariates in the Defense Alliance Network

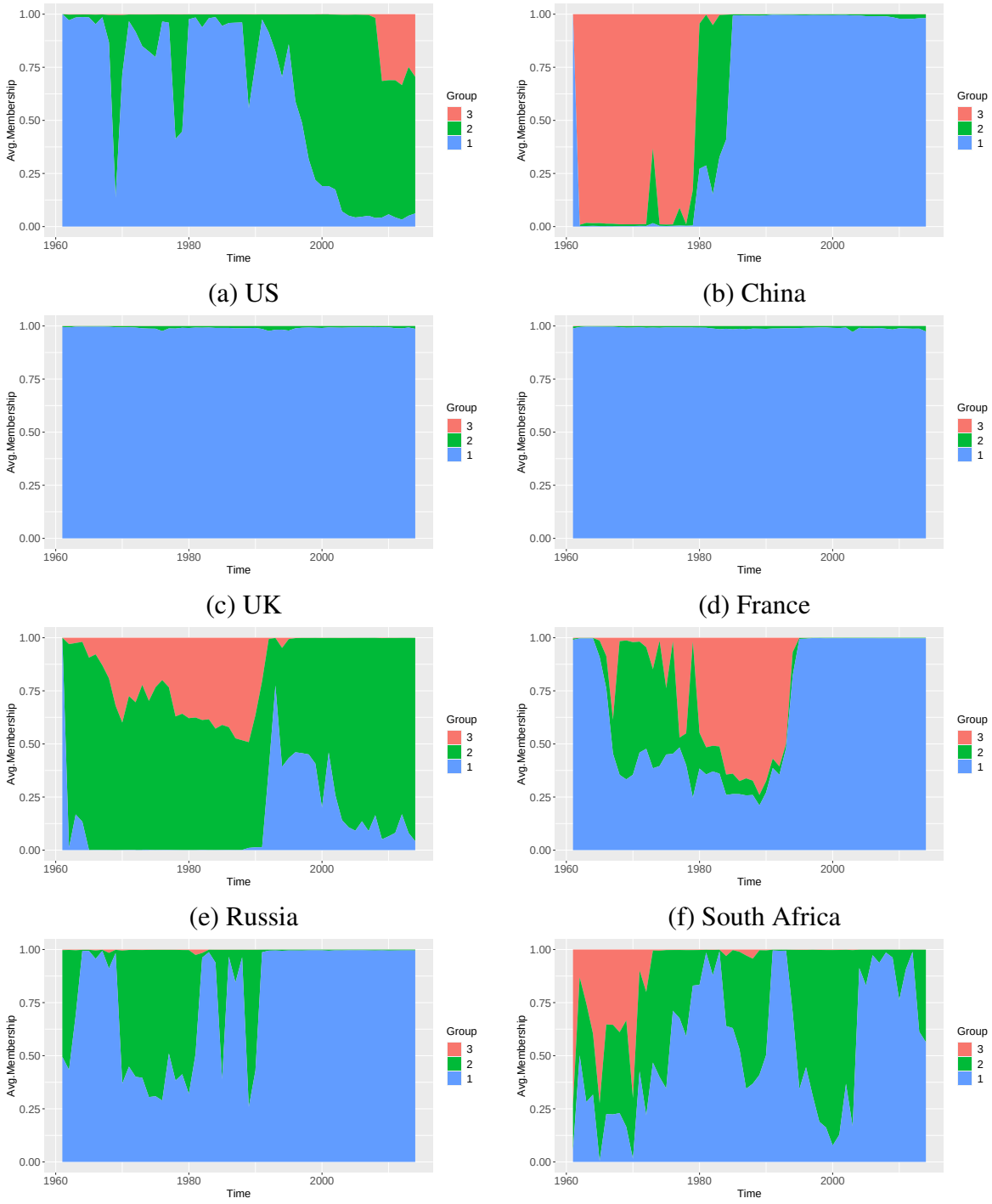
Note: This figure shows the effect of dyadic covariates on the probability of defense alliance tie formation. The solid dots are the posterior estimates, and the lines are 95% confidence intervals.

A.3 IGO Co-membership Network

Group 1	Group 2	Group 3
Australia	Ukraine	North Korea
Japan	Russia	South Sudan
Canada	Azerbaijan	Tajikistan
Argentina	Kazakhstan	Vietnam
Morocco	Nepal	Uzbekistan
Peru	Burundi	Belarus
Philippines	Chad	Yemen
India	Rwanda	Somalia
Chile	Germany	Afghanistan
Pakistan	Myanmar (Burma)	Mozambique
Portugal	Yemen	Angola
Spain	Belarus	China
Sweden	Niger	Zimbabwe
Belgium	Hungary	Azerbaijan
Indonesia	Afghanistan	Nepal
Tunisia	Ethiopia	Kazakhstan
Denmark	Slovakia	Rwanda
Brazil	Somalia	Cambodia
Egypt	Czechia	Ethiopia
Netherlands	Angola	Burundi
Nigeria	Cambodia	Myanmar (Burma)
Mexico	Malawi	South Africa
Italy	Honduras	Iraq
Colombia	Bulgaria	Russia
United Kingdom	Uzbekistan	Czechia

Table A2: IGO Co-membership Network: Countries with the Highest Membership Probability in Each Group

Note: This table shows the top 25 countries that most frequently instantiate membership in each latent group in the IGO co-membership network. We only include countries with an average population above five million.



(a) US (b) China

(c) UK (d) France

(e) Russia (f) South Africa

(g) Switzerland (h) Saudi Arabia

Figure A4: Example States' Membership in the IGO Co-membership Network

Note: The figure shows the mixed membership in three latent groups each year the state is present in the network for eight example states. The marked shifts in mixed membership can be explained by incidents changing states' monadic covariates (e.g., GDP) or large changes in tie-formation patterns.

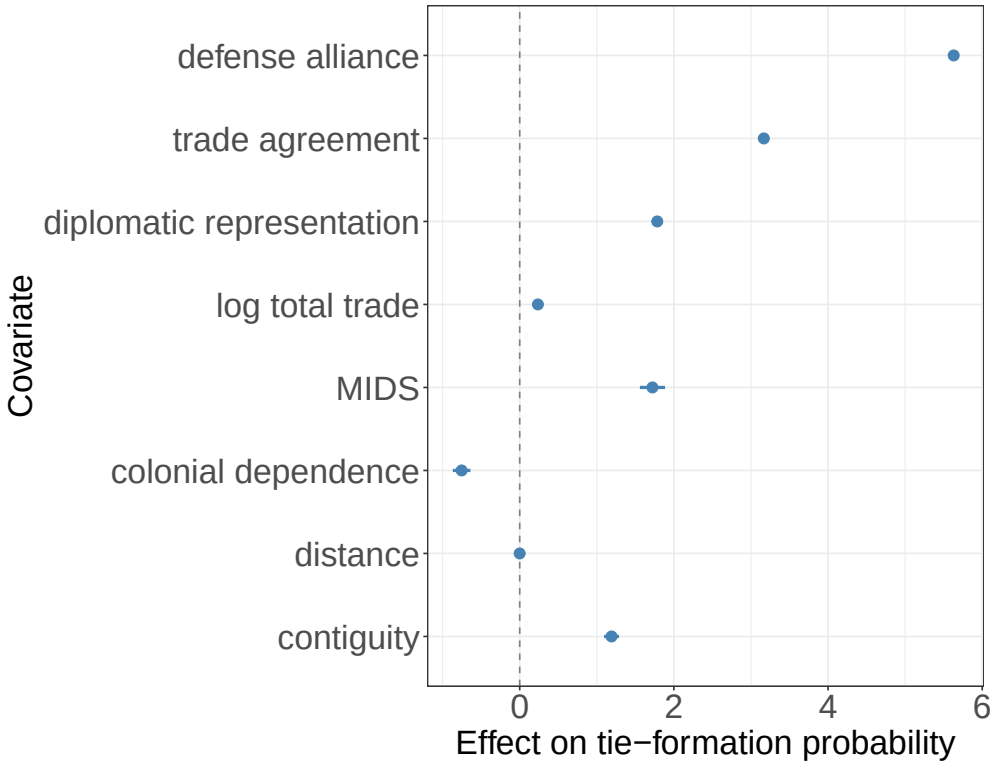
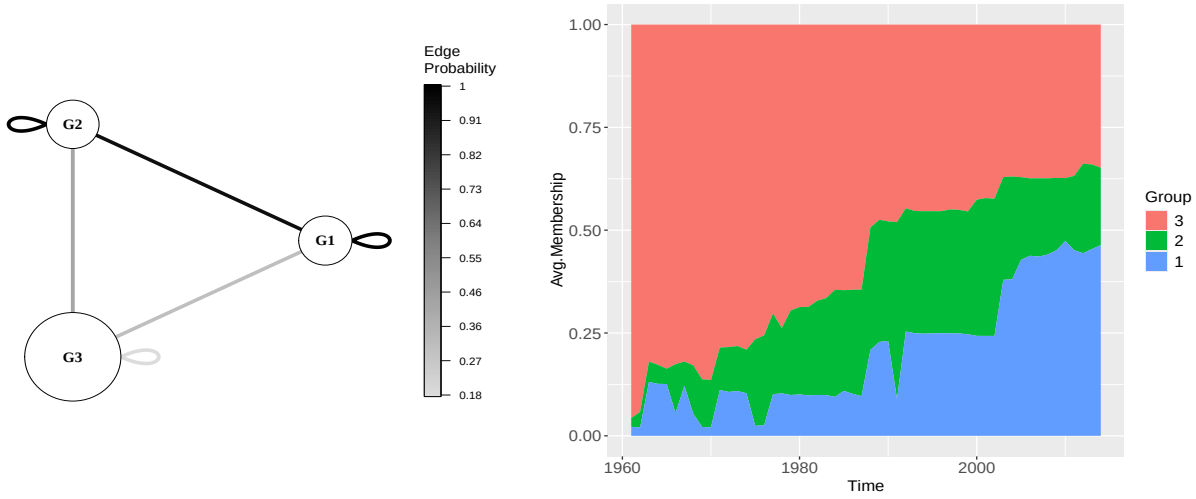


