Alliance networks and trade: The effect of indirect political alliances on bilateral trade flows

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Abstract

How does the network of international political alliances influence trade flows? Previous work suggests that alliances matter in predicting trade outcomes because governments align trade policies with national security interests and firms take political relations between states into account when assessing risk. However, work to date investigates only the relationship between *direct* political alliances and trade, which ignores the complexity of international alliance structures. In this article, I argue that states and firms not only consider direct political relationships when shaping international trade, but also focus crucially on indirect alliance relationships. I find that higher levels of trade result when states have more *shared* alliances and when they are in the same alliance *community*. Once these indirect relationships are accounted for, the apparent association of dyadic alliances with trade is drastically reduced. Joint membership in an alliance community predicts an increase in trade that is more than twice the increase associated with a dyadic alliance. This effect is magnified when considering highly 'central' states in the alliance network. States trade significantly more with central states in their own alliance community and less with central states in other communities.

Keywords: Alliances, trade, network analysis

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Introduction

While previous studies agree that political alliances have notable impacts on trade outcomes, the existing literature limits examination to direct political relationships. Focusing only on political relationships within dyads overlooks the complexity and interdependence of international alliance structures and misses important aspects of how international power politics affect trade. A growing literature on international networks has shown the value of considering extra-dyadic relationships between states when investigating a variety of international phenomena (Maoz, 2012; Ward, Stovel & Sacks, 2011; Hafner-Burton, Kahler & Montgomery, 2009). In this article, I argue that a network approach considering indirect alliances allows for important theoretical and empirical advances in understanding the relationship between alliances and trade.

Building on the seminal work of Gowa & Mansfield (1993), I focus on the influence of alliances on government trade policy shaped by security externalities (the potential for economic gains to be transferred to political and military power) and on firm-level risk. The central claim of this paper is that these mechanisms can be better conceptualized by considering the properties of the larger international alliance network rather than just dyadic relationships. When leaders in a state, A, consider security externalities of trade policy relating to another state, B, they take into account not only their direct political relationship with B, but also the alliances B has with other states. For example, during the Cold War, the US restricted trade with Soviet proxies in Eastern Europe through some of the most restrictive tariffs in the nation's history (Gowa, 1994). The motivation behind this had little to do with security externalities deriving from direct relationships with these countries. On their own, most Soviet proxies posed little threat to US security. More salient to US policy concerns were the potential negative security externalities deriving from the relationship these states had with the Soviet bloc. Additionally, at the sub-national level, firms take indirect alliance relationships into account when evaluating the risk of setting up trade channels because of the effect alliances have on the likelihood of conflict and opportunistic government behavior.

The rest of the paper proceeds as follows: I begin by laying out the mechanisms by which political alliances affect trade, focusing on the way that alliance networks shape government trade policy and firm-level risk. I argue that while the direct political relationship between a home country and a potential trading partner matter, in most cases, government policy and investment risk are driven primarily by the alliances trade partners have with other states. Next, I turn from theory to empirical hypotheses, predicting that *shared* alliances and alliance *communities* have important influences on trade flows. Additionally, because states that occupy central positions in an alliance community are likely to be more important to the security of their bloc than peripheral states, I predict that states will differentially promote trade to central members of their own community and restrict trade to central members of other communities. Finally, I present results from an empirical study of trade levels from 1950 to 2001. These results suggest that indirect alliances play an important role in determining international trade. Shared alliances, alliance communities, and states' centrality in the alliance network are substantially better predictors of trade flows than dyadic alliances. Joint membership in an alliance community predicts an increase in trade that is more than twice the increase associated with a dyadic alliance.

Theory: How indirect alliances influence trade

An important line of literature in international relations finds that political alliances facilitate international trade while political tensions result in trade restrictions (Gowa & Mansfield, 1993; Gowa, 1994; Pollins, 1989b; Long, 2003; Gowa & Mansfield, 2004). Alliances are linked to trade flows through two main mechanisms. First, political alliances drive 'security externalities' that arise from trade, which in turn influence government trade policy towards other states. Second, political alliances influence the likelihood of future opportunistic behavior by governments towards foreign firms and the risk of conflict between states, which firms take into account when determining whether to invest or set up trade channels with other states. Both of these factors can influence overall trade levels, but previous studies focus exclusively on the role of dyadic alliances when discussing these mechanisms. In this section, I elaborate each mechanism and discuss how indirect alliances affect both government policy and firm-level risk evaluation.

Policy mechanism

The first reason political alliances affect trade outcomes concerns the incentives facing national governments when setting trade policy. Because economic gains can be translated into military strength and international influence, trading with a political enemy results in negative security externalities that reduce the benefits of trade (Gowa & Mansfield, 1993; Gowa, 1994). In contrast, trading with an ally results in positive externalities, as the power that an ally gains from increased trade increases the security for both parties in the relationship. Taking into account the differential costs and benefits of trade, national governments set trade policy to better align with national security interests, encouraging trade with allies and discouraging trade with enemies.

While Gowa & Mansfield (1993) hint at the fact that indirect alliances matter, the theoretical implications of indirect alliance relationships are not discussed in detail and are not considered in the empirical analysis. Fleshing out the logic of security externalities through a network framework provides new theoretical insights and allows for measurement that more accurately captures real-world security externalities. I argue that governments explicitly think in terms of indirect alliances when making decisions over trade policy. This manifests in two ways: 1) states consider indirect alliances when crafting their own bilateral trade policy with other states, and 2) states actively promote trade *between* their allies.

First, historical evidence suggests that states explicitly consider indirect political alliances when crafting bilateral trade policy with other states. During the Cold War, the US actively promoted trade with countries aligned with the Western bloc while implementing the highest tariffs in the nation's history on imports from the Soviet bloc (Gowa, 1994). The political motivation behind these policies was likely not primarily based on direct alliance ties. For example, the US did not impose an embargo on Cuba primarily because of concerns stemming from the dyadic relationship. No matter how much of its economic gains it translated into military power and political influence, Cuba alone did not pose a significant threat to US security. Instead, a strengthened Cuba was considered threatening because of its effect on the international influence of the Soviet bloc. Having a more powerful economic and military ally in the Caribbean could provide important strategic benefits to the Soviet Union and inspire other communist revolutionaries.

After taking security externalities into account, governments have a menu of policy tools at their disposal to influence trade flows in a way that best satisfies national security interests. Gowa & Mansfield (1993) originally focused on the role of tarriffs, and differential tariff rates continue to be a widely used tool in the effort to isolate political enemies and benefit allies (Gowa, 2010). On top of this, states increasingly use non-tariff barriers[1] to shape trade flows (Bhagwati, 1988). Third, governments can incentivize trade with certain countries through preferential trade agreements (PTAs). In fact, negotiations over political alliances and trade policy are often directly tied with each other, resulting in bundled agreements that involve both political and economic aspects (Stasavage & Guillaume, 2002; Long & Leeds, 2006). Finally, in extreme cases, governments use explicit economic sanctions to isolate states that pose a security risk (Hufbauer et al., 1997).

Presuming that a state benefits from the increased economic and military power of its allies, that state should not only promote trade directly with its allies, but also attempt to facilitate trade *between* them. Thus, the level of trade between a pair of states will be influenced by their relationship with interested third party states. After WWII, the US 'had a decisive influence upon West European moves towards closer collaboration and integration' by facilitating the creation of the European Economic Community (Urwin, 2014: 13). The

[1]Including but not limited to: import quotas, anti-dumping measures, countervailing duties, export subsidies, and differential quality standards.

EEC established free trade zones and later developed into one of the pillars of the EU. One way the US accomplished this was by conditioning Marshall Plan aid on decreased trade barriers between Western European countries, which essentially ‘forced European countries into a closer pattern of economic cooperation’ (Urwin, 2014: 18). By promoting trade between its European allies, the US hoped to strengthen the economic power of these states, which could be translated into military strength for the Western bloc. In response, the Soviet Union attempted to promote trade between its allies through COMECON (Brine, 1992). More recently, under the influence of the United States as a hierarchal authority and the ‘“Washington consensus” on economic liberalism,’ Caribbean states ‘trade more overall and trade more with each other than other states’ (Lake, 2010).

