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Sharing rivals, sending weapons: Rivalry and cooperation in the international arms trade, 1920–1939

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Abstract

States must navigate the structure of the international system in their relations with other states. One crucial component of this structure are rivalries as they indicate latent threat to states. Rivalries should thus influence how states behave within the given system, but also how they seek to shape and restructure it. Focusing on arms transfers, we clarify how the systemic structure implied by rivalries drives states' efforts to engage in security cooperation with other states. Intuitively, a rivalry with another country should diminish an exporter's propensity to transfer weapons there. But what is more, we argue that rivalries outside of this focal dyad matter as a potential importer's enmity towards other countries will reveal information about its security interests to the exporter. Specifically, sharing rivalries with the same set of countries will signal to the exporter that there is a congruence in security interests and thus facilitate security cooperation. This security cooperation should take the form of arms transfers, at least if exporters value buck-passing and fear entrapment. We test our expectations using original data on Major Conventional Weapons transfers in the Interwar years, a period where this condition likely holds, and inferential network analysis models. Sharing rivals increases two countries' probability to trade arms whereas a rivalry between countries exhibits no effect. This research contributes to our understanding of security cooperation, the arms trade, and networked international relations.

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1 Introduction

Arms transfers are an important component of international relations as all but the most powerful and technologically advanced countries rely on them to acquire the weapons used to protect and enforce their sovereignty, territory, and rule. Particularly in the case of Major Conventional Weapons (MCW), such as fighter aircraft and bombers, tanks and armoured cars, or submarines and destroyers, only a small minority of countries has ever been able to produce and export them while most states depend on imports to arm their militaries. These imports, in turn, matter for security as they affect whether countries go to war (Kinsella, 1994, 1998; Krause, 2004; Beardsley et al., 2020), experience civil wars (Craft and Smaldone, 2002; Pamp et al., 2018), and how severe these conflicts become (Moore, 2012; Mehrl and Thurner, 2020; Fritz et al., 2022b). Beyond these immediate effects, the scarcity of MCW producers and most countries' need for these weapons also makes them foreign policy tools as producers can attach political strings to the arms they export (Krause, 1991). MCW transfers are thus important for international security and, accordingly, a sizeable literature has emerged that studies their determinants. Broadly, these determinants can be distinguished into economic and politico-strategic factors (Levine et al., 1994), where the latter are captured via countries sharing a defence alliance, their political similarity, or their difference in military capabilities (Martínez-Zarzoso and Johannsen, 2019; Thurner et al., 2019; Willardson and Johnson, 2022).

In contrast to these factors, *rivalries* and the latent threat to states' security that they imply have received little attention in the literature on the arms trade. We seek to address this gap by drawing on research on rivalries, the arms trade, and, importantly, networked international politics (see Maoz, 2010). We thus follow recent work that views global arms transfers as forming a network (see Thurner et al., 2019) and emphasize that the system of rivalries does the same (see Valeriano and Powers, 2016; Lee, 2022). Combining these insights, we argue that when arms exporters decide whether to trade weapons to a given country, they do not simply consider whether the potential receiver is a rival.[1] Instead, they take into account the wider web of interstate rivalries connecting both themselves and the potential receiver to other third countries. Quite intuitively, we expect that a country i will be *less* likely to transfer weapons to another country j if they are direct rivals. But we expect that two countries are *more* likely to transfer weapons if they are both rivals with the same other countries. This is the case because the two constellations have very different implications for the security

[1] We focus on the question whether weapons are being sent, that is, the extensive margin of the arms trade. Existing research suggests that hyperdyadic and political ties are relevant for this whereas the intensive margin, that is, how many weapons are transferred if a tie exists, is mainly determined by demand factors (see Martínez-Zarzoso and Johannsen, 2019; Pamp et al., 2021).

externalities *i* will face from sending weapons to *j*. If the two countries are rivals, this means that they deem each other credible sources of military threat (see Thompson, 2001), so *i* arming *j* would imply shifting their military balance in favor of the adversary. But if they share common rivals, instead, *i* and *j* are being threatened by the same countries and arms transfers become a tool of security cooperation. Arming *j* allows *i* to turn the military balance against its rival while, on one hand, increasing the chances that *j* would be able to handle a potential conflict with the common rival on its own and, on the other hand, allowing *i* to stay out of any other military action *j* may use its increased military capabilities for. In other words, countries sharing common rivals have overlapping security interests, and arms transfers allow them to capitalize on these security interests while giving one of them (the exporter) the chance to pass the buck of fighting to the arms importer without risking entrapment (Snyder, 1984; Christensen and Snyder, 1990; Yarhi-Milo et al., 2016). By sending weapons to their rivals' rivals, countries react to the existing international security structure they observe and, in turn, engage in the structuration of new ties within it (see Wendt, 1987). We expect that "rivals of rivals", countries sharing one or more common rival states, cooperate on their security and are thus more likely to transfer MCW.