Figure A5: Dyadic Covariates in the IGO Co-membership Network

Note: This figure shows the effect of dyadic covariates on the probability of IGO co-membership tie formation. The solid dots are the posterior estimates, and the lines are 95% confidence intervals.

A.4 Trade Agreement Network



(a) Blockmodel (b) Aggregate membership

Figure A6: Network Structure and Latent Memberships in the Trade Agreement Network

Note: In Panel (a), the nodes (circles) represent the three latent groups. The size of the nodes indicates the groups' membership size. The edges between the nodes represent the estimated probability a state from one group forms a trade agreement with nodes from the other group. Panel (b) shows the average membership proportion in the three latent groups from 1961 to 2014.

Predictor	Group1	Group2	Group3
(Intercept)	-2.622 (3.816)	0.484 (3.816)	1.716 (3.816)
log(GDP)	0.047 (3.825)	-0.146 (3.816)	-0.153 (3.816)
log(GDP per capita)	-0.024 (3.815)	0.153 (3.816)	0.129 (3.816)
log(CINC)	7.062 (3.816)	11.996 (3.816)	40.910 (3.816)
polity2	-0.009 (3.817)	-0.005 (3.816)	-0.023 (3.816)
MIDS	-0.001 (3.815)	0.005 (3.816)	0.084 (3.816)
WTO/GATT	0.080 (3.817)	0.074 (3.816)	-0.745 (3.816)

Table A3: Monadic Covariates in the Trade Agreement Network

Note: The model was in the first latent state for over 98% of the time, so we report coefficient estimates in this state. The estimates are coefficients of a Dirichlet regression, and standard errors are in parenthesis. The standard errors for Group 2 and Group 3 are different from four digits after the decimal point.

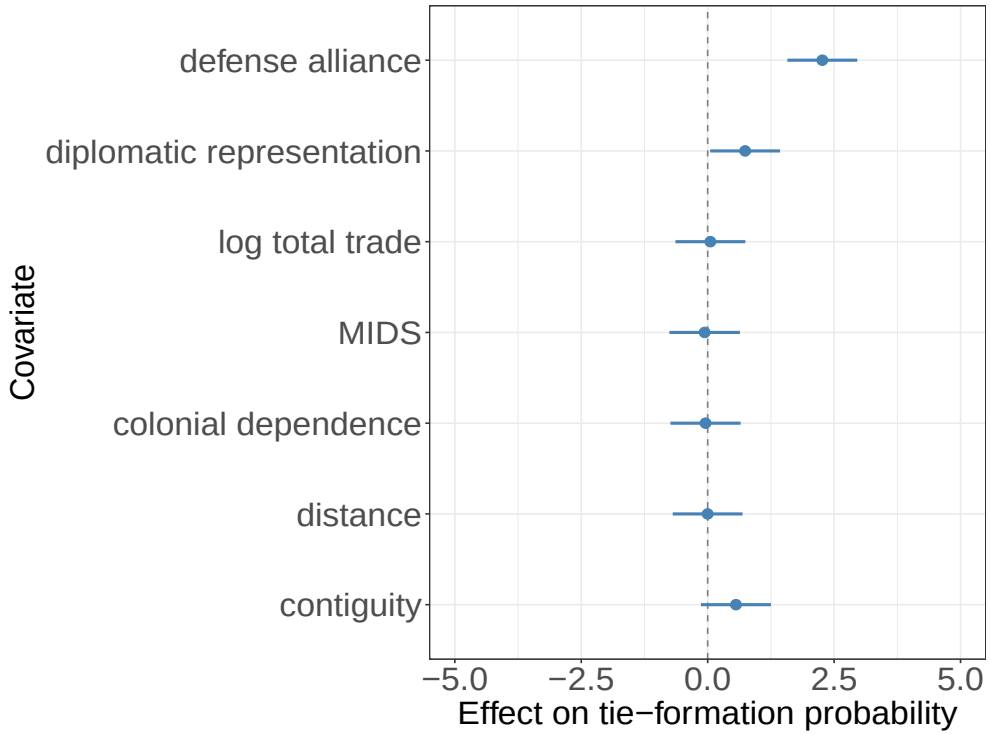


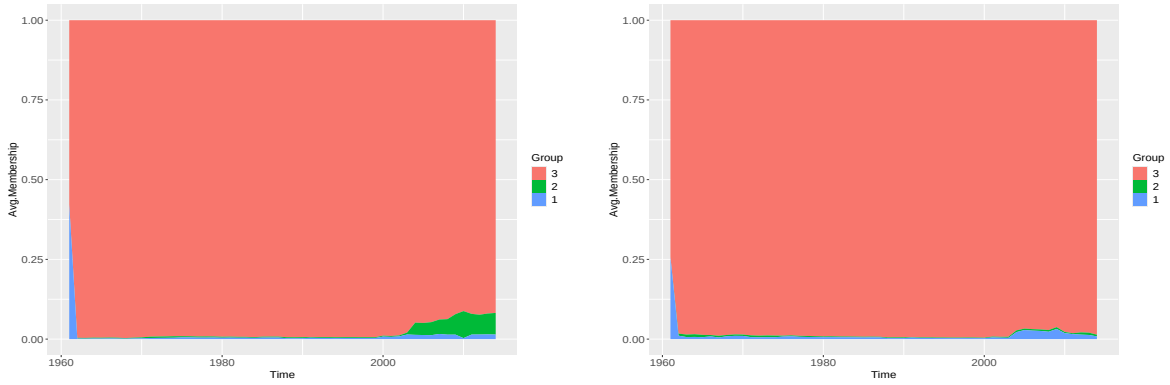
Figure A7: Dyadic Covariates in the Trade Agreement Network

Note: This figure shows the effect of dyadic covariates on the probability of trade agreement formation. The solid dots are the posterior estimates, and the lines are 95% confidence intervals.

Group 1	Group 2	Group 3
Egypt	France	Belarus
Benin	Italy	Azerbaijan
Tunisia	Germany	Uzbekistan
Angola	Belgium	Tajikistan
Mexico	Netherlands	South Sudan
Chile	Denmark	Kazakhstan
South Korea	United Kingdom	Ukraine
Mozambique	Mali	Afghanistan
Pakistan	Burkina Faso	Nepal
Peru	Niger	Russia
Philippines	Greece	Saudi Arabia
Cameroon	Côte d'Ivoire	China
Congo - Kinshasa	Senegal	Japan
Nigeria	Spain	Myanmar (Burma)
Brazil	Burundi	Cambodia
Ghana	Rwanda	United States
Algeria	Benin	Canada
Morocco	Madagascar	Honduras
Zimbabwe	Malawi	Guatemala
India	Somalia	Switzerland
Mali	Uganda	Yemen
Sudan	Zambia	Syria
Senegal	Kenya	Bulgaria
Tanzania	Portugal	Australia
Burkina Faso	Ethiopia	Hungary

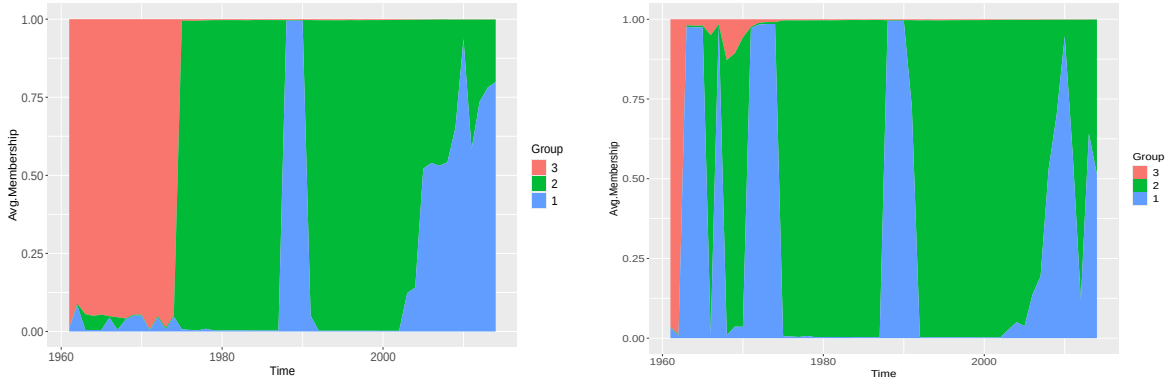
Table A4: Trade Agreement Network: Countries with the Highest Membership Probability in Each Group

Note: This table shows the top 25 countries that most frequently instantiate membership in each latent group in the trade agreement network. We only include countries with an average population above five million.