Firm risk mechanism

As has been highlighted by important recent work in IPE, the primary actors that determine trade flows are not states, but firms and individuals (Helpman & Krugman, 1985; Melitz, 2003; Helpman, 2014). Thus, a theory of how indirect alliances affect trade must take into account the way these political relationships influence firms that are motivated primarily by profit maximization rather than national security. In addition to their effect on government policy regulating trade, indirect alliances affect firm incentives 1) through their effect on the likelihood of future opportunistic behavior and trade barriers imposed by foreign governments and 2) through their effect on the likelihood of conflict.

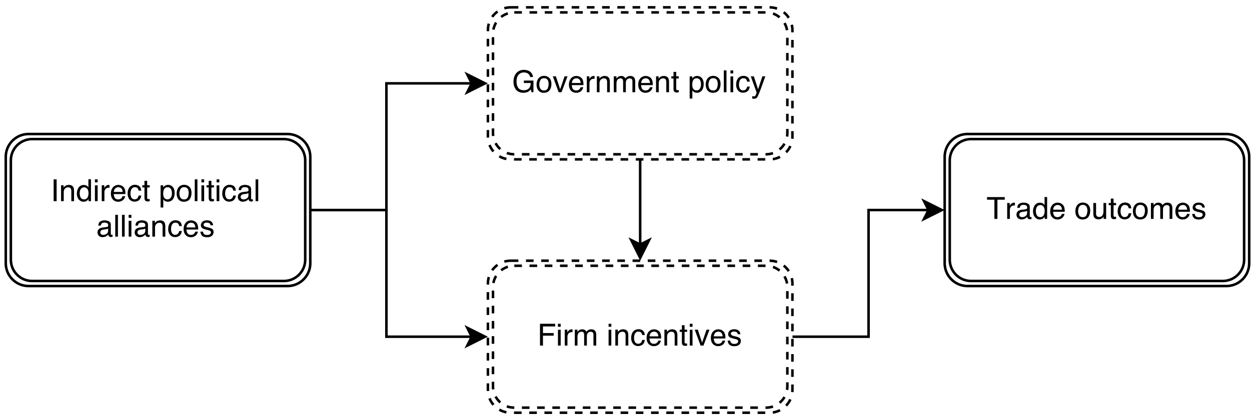
First, alliances affect trade because they shape government incentives to act opportunistically towards foreign firms, which can tip the scales in a firm’s calculation over whether to engage in trade and investment. Tailoring relation-specific assets towards a foreign market,[2] setting up trade channels with foreign firms, and entering a foreign industry all involve significant sunk costs for firms (Melitz, 2003; Yarbrough & Yarbrough, 1992; Williamson, 1985). Investing in countries allied with a firm’s home state reduces the risk of expropria-

[2]For example, Japanese car companies manufacturing cars to accord with US safety standards.

tion and future trade barriers imposed by both governments, increasing the probability that profits will surpass investment costs. Previous empirical findings reinforce the importance of this mechanism, as alliances have a larger influence on trade in sectors subject to increasing returns to scale that involve higher initial investment costs (Gowa & Mansfield, 2004) and when firms have less influence over government policy (Kastner, 2007). In addition, foreign direct investment is more likely to come from firms in allied states (Li & Vashchilko, 2010). This firm-level mechanism is strongly tied to the government policy mechanism: 'governments have incentives to engage in opportunistic behavior toward their adversaries' firms, since doing so helps to redress the security externalities arising from trade' (Mansfield & Bronson, 1997: 95). Therefore, if indirect alliances affect government incentives to shape trade, we should expect this to spill over to firm-level incentives to engage in trade.

A second mechanism linking indirect alliances to firm-level incentives involves the risk of conflict between states. When states are allied with each other and political tension is low, the probability of conflict between them is reduced, which lowers risk to firms' investments (Pollins, 1989a,b). Because trade generally suffers when conflict breaks out between states (Keshk, Pollins & Reuveny, 2004; Glick & Taylor, 2010) and political alliances seem to be honored in most cases (Leeds, Long & Mitchell, 2000; Leeds, 2003), firms should be more willing to invest in trade with states that are allied with their home country due to the lower risk of disrupted trade. However, dyadic political relationships are not the only factors that affect the likelihood of conflict. Empirical work shows that indirect alliance ties (or 'strategic affinity') between a pair of states has a profound influence on the probability of conflict (Signorino & Ritter, 1999; Maoz et al., 2006; Maoz, 2009). Thus, by investing in trade with a state that not only has a bilateral alliance with the firm's home state, but is also part of their home state's core alliance bloc, a firm can be more confident in avoiding future trade disruptions. At the same time, firms attribute the greatest risk to investments in a state that has many alliance ties with their home state's enemies (e.g. US firms investing in Soviet proxies) because a trade-disrupting conflict is most likely to occur with these states.

Figure 1. Mechanisms



In sum, there are two main mechanisms by which indirect alliances affect trade outcomes (Figure 1). First, indirect alliances affect the security externalities derived from trade, which incentivize governments to manipulate current trade policy (either their own state's trade policy or the trade policy of other states) to promote security interests. These policies, whether they be tariffs, NTBs, PTAs, sanctions, or strategic expropriation, then influence firm-level incentives to engage in investment and trade. Second, indirect alliances influence firm-level investment risk associated with the likelihood of conflict.

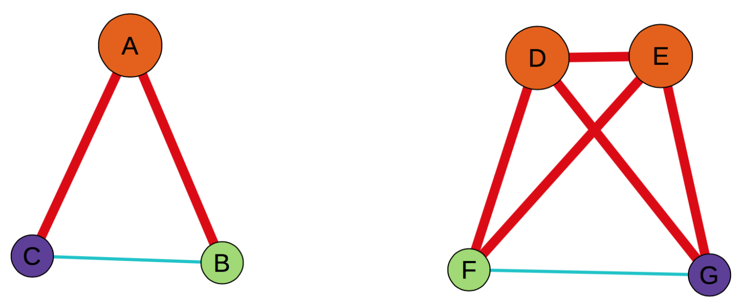
From theory to hypotheses

In this section, I use network theory to develop and operationalize specific hypotheses regarding the ways that indirect alliances are associated with trade flows. While, to my knowledge, social network analysis (SNA) has not been applied to the relationship between alliances and trade, a growing literature in international relations uses network theory to illuminate the importance of extra-dyadic ties for relationships between states.[3] One way to think about the influence of indirect alliance ties is by looking at the number of *shared* alliances. Shared alliances shape government and firm incentives when two states do not have a direct alliance with each other as well as when a direct alliance is in place.

[3]See Hafner-Burton, Kahler & Montgomery (2009) and Maoz (2012) for reviews of this literature.

First, shared alliances matter when two countries *do not* have a bilateral alliance with each other. In Figure 2, consider the relationship between countries B and C. While they do not have a direct political alliance (red), the security externalities of trade are affected by the fact that they each have a political alliance with country A. The negative externalities that might be generated by trade with a non-ally are tempered or, depending on the importance of country A to their security concerns, surpassed by the positive externalities associated with their joint relationship with country A. Because B benefits from increased strength for A and A benefits from increased strength for C, B should benefit from increased strength for C. Thus, B is less likely to implement restrictive trade policy towards C (and vice versa) than would be predicted by a model that considers only direct alliances. In addition, because state A has a vested interest in trade between states B and C, it might actively promote trade between these mutual allies.

Figure 2. Toy example 1



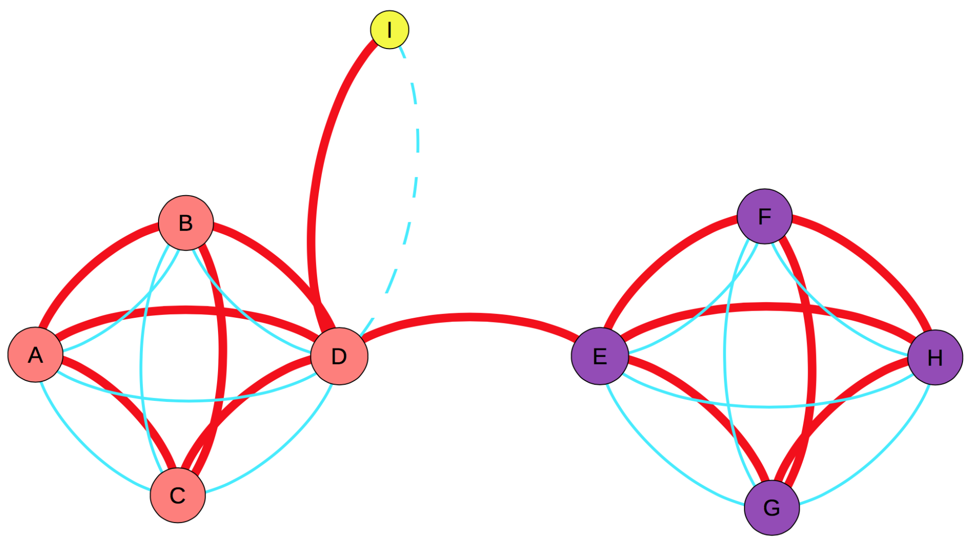
Red ties represent alliances. Blue ties represent trade relationships between non-allied states that are expected to be stronger than they would under a theory that considers only direct alliances in predicting trade. States C and B are likely to experience higher levels of trade because of their joint alliance relationship with A. Even more trade is predicted between F and G because they share two joint alliances.