To test the relationship between rivalries and arms transfers, we use newly collected data on MCW shipments in the Interwar years, 1920–1939 (Mehrl and Thurner, 2022a). We focus on this historical period for several reasons. First, the Interwar years have generally been characterized as multipolar, meaning that there were no superpowers and, as opposed to the bipolar Cold War (Kinsella, 1995), hence also no superpower rivalry to structure the global arms trade. Whereas the Cold War period exhibited a hierarchical security architecture where weapons were largely traded within pre-defined blocks, the Interwar period had no such blocks, meaning that individual states' rivalries should play a more significant role. And second, also resulting from the systemic structure, buck-passing and entrapment mattered much more as features of security cooperation in the multipolar Interwar period than in the later, superpower-dominated years. Christensen and Snyder explicitly describe buck-passing as a "pathology of multipolarity" (1990, p.141; see also Waltz, 1979) while Snyder (1984) similarly notes that the alliance dilemma as a whole, including the fears of entrapment and abandonment, is more significant in multipolar settings. The Interwar period thus offers an ideal opportunity to test how rivalries affect arms transfers as it matches our proposed theoretical mechanisms more closely than the years after World War II usually studied in the arms trade literature. At the same time, by focusing on the Interwar years, we can also investigate to what extent structural features of the arms trade documented in existing research, such as exporters trading with each other if they share common recipients (Thurner et al., 2019), depend on the bi- and unipolar structure of the systems after the second World War. Focusing on arms transfers in the period 1920–39 thus allows us to align our empirical tests with potential theoretical scope conditions and to investigate the historical scope of previous research on the arms trade.

We employ appropriate inferential network models, the Temporal Exponential Random Graph Model (TERGM, Hanneke et al., 2010) and the Additive and Multiplicative Effects (AME) model (Minhas et al., 2019; Hoff, 2021), to test our expectations. The TERGM and the AME model complement each other as the former allows explicitly

specifying and testing the effect of structural network features whereas the AME accounts for these via additive and multiplicative effects and is hence more robust to network misspecification. Our substantive results are the same in both models and indicate that the probability of arms being transferred between two countries is unaffected by a rivalry between them but increases if they share common rivals. While we focus on the Interwar period, additional specifications offer preliminary evidence that these results even apply to the arms trade of the 1950s and 1980s. In contrast to studies on the Cold War and post-Cold War arms trade, we find no evidence that, in the Interwar period, countries traded arms with each other if they exported to the same recipients.

This research makes several contributions to the literature on the arms trade, rivalries, and international security more generally. It improves our understanding of security considerations in arms trade decision making by, first, identifying rivalries as an important factor and, second, emphasizing that clear effects appear only when viewing their hyperdyadic constellation. This shift from the dyad to triadic settings should also inform further research on security considerations in the arms trade, with e.g. third- and fourth party alliance ties (Gartzke and Gleditsch, 2022) or a combination of cooperative and hostile ties (see Nieman et al., 2021; Fritz et al. 2022a) being prime candidates for this. By casting arms transfers and alliances as substitutable foreign policy instruments for security cooperation (Most and Starr, 1984; Morgan and Palmer, 2000; Yarhi-Milo et al., 2016) and discussing how such security cooperation is influenced by sharing rivals, it provides a clear bridge between research on arms transfers, especially recent quantitative contributions, and the much larger literature on alliances and foreign policy. As such, it informs future research on both rivalries and alliances within International Relations and on arms transfers within International Political Economy, contributing to increased interaction between these literatures. By linking rivalry structures to countries' security cooperation activities, it shines a light on the nexus of agency and structure in international security (Wendt, 1987). And furthermore, it shows that structural processes in the arms trade network differed across periods of multi-, bi-, and unipolarity, thus hinting at the importance of historical scope conditions when seeking to generalize quantitative findings (see Fordham, 2020). This last point is also bound to be relevant to researchers and practitioners in international security more generally as the international system possibly moves away from the unipolarity of the post-Cold War years and towards renewed multipolarity (Posen, 2011), making the study of the multipolar Interwar years all the more important.