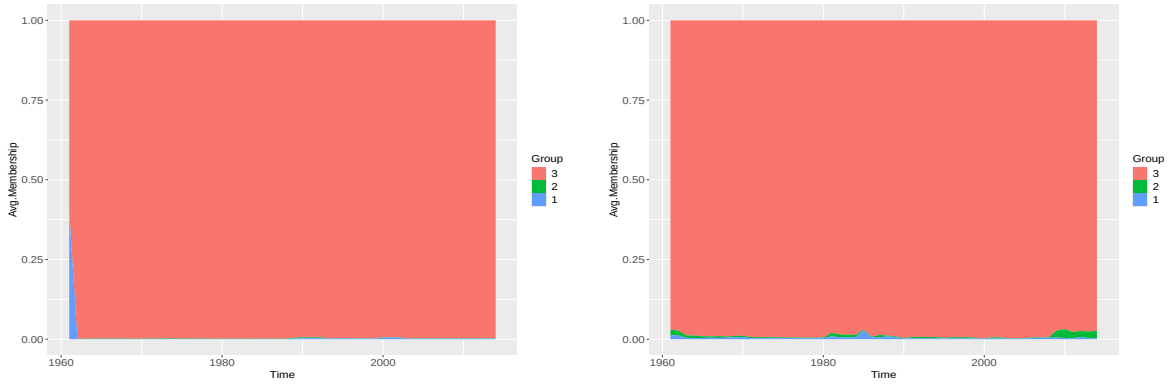
(a) US

(b) China



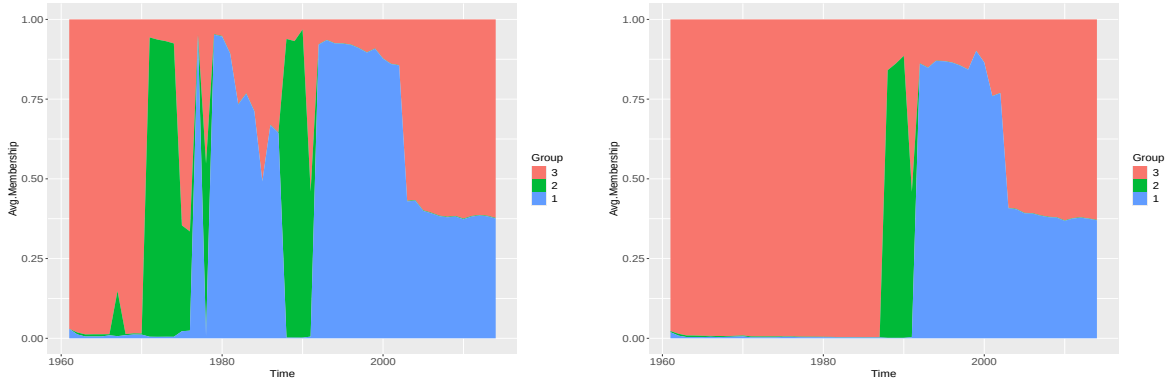
(c) UK

(d) France



(e) Russia

(f) Saudi Arabia



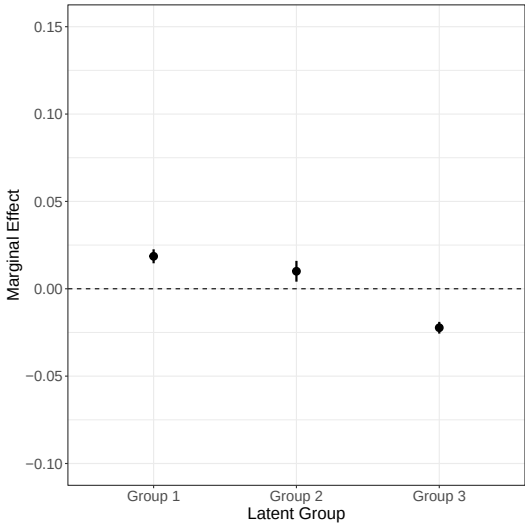
(g) India

(h) Iran

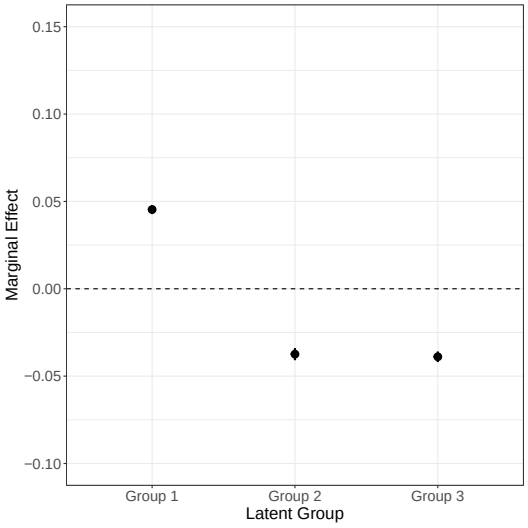
Figure A8: Example States' Membership in the Trade Agreement Network

Note: The figure shows the mixed membership in three latent groups each year the state is present in the network for eight example states. The marked shifts in mixed membership can be explained by incidents changing states' monadic covariates (e.g., GDP) or large changes in tie-formation patterns.

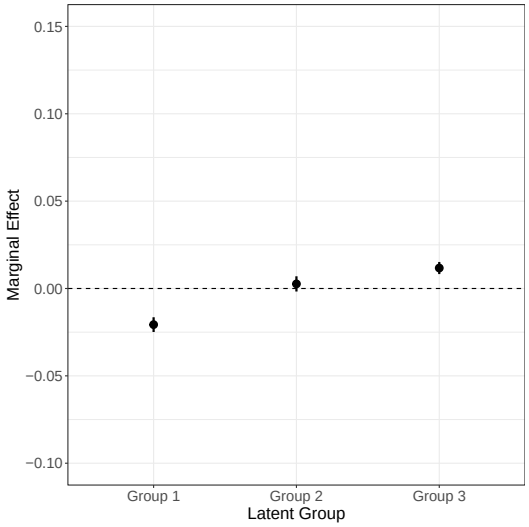
B Additional Figures on Key UNGA Votes



(a) Defense alliance network



(b) IGO co-membership network



(c) Trade agreement network

Figure B1: Latent Membership Probabilities and All UNGA Votes

Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups.

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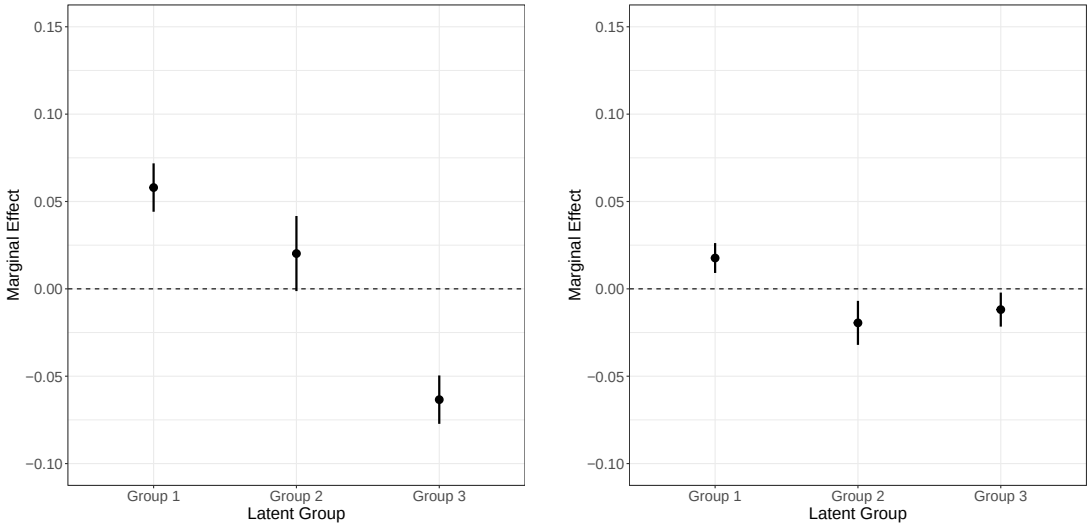
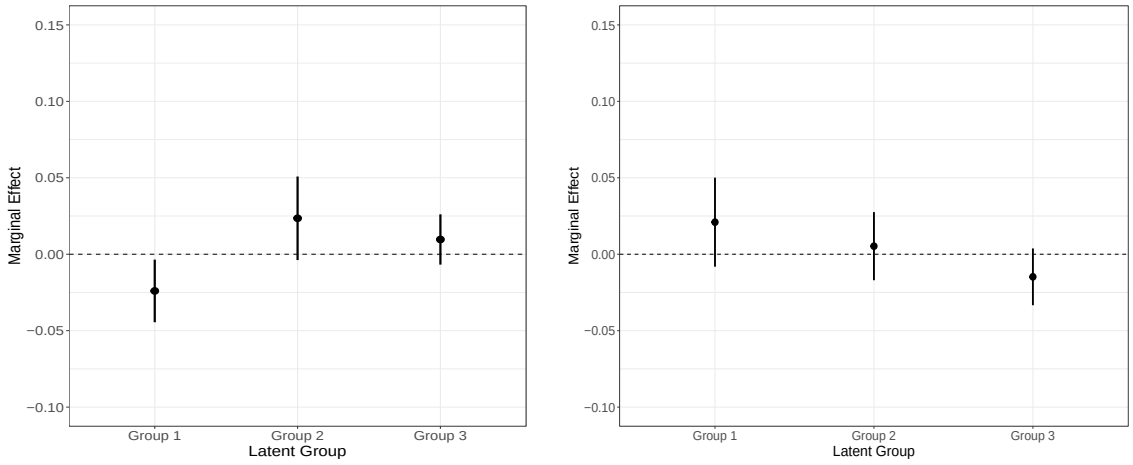