Now consider countries F and G, who share two joint allies. All else equal, they are even more likely to trade with each other than countries A and B, who only share one alliance. A greater number of shared alliances generates greater positive security externalities from trade because it benefits more joint allies. In addition, perhaps countries F and G are more likely to trade with each other because of the security relationship *between* their joint allies. Gains for G translate into gains for E which in turn translate into gains for D. Thus, F's trade with G produces benefits that multiply because of the relationship between D and E. In this way, a political alliance between a pair of states can affect trade relationships between states that are completely separate from the allied dyad.

In addition to their effect when two states do not share a direct alliance with each other, shared alliances affect security externalities generated by trade between two countries that *do* have a direct alliance. In Figure 3, countries A through D each have an alliance with each other. While country D also has a bilateral alliance with country I, it is more likely to trade with A, B, and C than with I (all else equal) because of second level security externalities. By being part of a cooperative clique, countries A through D benefit from more positive security externalities associated with trade with each other than if their alliance partners were not also aligned. At the first level, country D benefits from trade with C by bolstering the power of an alliance partner. At the second level, country D benefits from trade with C because gains for C translate into gains for A and B, which are also D's alliance partners. In contrast, D might benefit from first level security externalities associated with trade with I, but the lack of second level gains makes this a relative dead end.

For a potential trade partner, shared alliances matter, but so do the number of allies the potential partner has with states that are not allied with the home state ('discordant' alliances). In Figure 3, D has greater incentive to trade with countries A-C than with country I, but even less of an incentive to trade with E. Because trade with E would also benefit countries F through G (which are not allied with country D or any of its allies), trade with E will on average be associated with greater negative externalities. Discordant alliances also increase negative externalities of trade because certain goods can be transshipped directly to a salient adversary through indirect trade channels (Chyzh, 2016). Returning to the previous real world example, this analysis suggests that the US should restrict trade to a Soviet proxy not only because it does not share a direct alliance with that country, but also because that

Figure 3. Toy example 2



D has direct alliances with B, I, and E. However, because of indirect alliances, D's predicted trade with these state's will follow the pattern: B $>$ I $>$ E.

country has additional alliances with other non-US allies.

In addition to influencing government incentives to promote trade, alliance networks contribute to firm-level incentives to engage in trade. First, the government incentives described above shape current policy, which in turn shape firms' incentives to invest in trade. In addition, shared alliances shape firm expectations about the implications for future trade-disrupting political tension, or even conflict, between states. Returning to Figure 3, consider the calculus of a firm from State D. First, because State B has more joint alliances with the firm's home state, the firm can expect that, all else equal, D is less likely to come into direct conflict with B than with states I or E.[4] This lower risk of conflict increases the likelihood that the firm will recoup its initial investment in trade channels with state B. Second, consider the case where tensions arise between B and a state in the EFGH community. As Long (2003: 542-543) states, 'firms realize that a state with allies promising to

[4]This expectation is supported by the empirical findings that strategic affinity based on alliance profiles is associated with a lower risk of conflict (Signorino & Ritter, 1999; Maoz et al., 2006).

defend it is less likely to be attacked,' and so they 'should use this information in making decisions to establish trade.' This mechanism should be strongly driven by shared (rather than dyadic) alliances, as a firm's home state having a greater number of shared alliances with a potential trade partner implies that there are a greater number of states with a vested interest in coming to that state's defense. Stemming from the above analysis, I derive my first hypothesis:

H1. *All else equal, pairs of states with a greater number of shared alliances are likely to have higher levels of trade. Pairs of states with a greater number of discordant alliances are likely to have lower levels of trade.*

The more complexity that is added to the toy examples, the more they mirror real world concerns about security externalities, and as groups of allies become more densely connected, the more the security externalities of trade multiply with each other. Political alliances form interconnected webs of states that have important implications for trade outcomes. When situating themselves in these complex networks, states often begin to form integrated alliance *communities*. In a large network such as the full international system, the most salient divides between groups are often defined by these densely clustered communities (Lupu & Traag, 2013; Traag & Bruggeman, 2009). Trade that benefits one's alliance community has positive security externalities while trade that benefits another community has neutral or negative externalities. On top of this, firms can be more confident that other states will come to the defense of a state in which they have invested if that state is a member of a dense cluster of allied states. Community detection algorithms can be used to identify highly connected clusters of nodes that form alliance blocs.[5] An approach that uses alliance communities is similar to the shared alliances approach in the first hypothesis, but also takes into account third and fourth (etc.) level alliances that would not be picked up by the shared alliance measure. Recently, Lupu & Traag (2013) use community detection to show that members

[5]For example, in Figure 3, ABCD and EFGH.

of the same trade communities are less likely to go to war with each other than members of different communities. Using a similar logic, a second hypothesis arises:

H2. *All else equal, a pair of states in the same alliance community is likely to have higher levels of trade with each other than a pair of states in different communities.*

Conceptualizing the alliance network as being populated by a set of communities has important implications for international trade, but not all states in a particular alliance community are created equal. Some states are likely to be more important to the security of a given alliance community than others, and so we should expect different levels of security externalities to be generated by trade with these states. Of particular importance is the degree to which a certain state bridges the gaps between different clusters allied states, or its 'betweeness' centrality.[6] If a state that connects different sub-clusters of states in the same alliance community is weakened, the security of the whole community is put at risk. For example, when the Soviet Union (which exhibited high betweenness because it connected different clusters of allied communist states) collapsed, the entire security community fell with it. In addition, because states that exhibit high betweenness occupy crucial positions that link different sub-communities in alliance blocs, gains from trade accrued by these states are most likely to spill over to the greatest number of alliance community partners.[7] Thus, positive security externalities are enhanced when the gains from trade are transferred to central states in one's own community and negative externalities are exacerbated when gains are accrued by central states in opposing communities. A third hypothesis arises:

[6]Betweenness is calculated at the state level by summing the number of shortest paths from all nodes to all others that pass through a certain state. As other studies have theorized, a node's betweenness centrality in the international system proxies it's bargaining power (Kahler, 2009: 12). While some have used *degree* centrality to proxy for 'social power' (Hafner-Burton & Montgomery, 2009), this measure does not have high face validity in the alliance network. Countries in certain regions are more likely to sign formal alliances than others. Degree centrality, which simply counts a country's overall number of alliance ties, is highly correlated with these regional dynamics. In addition, towards the later years of the study, the alliance network is highly connected, and, as other studies on alliance networks have noted: 'as the density of the segment increases, the importance of degree in measuring the influence of states decreases' (Cranmer, Desmarais & Kirkland, 2012: 306).

[7]If security externalities are conceptualized as being transitive, this spread of externalities is loosely analogous to the process of diffusion or the spread of an infectious disease. Individuals with high betweenness have been shown to play a particularly important role in these processes (Christakis & Fowler, 2010).