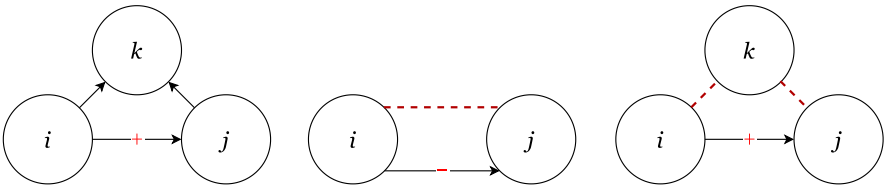
The remainder of the paper is structured as follows. The next section discusses existing research on the influence of security considerations and cooperation on arms transfers before developing three expectations. The first pertains to the influence of hyperdyadic structures in the arms trade network, the second one to dyadic rivalry, and the third brings these together by focusing on how hyperdyadic rivalry structures affect the arms trade network. We discuss how we test these expectations in Section 3. Section 4 then provides descriptive statistics and Section 5 presents our empirical results. Finally, Section 6 concludes by summarizing our findings, discussing their implications, and outlining avenues for future research.

2 Security cooperation, rivalry, and arms transfers

Much of the existing literature on the arms trade considers weapons to be transferred based on the suppliers' and receivers' security interests. For receivers, the link between arms imports and security is straightforward as obtaining arms means increasing their military capabilities and thus their ability to defend themselves. For suppliers, this link is less straightforward as recipients may always turn the provided weapons against them. Theoretical work on the arms trade thus argues that arms transfers will be more likely and numerous as the probability of this happening decreases (Levine et al., 1994; García-Alonso and Levine, 2007), while empirical studies are, in turn, concerned with capturing under which circumstances this is the case. Proposals include that the supplier *i* may be more certain about the recipient *j*'s intentions – and hence send weapons – when they share a defence alliance or are politically more similar (Martínez-Zarzoso and Johannsen, 2019; Mehrl et al., 2022; Thurner et al., 2019; Willardson and Johnson, 2022). In addition, *i* should also be more willing to transfer weapons as it feels less threatened by *j*, implying that transfers should occur more when *i* has a larger military capability advantage (Willardson and Johnson, 2022; Mehrl et al., 2022). And finally, recent work emphasizes the importance of triadic arms transfer structures, as *i* will know more about *j*'s intentions, better be able to sanction misbehavior, and even have common security interests if they share a common supplier or recipient *k* (Thurner et al., 2019; Pamp et al., 2021). We subscribe to this idea that *hyperdyadic* structures involving not just *i* and *j* but also other countries *k* play an important role in *i*'s decision-making on whether to send weapons to *j* but ultimately emphasize the role of non-arms trade ties in this process.

Regarding hyperdyadic structures in the arms trade, Thurner et al. (2019) take a network perspective of the arms trade and argue that network dynamics crucially influence whether *i* will trade with *j*, with this decision depending not only on the attributes of or relationship between these two countries, but also their existing arms trade ties with other states. Specifically, they point to the importance of triads, formed by *i*, *j*, and other countries *k*, and argue that sharing common trade partners allows *i* and *j* to better monitor, influence, and ultimately trust each other. If *i* and *j* already trade with the same countries, this decreases transaction costs and increases their extent of information about each other (see Pamp et al., 2021). In particular, studying the existing trade ties of a potential recipient *j* allows *i* to understand *j*'s security commitments and interests. If they trade with completely different countries, this may imply diverging interests. But if they already have common arms recipients, this points to shared security interests and policy goals. Thus, trading with each other becomes more attractive as "two suppliers lower their risk when jointly sharing import countries" (Thurner et al., 2019, p.1747). Furthermore, this constellation, by triggering trust-building and cooperation between *i* and *j*, even allows them to ultimately split the costs of monitoring their shared recipients *k*. This line of argument leads us to the following expectation: A potential supplier *i* is more likely to transfer weapons to a potential recipient *j* if *i* and *j* export weapons to the same country *k* (see Fig. 1a).

However, it may be the case that for this expectation to hold, a relatively institutionalized and hierarchical international security architecture is necessary. The most common triadic constellations observed by Thurner et al. (2019) all involve two core



(a) Outgoing Shared Partner (b) Dyadic Rivalry (c) Shared Rivalry

Fig. 1 Three expectations on hyperdyadic influence and rivalry in the arms trade. Solid arrows (in black) indicate arms transfers, dashed lines (in red) rivalry ties. Plus and minus signs on the *ij* tie indicate expected effect direction

NATO members trading with each other while both sending weapons to a third country which is either also in NATO, e.g. Turkey, or at least "alliance-adjacent", e.g. Chile. There, the sender countries thus operate within the same security community which arms transfers serve to structure (Beardsley et al., 2020), clearly share common policy interests, and can cooperate in monitoring the shared recipients' use of the provided weapons. At the same time, recent research studying the arms trade of the Interwar years, i.e. a period where no such developed security architecture existed, finds that countries were *less* likely to trade small arms with each other if they shared common customers (Mehrl et al., 2022). And for MCW, only 17% of observed triangles where both i and j send arms to k also saw trade between i and j in this period whereas during the Cold War, it were 63%-74% (Mehrl and Thurner, 2022b). Instead, Mehrl and Thurner (2022b) emphasize the importance of different countries' competition over influence in the Interwar arms trade.