(a) Defense alliance network (b) IGO co-membership network

Figure B2: Latent Membership Probabilities and 381 UNGA Key Votes Identified by the US

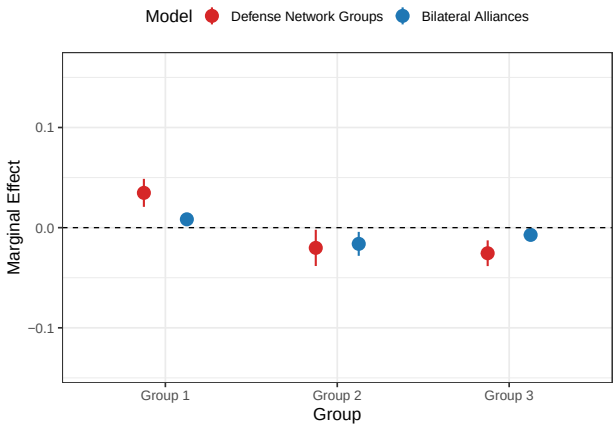
Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups.



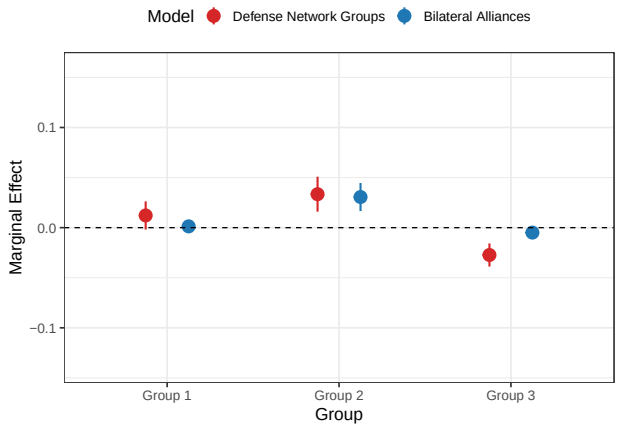
(a) Defense Alliance Network (b) Trade Agreement Network

Figure B3: Controversial Votes on Colonialism (408 votes)

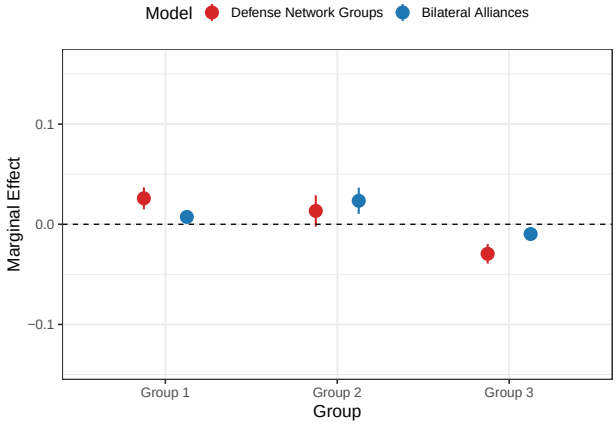
Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups.



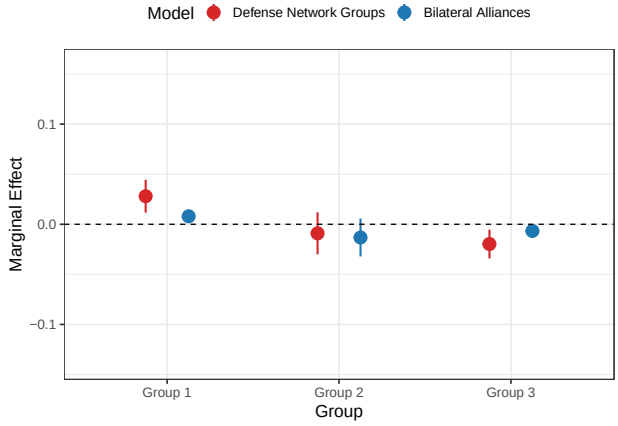
(a) Palestinian conflict (237 votes)



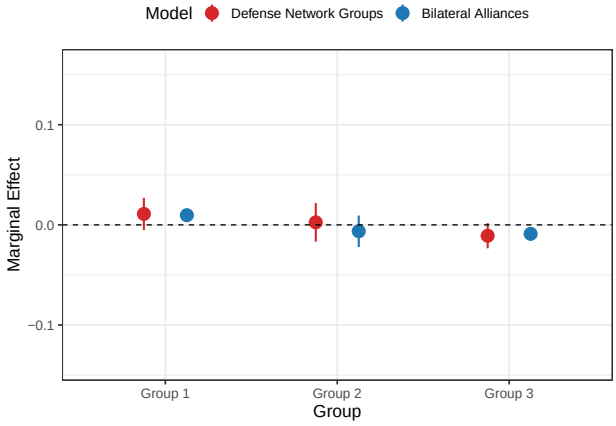
(b) Nuclear weapons and nuclear material (193 votes)



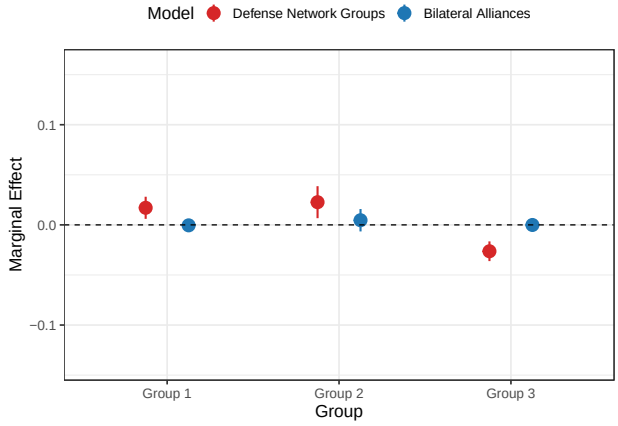
(c) Arms control and disarmament (240 votes)



(d) Collective Security (156 votes)

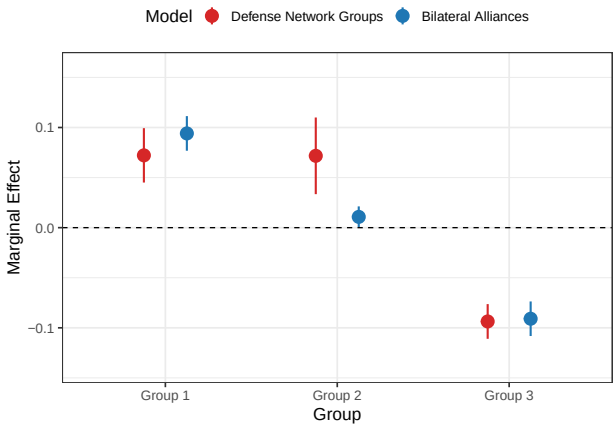


(e) Human rights (209 votes)

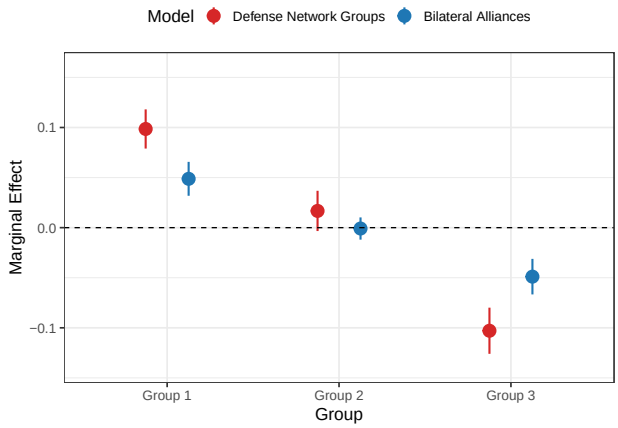


(f) Economic development (293 votes)