H3. *All else equal, a state is* more *likely to trade with a state that exhibits high betweenness in its* own *community and* less *likely trade with a state that exhibits high betweenness in a* different *community.*

Data and methods

To test the hypotheses in the previous section, I start with the standard gravity model of trade (Anderson, 1979) and then incorporate information on the network of alliance ties. The unit of analysis is the directed dyad-year for all years 1950-2001. The dependent variable in all models is the natural log of exports (measured in millions of standardized US dollars) from state i to state j.[8] To incorporate alliance network information into the models, I first construct the full network of political alliance ties for each year. In these networks, each country is a node and each alliance is a tie between the nodes. I count all defense pacts, neutrality or nonaggression treaties, and ententes as political alliances, which is consistent with previous literature.[9] However, as Long (2003) points out, defense pacts might be of particular importance, as states and firms should be particularly invested in the military strength of allies who will come to their defense in the case of conflict. As a robustness check, I create the network of only defense pacts and recalculate alliance network variables. All results hold using this restricted definition of alliance.[10] Because the alliance variable is binary, the network is unweighted. As a sample of what these networks look like, Figures 6 and 7 in the Appendix represent the full alliance network for the years 1960 and 2000. In 1960, four communities are detected, with the Western and Soviet blocs clearly visible. High betweenness states include the US, France, UK, China, and the USSR. By 2000, a vastly different picture arises. Eight distinct communities are detected, though they are

[8]Data from CEPII (Head & Mayer, 2013). Unless otherwise mentioned, all other variables also come from this dataset.

[9]Alliance data acquired from the 'Alliance Treaty Obligations and Provisions' (ATOP) dataset (Leeds et al., 2002).

[10]This, and all other models mentioned in the paper that do not appear in tables I and II are found in the online Supplementary Appendix.

more intertwined than the 1960 communities.

A *Shared alliances* variable operationalizing the first hypothesis (H1) is created by summing the mutual alliances shared by both members of a dyad and then subtracting the number of unique allies of the importing state that are not shared by the exporting state.[11] To detect communities, I use the 'Fast Greedy' community detection algorithm to classify groups of highly connected states (Clauset, Newman & Moore, 2004). For the second hypothesis (H2), the variable *Shared community* is operationalized as a dummy variable indicating whether both countries in a dyad are part of the same alliance community in a given year. Betweenness centrality is calculated at the state level by summing the number of shortest paths from all nodes to all others that pass through a certain state (Freeman, 1977). The key variable for the third hypothesis (H3) is the interaction between whether the states in a dyad share a community and the betweenness centrality of each state.

As a base model consistent with Gowa & Mansfield (1993), I run a gravity model that incorporates logged country-level *GDP* and *Population*, logged geographic *Distance*, conflict (all militarized interstate disputes – *MIDs*)[12], and *Dyadic alliance* ties to predict trade in a dyad. I then include the alliance network variables for the three hypotheses described above. A series of additional control variables identified by the literature (including geographic *Contiguity*, joint membership in regional trade agreements –*RTAs*, *Colonial history*, *Common currency*, *Common language*, and *GATT*/WTO membership) are included in a more rigorous specification of the model. In accordance with Morrow, Siverson & Tabares (1998), I then run models that control for joint democracy and preference similarity, which they find to be correlated with both alliances and trade. *Joint democracy* is coded one in a given year if both states in a dyad have a Polity score greater than five.[13] I control for the similarity of states' votes in the UN general assembly (*S-score*) to capture preference similarity.[14] To account

[11]As robustness checks, I also calculate the shared alliance variable as the *proportion* of shared alliances (shared alliances divided by the sum of all the importer's alliances) and by subtracting unique allies of the *exporting* state from the sum of shared allies. All results hold with these specifications.

[12]Data from Correlates of War, Militarized Interstate Disputes version 3.1 (Ghosn & Bennett, 2003)

[13]Data from Polity IV (Marshall & Jaggers, 2008)

[14]Morrow et al use tau-b (Bueno de Mesquita, 1981) to measure preference similarity, but because my

for autocorrelation in trade flows, I include a lagged measure of the dependent variable and cluster standard errors at the dyad and year.

An important question for empirical social network analysis is how to deal with social 'isolates' (nodes with no ties) (Wasserman & Faust, 1994). Isolates in the alliance network are detected as being in a community including only themselves and have no shared alliances with other states, only discordant ones. Including isolates in the analysis might make it more likely to find a significant association of indirect alliances with trade if these isolated states also have a lower propensity to engage in international trade. Taking these concerns into account, I run the main models on 1) the subsample of states having one or more alliances in a given year and 2) the full sample of states in the international system. The results presented in the following section are from the subsample of states excluding isolates, but all results are robust to using the full sample.

One might question whether the theory in this paper is best tested with OLS regression, which assumes that, conditioning on covariates, all dyadic observations are independent. While I account for specific interdependencies in the alliance network that correspond with my hypotheses, other interdependencies might bias the results. Of particular importance is the possibility of endogenous processes in the outcome network (trade) being correlated with indirect alliances. The driving models behind studies that attempt to identify and control for interdependencies in international network formation are exponential random graph models (ERGMs) (Robins et al., 2007; Cranmer, Desmarais & Kirkland, 2012) and stochastic actor-oriented models (SAOMs) (Warren, 2010; Kinne, 2013; Warren, 2016; Kinne, 2016; Chyzh, 2016).[15] While this is a promising avenue for future research on trade networks, existing models either do not 1) account for dynamic network formation in cross-temporal data

main explanatory variables are also based on indirect alliances, I use UN voting similarity (Gartzke, 2010), which is often used to operationalize a similar concept.

[15]As an alternative, dynamic general bi-linear mixed effects models estimate a dyad's latent propensity for trade by accounting for higher-order interdependencies (Ward, Ahlquist & Rozenas, 2013). While this approach does not yet readily incorporate time-varying relational data (e.g. alliances) as explanatory variables, it represents a promising avenue for future research on the determinants of trade. The related latent space approach presented by Minahs, Hoff & Ward (2016) in this issue is particularly promising.

or 2) are incompatible with 'valued' (non-binary) outcome networks such as international trade.[16] Because existing network models are not an ideal fit for this particular study, I follow much of the previous literature on international networks by incorporating information from indirect, networked relations into a regression framework (Dorussen & Ward, 2008; Maoz, 2009; Dorussen & Ward, 2010; Lupu & Traag, 2013; Ward & Dorussen, 2016; Wilson, Davis & Murdie, 2016; Bohmelt, 2016). To adjust for interdependencies, I cluster standard errors at both the dyad and year level (Cameron, Gelbach & Miller, 2011). While, unlike a network model, this approach does not account for interdependencies in the trade network when estimating coefficients, it does allow error terms for dyads within a given year to be correlated in an arbitrary way, establishing a more appropriate level of uncertainty.[17] In addition, I examine the robustness of the main results to the multiple regression quadratic assignment procedure (MRQAP) that tests the sensitivity of observed coefficients to network dependencies, and results hold (Dekker, Krackhardt & Snijders, 2007).

Results

Table I shows the results for models relating to the first two hypotheses. Model 1 reproduces the original Gowa and Mansfield (G&M) model, showing that, consistent with their finding, political alliances are significantly associated with increased trade flows in a dyad after accounting for the gravity variables and conflict. Models 2 through 4 add the *Shared alliances* variable used to operationalize H1. The coefficient on *Shared alliances* is positive, statistically significant, and of consistent magnitude across all models, while the coefficient

[16]Temporal ERGMs (Hanneke, Fu & Xing, 2010) and SAOMs (Snijders, van de Bunt & Steglich, 2010) examine the evolution of networks over time but are currently limited to binary outcome networks such as alliances or international agreements. On the other side of the coin, ERGMs extended to valued networks (Desmarais & Cranmer, 2012; Krivitsky, 2012) are currently limited to cross-sectional analysis.

[17]For instance, this model does not assume that the error term of predicted exports from state A to state B in a given year is uncorrelated with the exports from state B to state A (reciprocity), that the error term of predicted exports from state A to B is uncorrelated with exports from B to C (transitivity), that the predicted exports from A to C are uncorrelated with the exports from B to C, or any other correlation structure in the cross-sectional errors. To more explicitly account for the influence of reciprocity in the trade network on coefficient estimates, I re-run the main models on data aggregated at the *undirected* dyad-year and all results hold.

on *Dyadic alliance* is drastically reduced once shared alliances are taken into account. Model 2 adds only the *Shared alliances* variable to the G&M model. Under this specification, the apparent association of *Dyadic alliance* with trade is reduced almost three-fold and is equivalent to approximately 25 shared alliances.[18]

Table I in here

Model 3 adds the series of control variables frequently associated with trade. Once these factors are accounted for, the coefficient on *Shared alliances* remains remarkably consistent while the coefficient on *Dyadic alliance* is again notably reduced and is no longer statistically significant. Under this specification, the increase in trade associated with a dyadic alliance is equivalent to approximately 12 shared alliances. All controls have the expected relationship with trade flows.[19] Finally, Model 4 includes the variables that Morrow, Siverson & Tabares (1998) claim to be driving the relationship between alliances and trade – *Joint democracy* and preference similarity (*S-score*).[20] After accounting for these variables, the association between shared alliances and trade remains strong. The increase in trade associated with a dyadic alliance is now only equivalent to just nine shared alliances and the presence of a dyadic alliance remains a statistically insignificant predictor of trade.