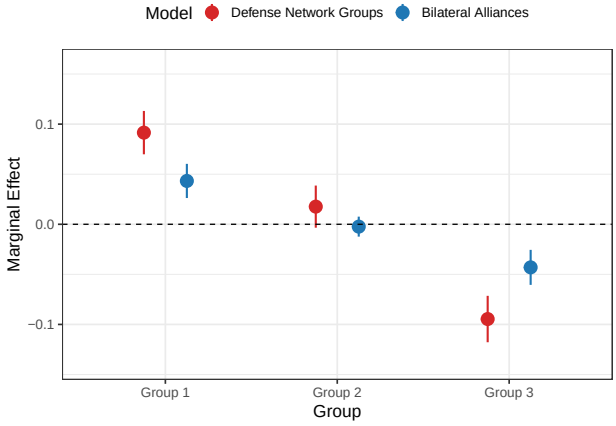
Figure B4: Defense Alliance Group Membership (versus US/Russia-USSR allies) and Controversial UNGA Votes (Cold War period: Pre-1988)



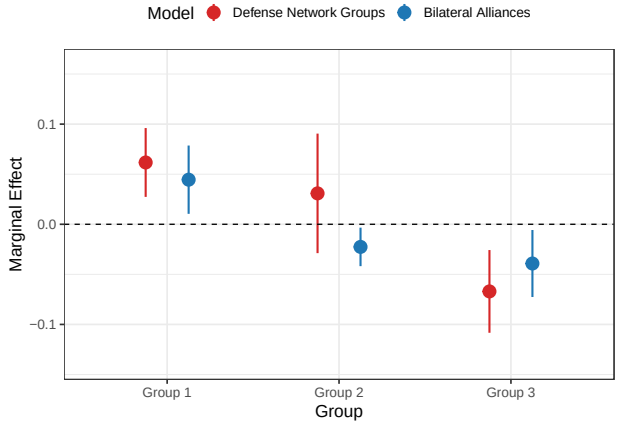
(a) Palestinian conflict (107 votes)



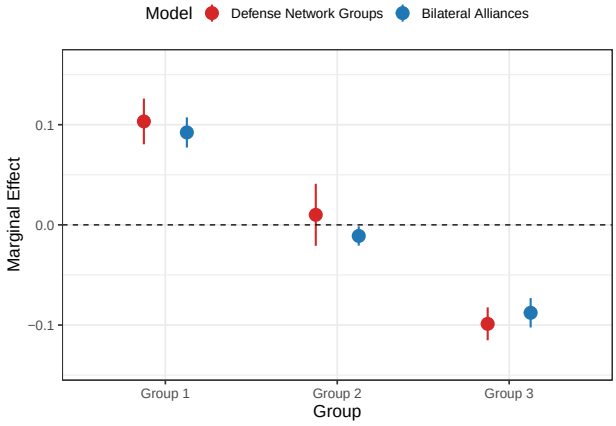
(b) Nuclear weapons and nuclear material (100 votes)



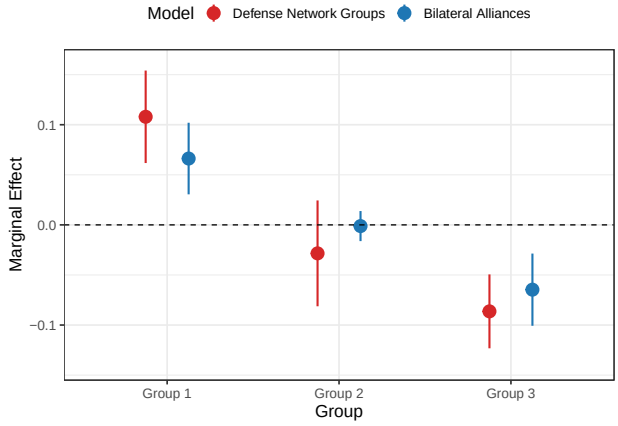
(c) Arms control and disarmament (120 votes)



(d) Collective Security (32 votes)

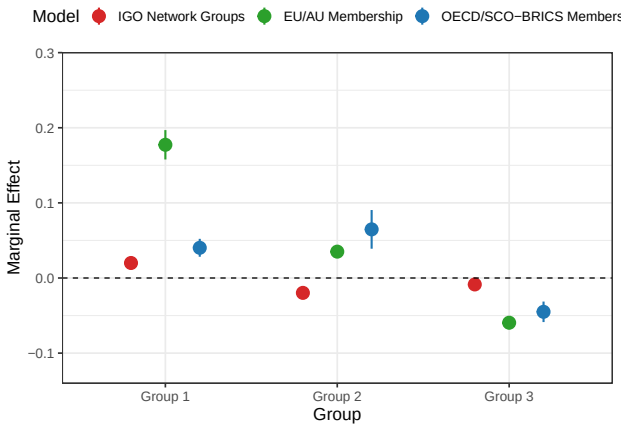


(e) Human rights (172 votes)

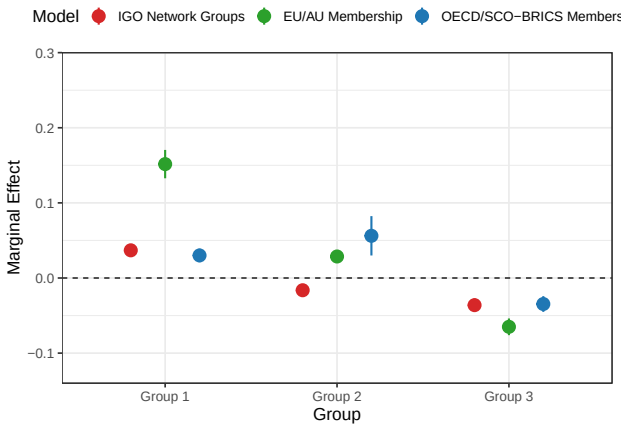


(f) Economic development (30 votes)

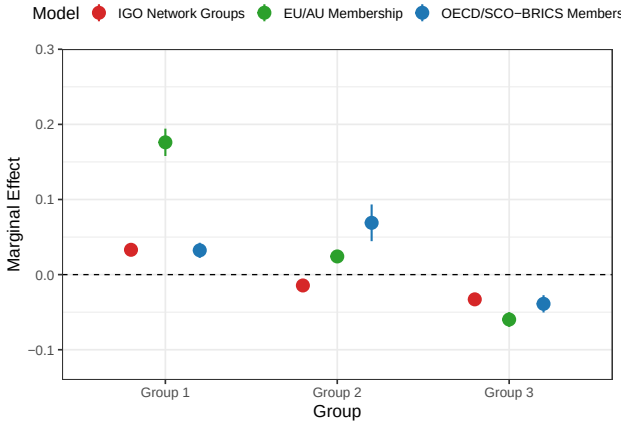
Figure B5: Defense Alliance Group Membership (versus US/Russia-USSR allies) and Controversial UNGA Votes (Post Cold War period: Post-1994)



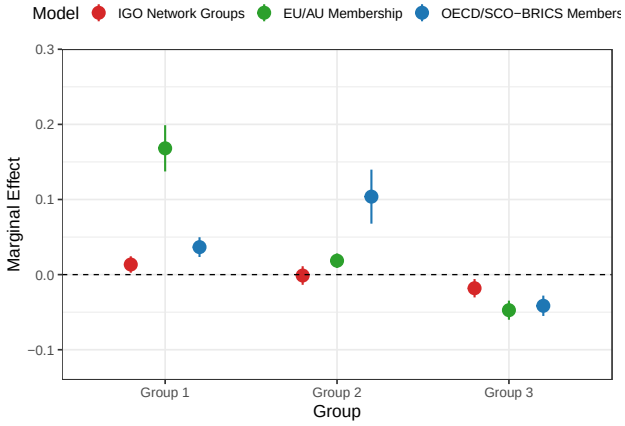
(a) Palestinian conflict (403 votes)



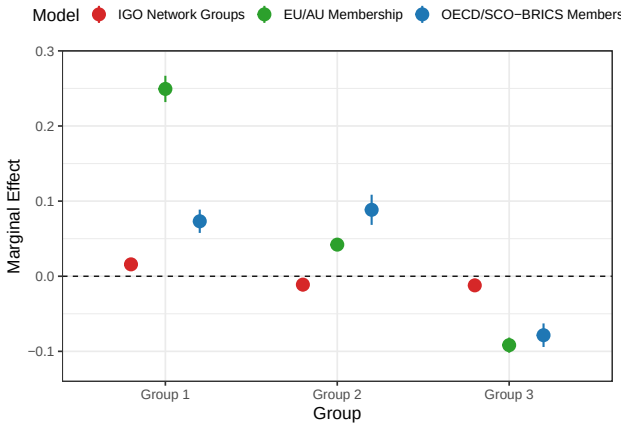
(b) Nuclear weapons and nuclear material (325 votes)



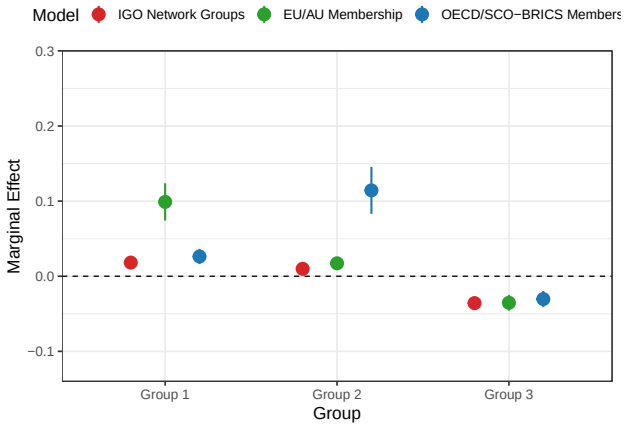
(c) Arms control and disarmament (391 votes)



(d) Collective Security (205 votes)

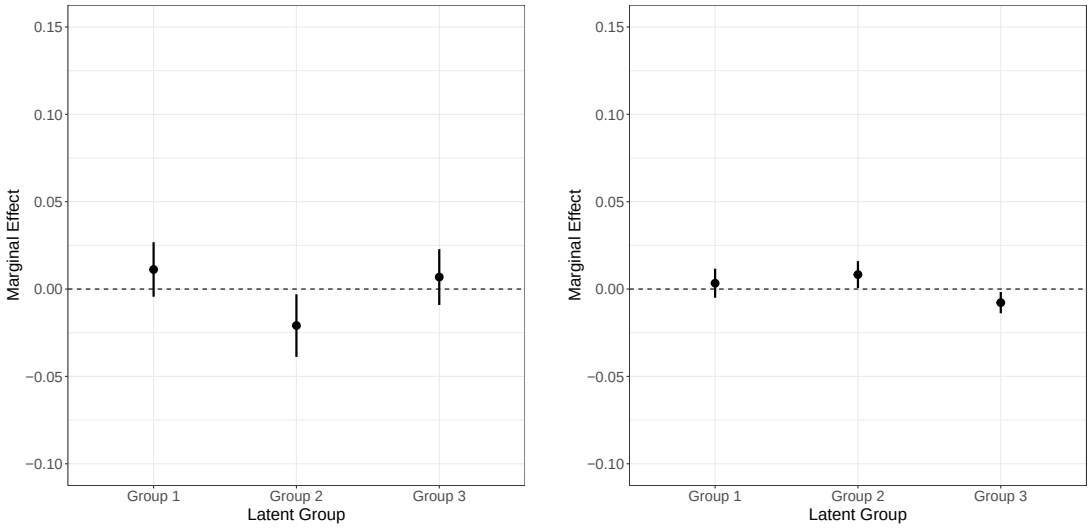


(e) Human rights (421 votes)



(f) Economic development (351 votes)

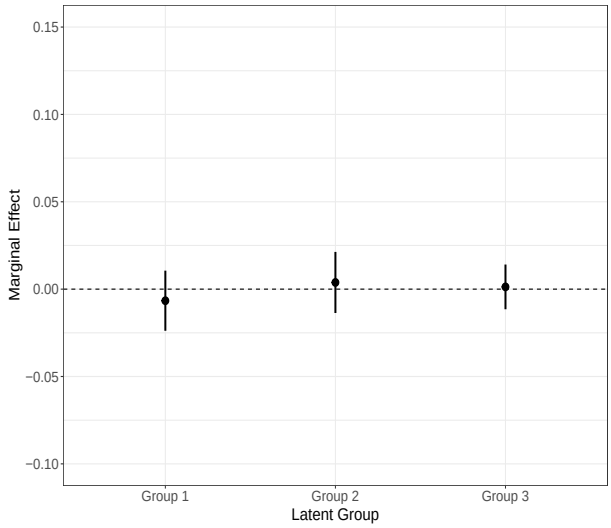
Figure B6: IO Group Membership and Controversial UNGA Votes



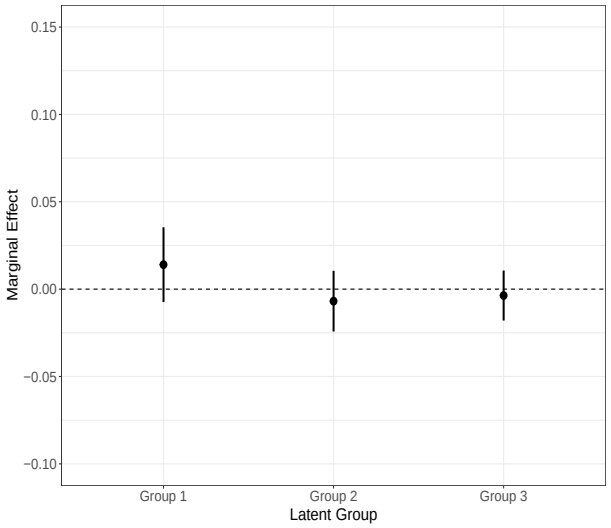
(a)381 US Important Votes (b) 2643 Controversial Votes

Figure B7: Latent Membership Probabilities in the Trade Agreement Network and UNGA Key Votes

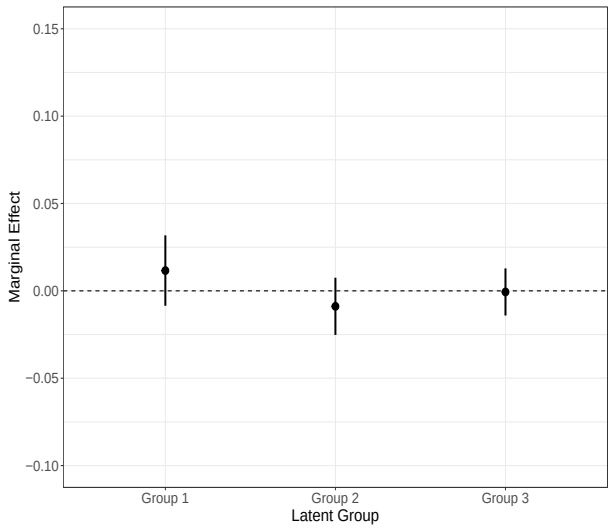
Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups.



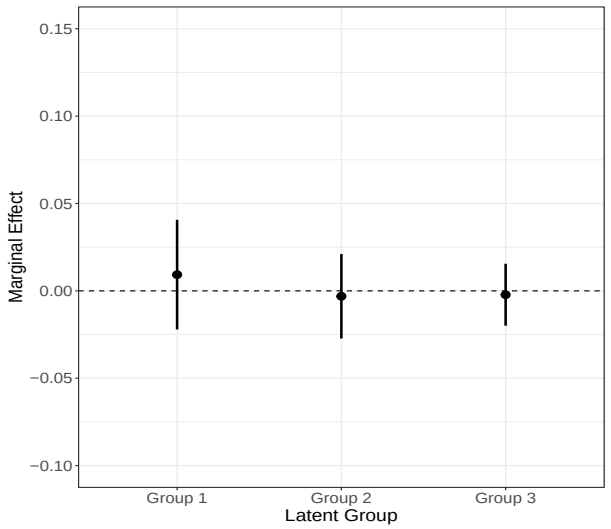
(a) Palestinian conflict (403 votes)



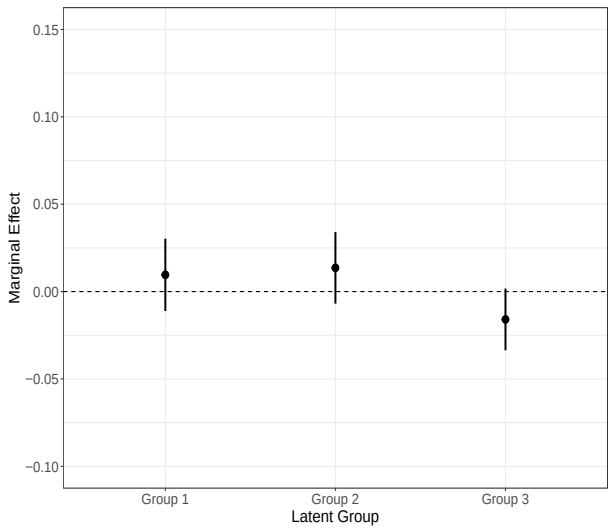
(b) Nuclear weapons and nuclear material (325 votes)