Models 5 through 7 shows the results for H2 featuring the *Shared community* variable. These results suggest a similar pattern to the results for H1. By including only the *Shared community* measure, the coefficient on *Dyadic alliance* is halved. Even in the most basic model (Model 5), being in the same alliance community as a potential trade partner predicts an increase in trade that is about 130% the magnitude of being in a dyadic alliance. Once

[18] 99 percent of the observations for *Shared alliances* fall between *-50* and *50*.

[19] *GDP, Population, Contiguity, RTAs, Common currency, Common language*, and *Colonial history* are all positively associated with trade, while *Conflict* and *Distance* are negatively associated with trade.

[20] The small decrease in observations under this specification is due to missingness in *S-score* data. The influence of *Joint democracy* is positive as expected, but preference similarity appears to be negatively associated with trade. While puzzling, this is consistent with the coefficient on preference similarity in other recent studies on the relationship between alliances and trade (Long, 2003), and might be driven by high correlation with indirect alliance profiles.

the additional controls are accounted for (Models 6 and 7), being in the same alliance community predicts more than twice as much increased trade as being in a dyadic alliance and dyadic alliances are not statistically significant predictors of trade.[21] The results in Table I are particularly promising because of the remarkable consistency of the coefficients on the indirect alliance measures. While the coefficient on *Dyadic alliance* is drastically reduced after including additional controls, these more rigorous specifications leave the magnitude and significance of coefficients on the indirect alliance measures virtually unchanged.

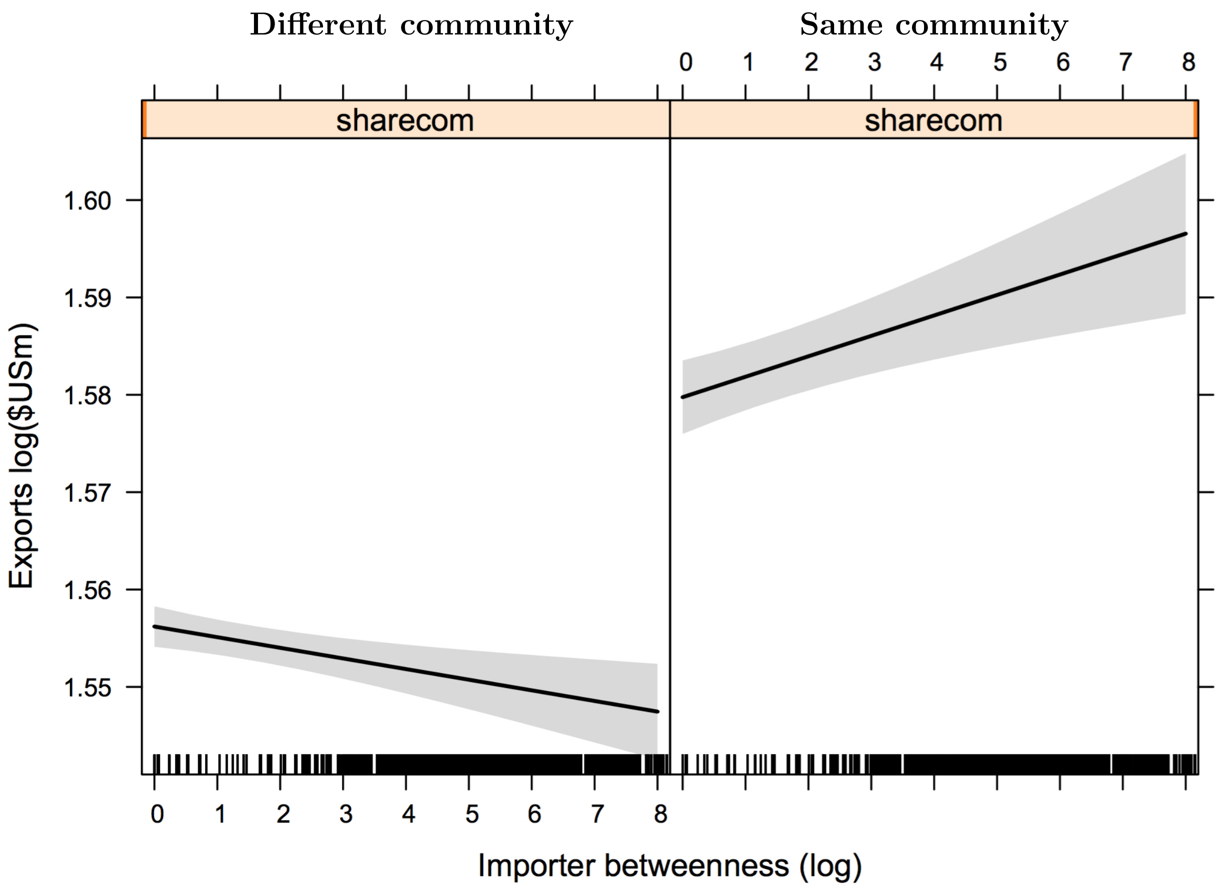
Figure 4 displays results for a model featuring the interaction of *Shared community* and states' logged *Betweenness* centrality in the alliance network.[22] This shows striking support for H3. States are significantly more likely to trade with central states in their *own* alliance community and significantly less likely to trade with central states in *other* communities. This pattern supports the hypothesis that indirect alliances shaping power structures factor into the security externalities associated with trade.

A problematic feature of the above models is the possibility of reverse causality. While theory suggests that alliances should influence trade, it is also possible that trade flows influence the formation of alliance structures. To address this, I first run the main models with different lag structures on the independent variables of interest and then run models where I test the predictive power of trade levels on alliance community formation. Lagging the *Shared community* and *Dyadic alliance* variables produces very similar results to the main model for both one and five year lags. *Shared community* remains strongly predictive of future trade levels while the *Dyadic alliance* variable remains less significant. Next, I estimate a logistic regression in which the dependent variable is coded 1 if both states in a dyad are members of the same alliance community in year t. I regress the *Shared community* variable on all the controls from the main model in year t along with lagged *Trade* and the

[21]Using MRQAP on the full specification, the 95% confidence interval of the null distribution for the *Shared community* coefficient spans from -.406 to .276.

[22]The model includes all controls from the full model (Model 7). The interaction between *Shared community* and *Betweenness* is significant for both the importing and exporting state. This result is robust to controlling for the *Degree* centrality of the states in a dyad.

Figure 4. Interaction of betweenness centrality and shared community



The left panel shows the relationship between importing states' betweenness centrality and average predicted exports to those states when two states are in different alliance communities. The right panel shows the same for when two states are in the same alliance community.

lagged alliance community dummy.[23] Trade is an insignificant predictor of two states joining the same community at both one and five year lags.

Consistent with the findings of Mansfield & Bronson (1997) and Gowa & Mansfield (2004), the above provides suggestive evidence that trade levels do not have a strong influence on alliance structures. To supplement this, I consider how trade responds to shocks in indirect alliances. While certainly not a perfect 'exogenous' shock, the sudden collapse of the USSR resulted in a relatively unexpected and profound shift to the international alliance network

[23]I include year fixed effects as suggested for panel data with a binary dependent variable (Beck, Katz & Tucker, 1998).

(Maoz & Joyce, 2016). With the subsequent collapse of the Warsaw Pact, Eastern Bloc countries lost important alliances with the Soviet Union and each other. In response, the nature of intra-European trade saw a pronounced shift, as Western European countries saw a sudden and sustained uptick in trade with the former Eastern Bloc (Figure 5b).[24] This happened despite the fact that former Eastern Bloc countries did not formally enter direct military alliances with the West until NATO expansion almost a decade later. For Western European countries and firms, the most significant shift to security externalities and risk generated by trade to the East occurred because of the change in *indirect* political relationships these countries shared with the USSR and each other.

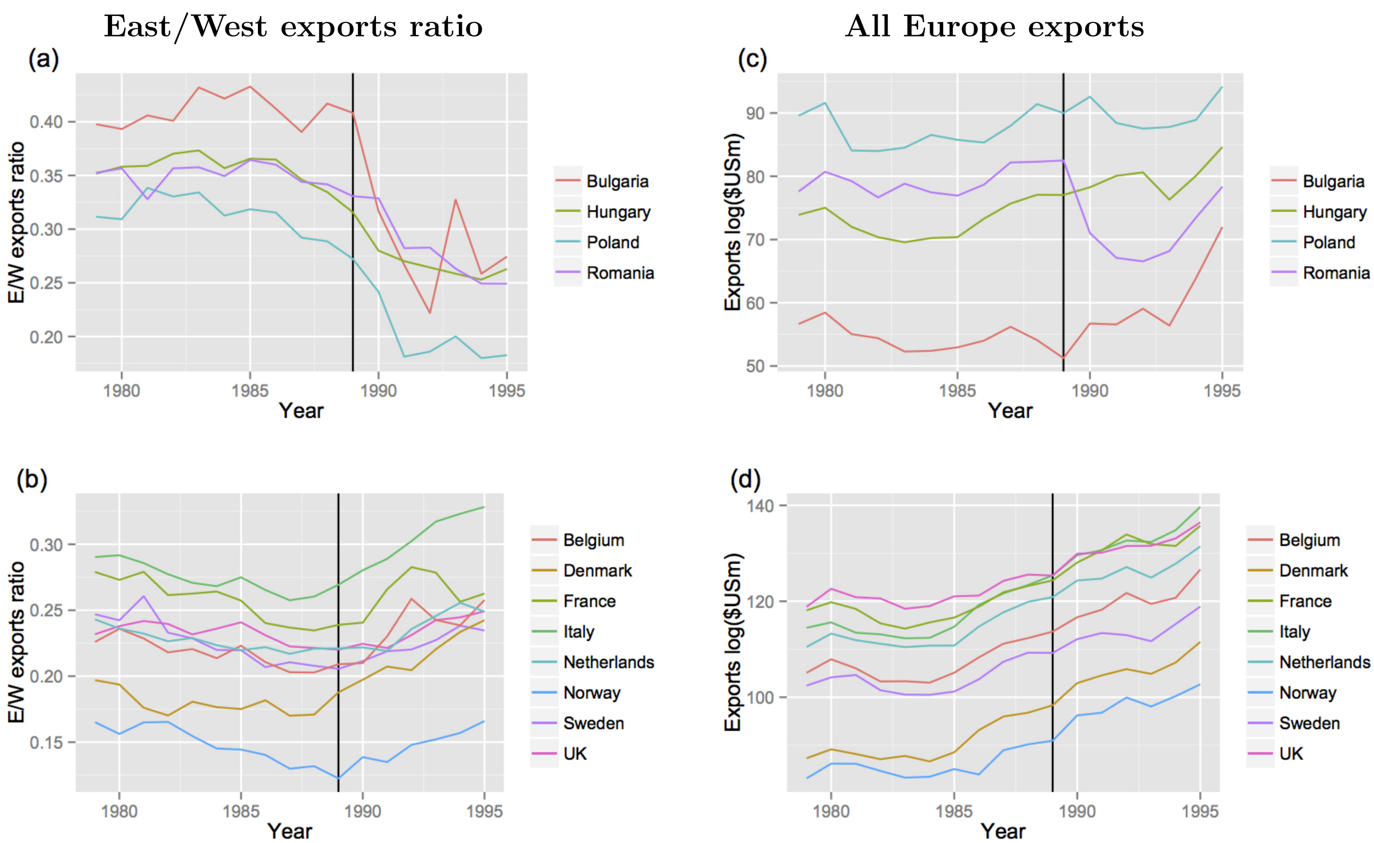
One would be right to point out that Eastern European countries also went through major shifts to their domestic political systems during this time period. Perhaps the collapse of communist regimes affected general openness of these countries, which created new opportunities for Western countries and firms to develop trade relations. However, for most European states, including the former Eastern Bloc, trends in overall intra-Europe exports remained relatively constant before and after the fall of the USSR (Figure 5c and 5d). The big change was in the *ratio* of trade trade between the blocs. In addition, it does not appear that shifts in trade patterns preceded shifts in the alliance structure, as trade between the blocs was relatively constant in the decade preceding the fall of the USSR. While I certainly do not mean to present this as a definitive test of whether indirect alliances drive trade flows, this does provide additional suggestive evidence in support of the models with different lags.

Mechanisms

In addition to the mechanisms I propose, one might claim that the indirect alliance variables are capturing the same reduction in transaction costs posited by Ingram, Robinson & Busch (2005), who claim that joint IGO memberships predict greater trade. However, when controlling for the number of joint IGO memberships in a dyad, the main results are

[24] A difference-in-difference analysis shows that the change in the exports ratio between the Eastern and Western blocs in response to the 1989 'shock' is statistically significant.

Figure 5. Intra-European trade before and after the Cold War



Plots (a) and (b) show the ratio of all exports to European Eastern Bloc countries (excluding the USSR) divided by all exports to European Western Bloc countries. Higher values on the vertical axis in these plots represents higher trade to the East relative to the West. Plots (c) and (d) shows the sum of exports to all European countries (both blocs). While overall exports remained relatively constant, states in both blocs increased the *proportion* of trade to the other bloc after the effective end of the Cold War (vertical black line).

unaffected. Alternatively, one might think that the community detection algorithm is simply identifying groups of states involved in multilateral alliances (e.g. NATO).[25] However, the coefficients on the indirect alliance variables remain significant and of a similar magnitude if bilateral and multilateral alliance ties are included separately. Consistent with Gowa & Mansfield (1993), multilateral alliance ties remain insignificant predictors of trade (whether or not *Shared community* is included), suggesting that the alliance communities most salient

[25] A significant portion of what appear to be bilateral alliances and non-aggression pacts in dyadic data actually represent co-membership in these larger 'k-adic' alliances (Lupu & Poast, 2016).

to international trade are not simply groups of countries that enter large multilateral alliances with each other.

A more direct test of the central mechanisms proposed in this paper would be to look at the relationship of indirect alliances with government policy and firm-level risk assessment. However, given the lack of data that would be necessary to precisely disentangle these mechanisms, I argue that, consistent with previous literature, the best empirical option is still to focus on the *aggregate* relationship between indirect alliances and overall trade (the variables at the beginning and end of the causal chain proposed in Figure 1). In order to empirically disentangle the effects of the government and firm-level mechanisms, one would have to control for all government policies that affect trade and then establish the residual effect of firm incentives not affected by these policies. Unfortunately, this is not a feasible empirical strategy. As earlier discussed, governments have a wide range of policy options by which to influence trade, including but not limited to tariffs, non-tariff barriers (NTBs), PTAs, sanctions, and expropriation. Relational data on most of these policies are severely limited. Existing measures of the incidence of tariffs and NTBs are not appropriate for use in this study because they measure trade restrictions at the country (rather than dyad) level (Anderson & Neary, 1994). Due to the lack of variation, data on economic sanctions also do not allow for a good test of the argument in this study. Only 226 cases of dyadic sanction onset were observed over the timeframe of this study, less than .05% of observations, and 60% of these involved the United States (Hafner-Burton & Montgomery, 2008).

With limitations in mind, I consider models predicting 1) the ratification of preferential trade agreements (PTAs) and 2) foreign direct investment (FDI) as a blunt investigation of the hypothesized mechanisms. While these are not meant as definitive tests, they do provide evidence that both government and firm incentives are shaped by indirect political alliances. For each mechanism, I start by including the *Shared community* variable in similar empirical specifications to prominent recent studies on these subjects: Mansfield & Milner

(2015) (M&M) for PTAs[26] and Li & Vashchilko (2010) (L&V) for FDI. To produce results more directly comparable to the ones in the present study, I then run models accounting for the same set of controls as the full model in the previous section (Table II).[27] Both M&M and L&V find a significant positive association of direct alliance ties with their dependent variables of interest.