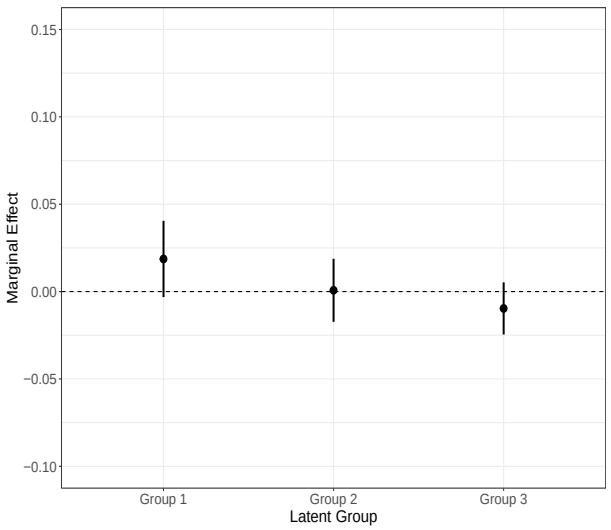
(c) Arms control and disarmament (391 votes)



(d) Collective Security (126 votes)

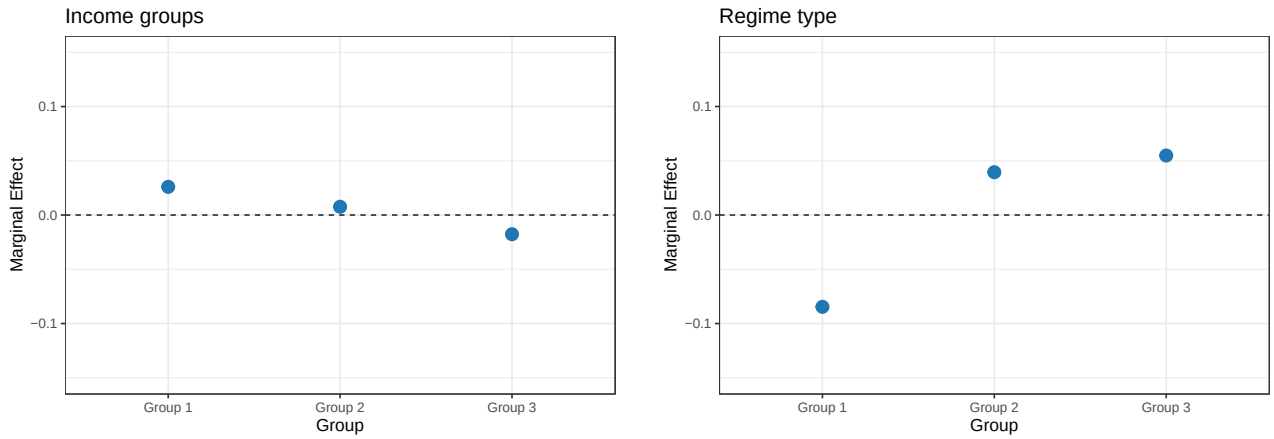


(e) Human rights (421 votes)



(f) Economic development (351 votes)

Figure B8: Trade Agreement Network: Latent Membership Probabilities and Controversial UNGA Votes



(a) Income groups

(b) Regime type groups

Figure B9: Interest-based Groups and UNGA Key Votes

Note: The y-axis is the effect of income group membership on a state's probability of voting with the majority in that group. The nodes represent point estimates, and the error bars are 95% confidence intervals. The y-axis is the effect of regime-based group membership on a state's probability of voting with the majority in that group. In figure (a), the x-axis is the three World Bank income groups. Group 1 is high-income countries, group 2 is low-income countries, and group 3 includes middle-income countries. In figure (b), the x-axis represents the three regime-based groups. Group 1 is democracies (polity2 >5), group 2 is autocracies (polity2 <-5), and group 3 includes countries in between.

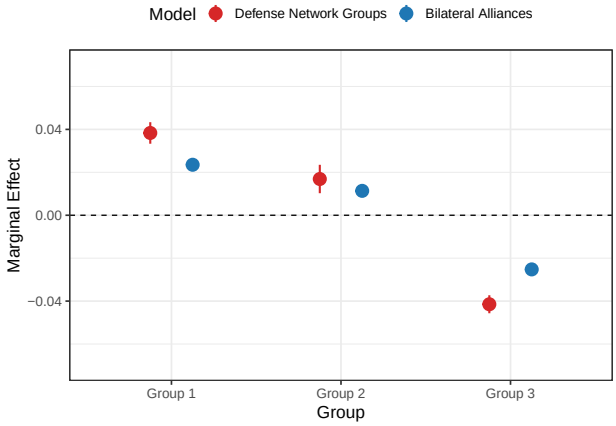
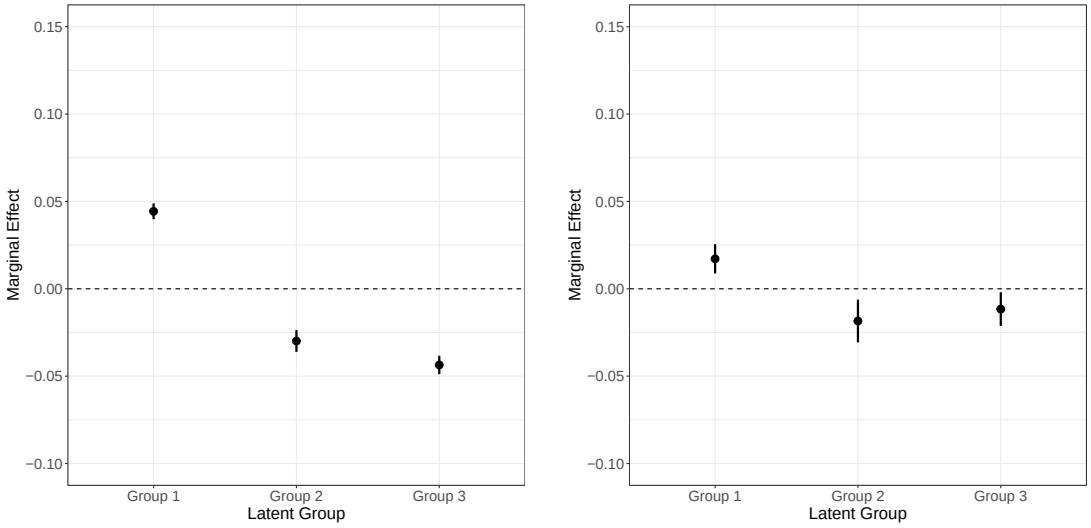


Figure B10: Defense Alliance Group Membership (versus US/Saudi Arabia allies) and UNGA Controversial Votes

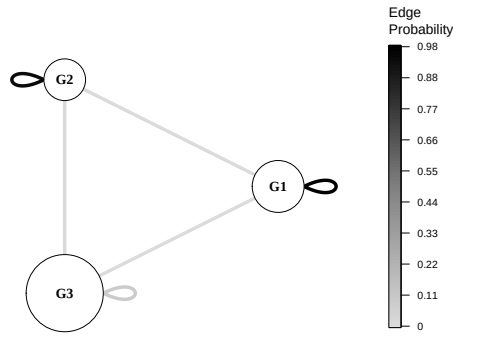
Note: The y-axis is the effect of defense alliance group membership on a state's probability of voting with the majority in that group. The x-axis is the three latent groups. The nodes represent point estimates, and the error bars are 95% confidence intervals. For defense network groups, groups 1 to 3 are ranked according to the probability of their in-group tie formation (high to low). For bilateral alliances, group 1 includes all US allies, group 2 includes Saudi Arabia's allies, and group 3 includes all other countries.



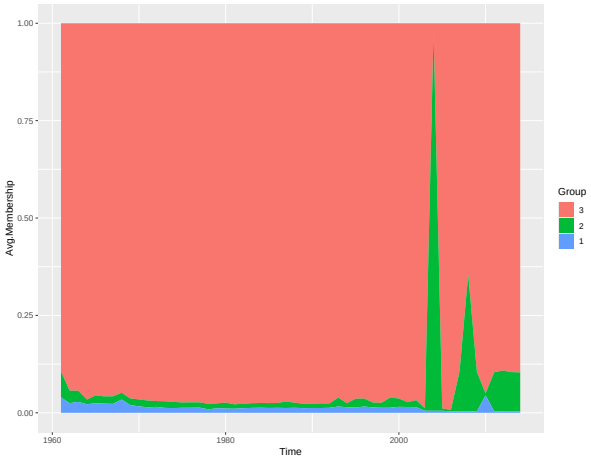
(a) Controversial votes (b) US important votes

Figure B11: Latent Membership Probabilities in the IGO Co-membership Network (Removing UN) and UNGA Key Votes

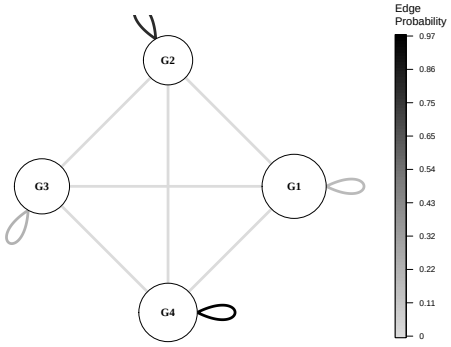
Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups.