Table II in here

For PTA formation, I run a logistic regression on directed dyads where the dependent variable is coded 1 if two states in a dyad ratify a PTA in a given year and 0 otherwise, controlling for whether the two states in a dyad have one or more existing PTAs. Being in the same alliance community predicts a significantly higher likelihood that two states will ratify a PTA in a given year, while a direct alliance is an insignificant predictor of PTA formation (Model 8). From these results, it is difficult to determine how big a role PTAs play compared to other strategies states use to align their policies with national security interests. However, government incentives to formulate trade policy indeed appear to be shaped by indirect alliances.

Turning to the firm-level mechanism, I use Li & Vashchilko (2010) data on dyadic FDI flows to examine whether firm investment decisions are shaped by indirect alliances.[28] L&V (2010: 769) postulate that, of alliance types, defense pacts should be most strongly associated with FDI because they 'imply more compatible security interests and stronger security commitments between members.' This is consistent with Long's (2003: 542) argument that 'opportunistic behavior against an ally's firms would reduce the military power of the entire coalition, but only when the states commit to defend one another in the first place.' In their

[26] Which includes updated data from Mansfield & Milner (2012).

[27] For simplicity, Table II includes only these 'full' models. The M&M and L&V specifications are found in the online Supplementary Appendix, and all results hold.

[28] I follow Lee & Mitchell (2012) by replacing missing data with 0 in cases where there is positive FDI measured to or from one of the countries in a dyad in a given year.

empirical analysis, L&V find that defense pacts are significantly associated with increased FDI, but pooled alliances are not robust predictors. Following the same structure as L&V, I first run the full model including the *Shared community* variable derived from all alliances (Model 9) and then run the model including a *Defense community* variable derived from the abbreviated network of defense pacts (Model 10). Consistent with the L&V finding using all alliance types, being in the same broad alliance community as another state is not a robust predictor of FDI,[29] but being in the same *Defense community* is positively and significantly associated with FDI flows. Dyadic alliances are insignificant predictors of FDI in all models. These tests have three significant limitations. First, because it is not feasible to control for all government policy that affects trade, I do not distinguish between firm risk driven by government policy versus conflict. Second, as discussed earlier, FDI is only one of the realms in which indirect alliances shape firm-level decisions that affect trade. Finally, dyadic FDI data is limited to a sample of 58 states[30] from 1980 to 2000. Despite these limitations, evidence for a relationship between indirect alliances and FDI on this subsample corroborates the story that extra-dyadic relationships matter in shaping incentives all the way down to the firm level.

Conclusion

The overarching goal of this article is to incorporate information on indirect alliance ties into the understanding of how countries' security concerns and firms' risk assessments influence trade. I find evidence for robust patterns suggesting that these indirect alliances matter for trade outcomes. The number of alliances *shared* by a pair of states is a significant predictor of trade and states trade significantly more with other states in their same alliance *communities*. Not only do indirect alliances predict trade levels, but they are a more robust and substantively important predictor of trade relations that direct alliance ties. The increase

[29]Though it is a marginally significant predictor (p=.054) in the L&V model that does not control for *Joint democracy* and preference similarity.

[30]29 OECD and 29 non-OECD states listed in the online Supplementary Appendix.

in trade associated with two states being in the same alliance community is more than twice the increase in trade associated with a dyadic alliance tie. In addition, the degree to which these patterns manifest depends on the centrality of a potential trade partner. States trade more with states that are central to the security structure of their own alliance blocs and less with states that are central in other alliance blocs.

The findings of this article imply that large-scale international security structures are still important predictors of economic relations between states. On a broader level, the theoretical and empirical strategies of this article highlight the importance of indirect relationships in international relations that can be better understood through social network analysis. While network theory provides an important methodological tool for uncovering subtle empirical patterns and investigating previously untestable hypotheses, it can also allow for important theoretical insights into many of the biggest questions in international relations.

Replication data: The dataset, codebook, and R scripts for the empirical analysis in this article, along with the online appendix, are available at https://www.prio.org/jpr/datasets/ and at www.dotanhaim.com. All analyses were conducted using R.

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Table I. Main results - Indirect alliances and trade flows

	Dependent variable: Trade flows (exports)						
	G&M	**H1: Shared alliance**			**H2: Shared community**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Shared alliances		**.00066***** (.0001)	**.00068***** (.0001)	**.00077***** (.0001)			
Shared community					**.029***** (.007)	**.029***** (.007)	**.029***** (.007)
Dyadic alliance	**.043***** (.006)	**.018*** (.008)	**.008** (.008)	**.007** (.008)	**.022**** (.008)	**.013** (.008)	**.014**$^{+}$ (.007)
Conflict (MID)	−.130* (.063)	−.127* (.063)	−.141* (.064)	−.151* (.062)	−.129* (.063)	−.142* (.064)	−.151* (.062)
Lagged trade	.934*** (.004)	.933*** (.004)	.932*** (.004)	.928*** (.004)	.933*** (.004)	.932*** (.004)	.928*** (.004)
Joint democracy				.035*** (.008)			.036*** (.008)
S-score				−.059*** (.008)			−.056*** (.007)
Contiguity			.054*** (.012)	.061*** (.012)		.051*** (.012)	.057*** (.012)
GATT.ex			.004 (.005)	.001 (.005)		.003 (.005)	.0002 (.005)
GATT.imp			−.005 (.004)	−.008* (.004)		−.005 (.004)	−.008* (.004)
RTA			.047*** (.011)	.050*** (.010)		.052*** (.011)	.055*** (.011)
Common currency			.024** (.008)	.025** (.009)		.023** (.008)	.024* (.009)
Common language			.009^{+} (.005)	.010* (.005)		.007 (.005)	.008^{+} (.005)
Colonial history			.008*** (.002)	.013*** (.002)		.008*** (.002)	.013*** (.002)
GDP.ex (log)	.040*** (.003)	.039*** (.003)	.040*** (.003)	.039*** (.003)	.040*** (.003)	.041*** (.003)	.040*** (.003)
GDP.im (log)	.032*** (.003)	.034*** (.003)	.036*** (.003)	.035*** (.003)	.032*** (.003)	.033*** (.003)	.032*** (.003)
Population.ex (log)	.005** (.002)	.006*** (.002)	.006*** (.002)	.006*** (.002)	.005** (.002)	.005** (.002)	.005** (.002)
Population.im (log)	.006*** (.002)	.004* (.002)	.003^{+} (.002)	.003^{+} (.002)	.006** (.002)	.005** (.002)	.006*** (.002)
Distance (log)	−.051*** (.004)	−.049*** (.004)	−.043*** (.004)	−.046*** (.004)	−.049*** (.004)	−.043*** (.004)	−.045*** (.004)
Constant	−.115*** (.033)	−.128*** (.032)	−.202*** (.039)	−.135*** (.037)	−.136*** (.032)	−.209*** (.039)	−.142*** (.037)
Observations	505,094	505,094	505,094	495,797	505,094	505,094	495,797
R^2	.944	.944	.944	.943	.944	.944	.943
Residual std. error	.489	.489	.489	.489	.489	.489	.489

$^{+}$p<0.1;*p<0.05; **p<0.01; ***p<0.001
Standard errors clustered by dyad and year in parentheses.