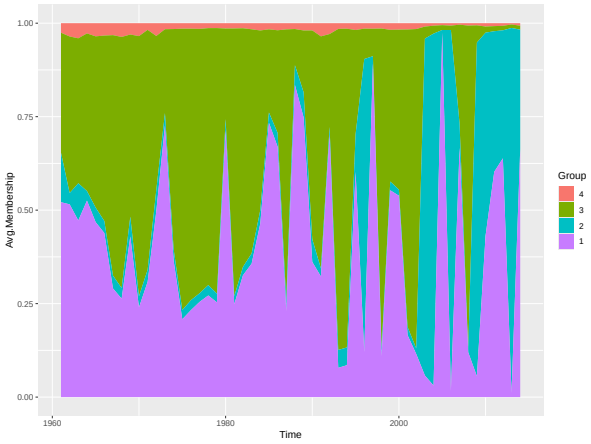
(a) Defense alliance network: 3 groups



(b) Kenya Membership: 3 groups



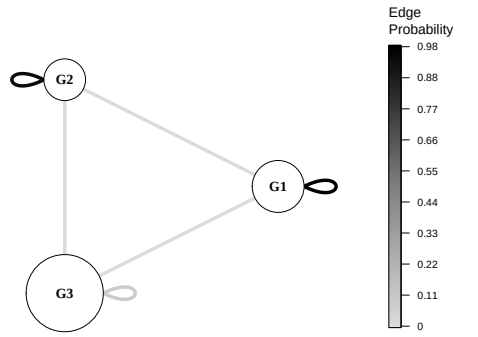
(c) Defense alliance network: 4 groups



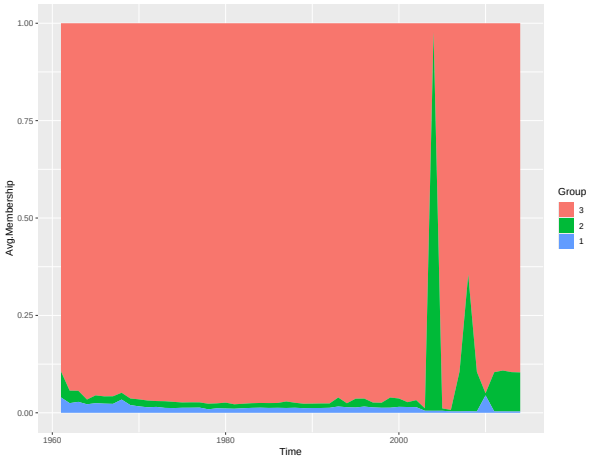
(d) Kenya Membership: 4 groups

Figure B12: Defense Alliance Network with Three vs Four Latent Groups

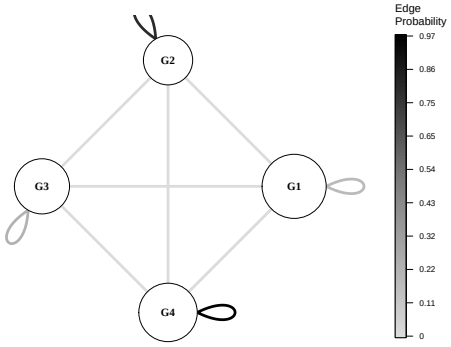
Note: In Panels a) and c), the nodes (circles) represent the latent groups. The size of the nodes indicates the group's membership size. The edges between the nodes represent the estimated probability a state from one group forms a defense pact with nodes from the other group. Panels b) and d) show the mixed membership for Kenya. When there are four groups, groups 1 and 3 are structurally similar, and Kenya switches constantly between the two.



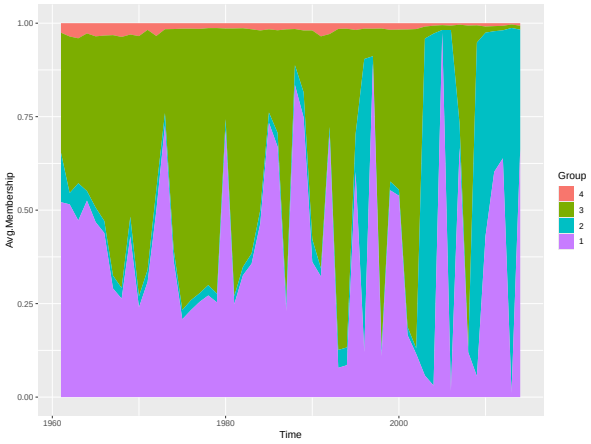
(a) Defense alliance network: 3 groups



(b) Kenya Membership: 3 groups



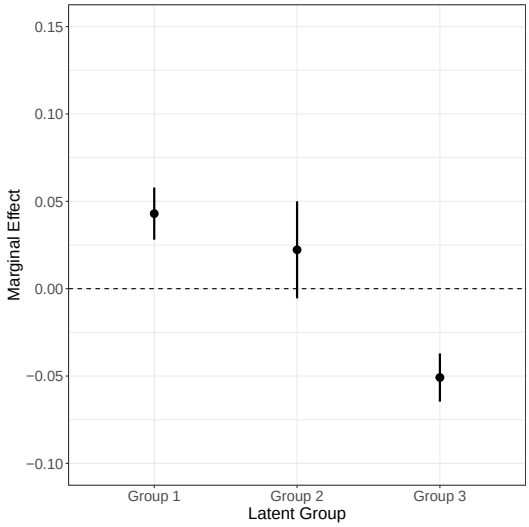
(c) Defense alliance network: 4 groups



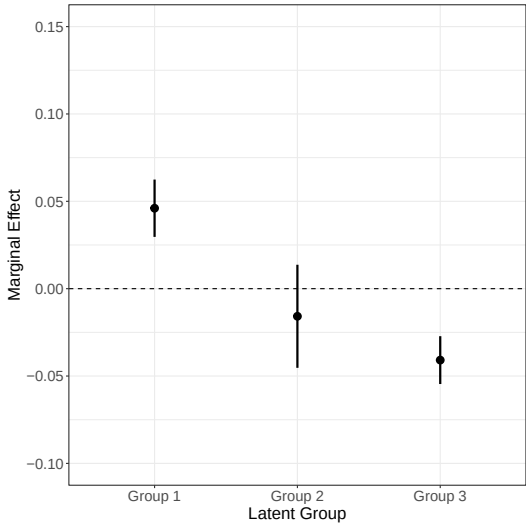
(d) Kenya Membership: 4 groups

Figure B13: Defense Alliance Network with Three vs Four Latent Groups

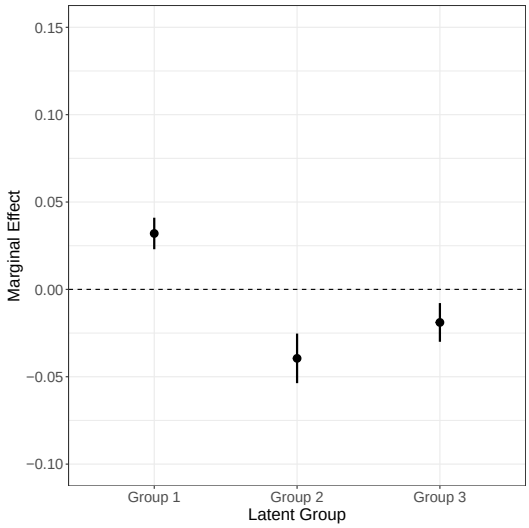
Note: In Panels a) and c), the nodes (circles) represent the latent groups. The size of the nodes indicates the group's membership size. The edges between the nodes represent the estimated probability a state from one group forms a defense pact with nodes from the other group. Panels b) and d) show the mixed membership for Kenya. When there are four groups, groups 1 and 3 are structurally similar, and Kenya switches constantly between the two.



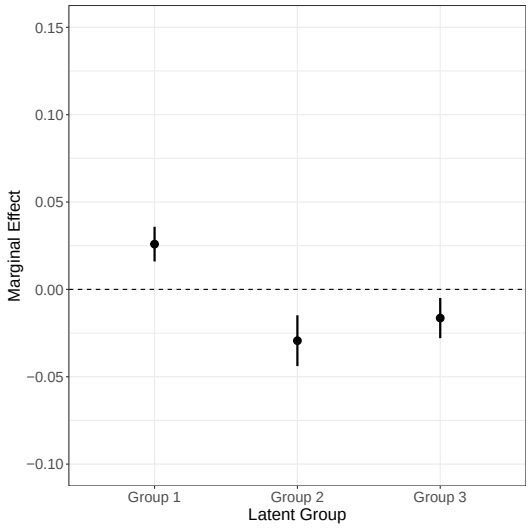
(a) Defense: Removing most relevant ME states



(b) Defense: Removing relevant ME states



(c) IGO: Removing most relevant ME states



(d) IGO: Removing relevant ME states

Figure B14: Latent Membership Probabilities in the Defense Alliance and IGO Co-membership Network and UNGA Key Votes on Middle East Issues

Note: The y-axis is the effect of latent group membership probabilities on a state's probability of voting with the majority in that group. The x-axis is the three latent groups. Figures (a) and (c) removes the U.S., Iran, Iraq, Israel, Saudi Arabia, and Syria. Figures (b) and (d) removes the U.S. and all Middle East and North Africa countries defined by the World Bank data.