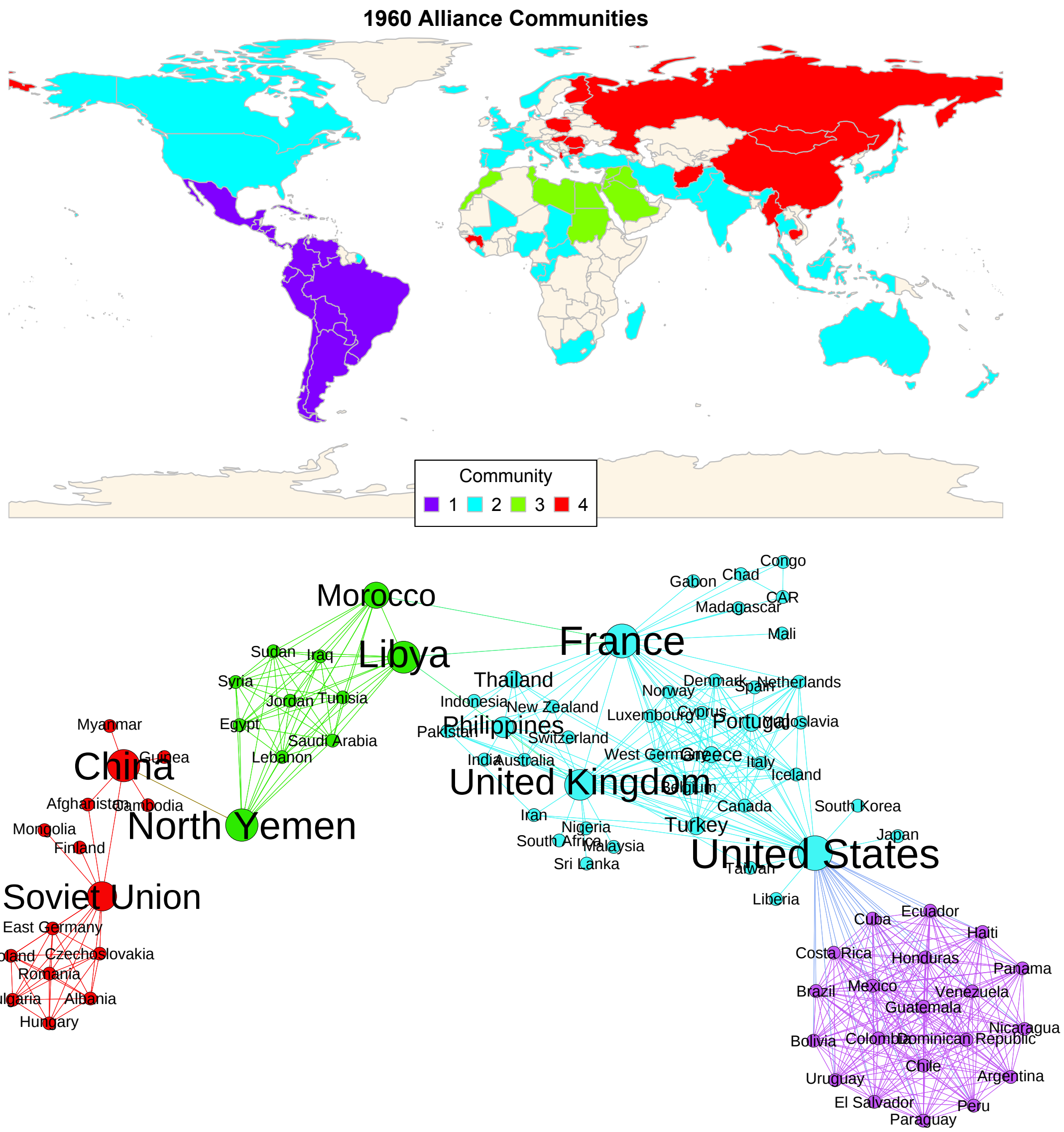
Table II. Mechanisms – PTA ratification & bilateral FDI

	DV: PTA ratification	DV: Bilateral FDI	
	Logit	*OLS*	
	(8)	(9)	(10)
Alliance community	**.0044***** (.001)	**.001** (.004)	
Defense community			**.014*** (.006)
Dyadic alliance	**.005** (.004)	−**.001** (.003)	−**.004** (.002)
FDI (lagged)		.354** (.135)	.350** (.135)
Existing PTA	.011* (.004)	.004 (.003)	.001 (.004)
Conflict (MID)	−.007^{+} (.004)	−.0001 (.002)	−.001 (.002)
Trade (exports)	−.0002 (.0003)	.002*** (.001)	.002*** (.001)
Joint democracy	.007** (.002)	.008*** (.002)	.009*** (.002)
S-score	.012*** (.003)	.015*** (.004)	.011*** (.003)
Contiguity	.018*** (.005)	.001 (.004)	.001 (.004)
Common currency	.013 (.010)	.022^{+} (.013)	.022^{+} (.012)
Common language	.005 (.003)	.003 (.004)	.002 (.004)
Colonial history	.0002 (.001)	.001 (.003)	.001 (.003)
Constant	.082*** (.018)	−.134*** (.025)	−.133*** (.025)
Gravity variables	Yes	Yes	Yes
Observations	507,614	16,410	16,410
R^2		.276	.278
Residual std. error		.074	.074
Log likelihood	490,525.600		

$^{+}$p<0.1;*p<0.05; **p<0.01; ***p<0.001
Standard errors clustered by dyad and year in parentheses.

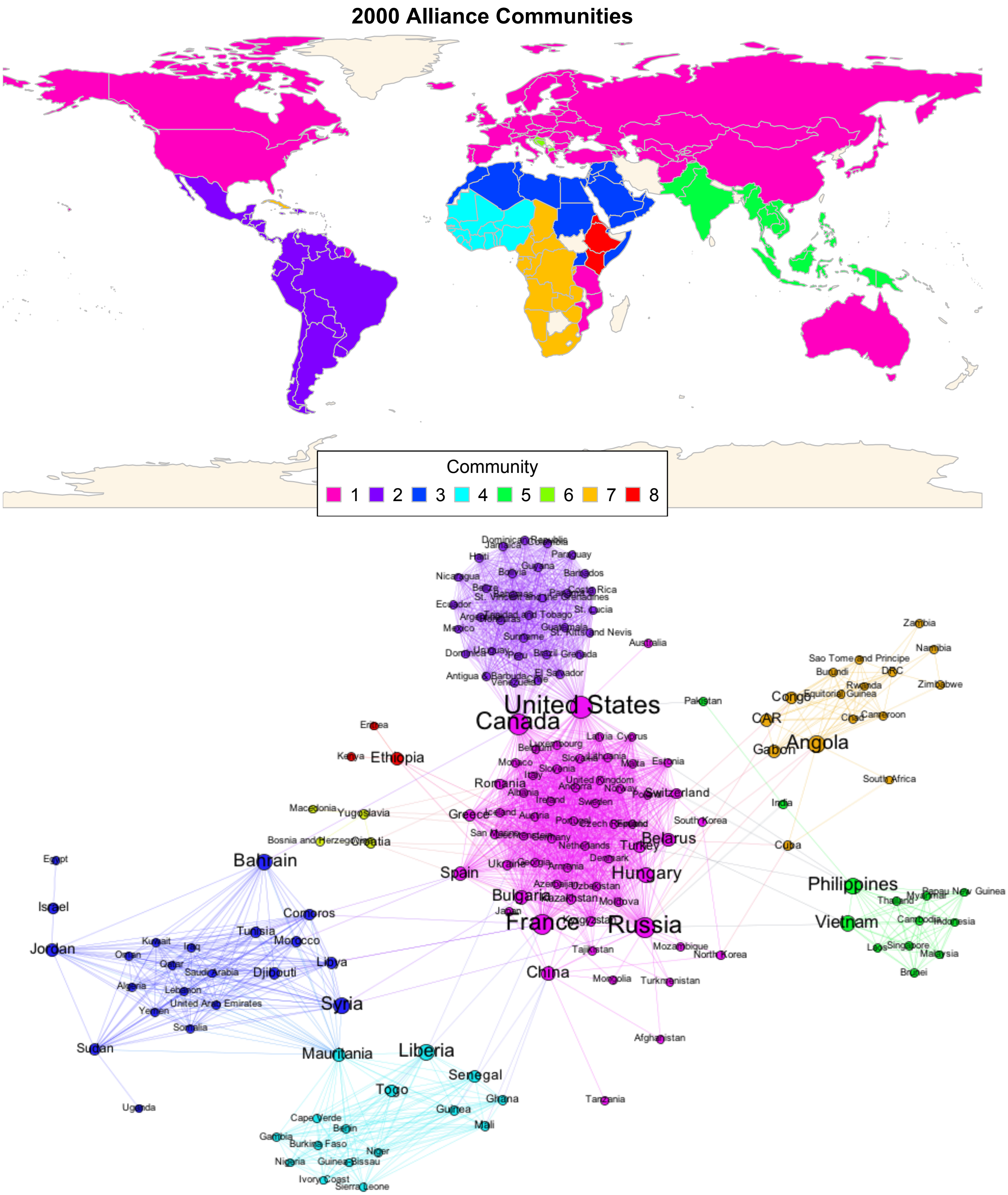
Appendix

Figure 6. 1960 Alliance network



Ties between state nodes represent alliances. Nodes are colored by community and sized by betweenness centrality.

Figure 7. 2000 Alliance network



Ties between state nodes represent alliances. Nodes are colored by community and sized by betweenness centrality.