We take this as motivation to focus on a type of non-arms trade ties that are independent of the prevailing security architecture, also form a network where hyperdyadic structures not only occur but are relevant, and capture the idea of competition between states: Rivalries. According to one commonly used definition, rivalries exist between countries which "regard each other as (a) competitors, (b) the source of actual or latent threats that pose some possibility of becoming militarized, and (c) enemies" (Thompson, 2001, p.560). From this perspective, the existence or a history of war is not necessary for countries to be rivals, but instead that they consider each other to be potential foes in a coming war. While war is not necessary for rivalries to exist, rivalries are a strong predictor of conflict as, according to Thompson (2001), pairs of rivals fought each other in 81 of the 87 interstate wars in the twentieth century. Beyond war, rivalry also increases the probability that pairs of states experience militarized interstate disputes (Rasler and Thompson, 2006), arms races (Rider et al., 2011), crisis escalation (Colaresi and Thompson, 2002), or diversionary forms of conflict (Mitchell and Prins, 2004; Mehrl and Choulis, 2021). In short, i and j are more likely to engage in competition if they are rivals and, in turn, less likely to cooperate. Mirroring the common idea that allies are more likely to trade weapons (Martínez-Zarzoso and Johannsen, 2019; Thurner et al., 2019; Mehrl et al., 2022), we can thus formulate an expectation on how a dyadic rivalry between two states influences their arms transfers to each other: A potential supplier i is less likely to transfer weapons to a potential recipient j if i and j are rivals (see Fig. 1b).

But, as noted above, rivalries also form a web of relationships between states. A country may be rivals with multiple opponents and these concurrent ties are bound to influence each other, but also how that country acts towards other, non-rival actors (see Valeriano and Powers, 2016). Along these lines, there is evidence that country *i* is more likely to accommodate rival *j* when acutely threatened by another rival *k* (Akcinaroglu et al., 2014), although this depends on the economic and military leverage of *k* (Akcinaroglu and Radziszewski, 2017) as well as its relationship to *j* (Allen et al., 2016), and that a rivalry between *i* and *j* is more likely to terminate when both are rivals – or allies – of *k* (Lee, 2022). And just like alliance ties to *k* can impact rivalry dynamics between *i* and *j*, *i* will also be more likely to support violent non-state actors targeting another state *j* if that state is a rival (Findley et al., 2012; Maoz and San-Akca, 2012). This research demonstrates that rivalries matter beyond the dyad they occur in as they exhibit hyperdyadic influences.[2] Countries do not deal with their rivals in isolation but observe, take into account, and alter the web of relations to other states – and even non-state actors – surrounding them when doing so. This is in line with more general theories of networked international politics where one type of tie between states is argued to be affected by others (Maoz, 2010). Just like within the arms trade network, a state can gauge valuable information regarding security interests from other countries' rivalry ties. Specifically, if *i* has a rivalry with *k* and observes that *j* is also rivals with *k*, this implies that *i* and *j* both view *k* as a source of future threat, have common security interests, and thus the possibility to cooperate against *k* (see Johnson, 2017). In other words, the rival of my rival may be my friend. Just like countries are more likely to sign security pacts when they fight the same enemy (Maoz et al., 2007; Lerner, 2016; Fritz et al., 2022a), countries sharing a common rival should become more likely to cooperate on their defence.

To do so, these countries can pick between several, substitutable tools for security cooperation, the most relevant of which are arguably formal alliances and arms transfers (Most and Starr, 1984; Morgan and Palmer, 2000; Yarhi-Milo et al., 2016).[3] Alliances serve to deter *k* from attacking via an agreement that if it targets either *i* or *j*, it will have to contend with both as the unattacked ally will intervene and help the attacked one (see e.g. Morrow, 1991). Arms transfers serve a similar purpose, as additional weapons increase the importer *j*'s ability to deter *k* even without further intervention by the exporter *i*. From that perspective, *i* assists *j* in its internal balancing, allowing it to arm quicker and more efficiently than if it had to engage in domestic weapons production, instead of its external balancing in the form of an alliance commitment (see Morrow, 1993). Both alliances and arms transfers thus align with the more general idea of security cooperation as tool for major powers "to further their pursuit of changes in the foreign policy status quo" and for other countries to increase "their protection from external threats" (Morrow, 1991, p.905). However, countries may often choose between them as they offer different benefits and drawbacks and can vary in their relative efficiency (Morrow, 1993; Morgan and Palmer, 2000).

[2] Relatedly, Kinsella (1994) also presents evidence that conflict intensity between rivals is affected by arms imports from third countries.

[3] Other forms of security cooperation, such as external military bases or defence cooperation agreements, are also possible but were rare or nonexistent until the Cold War (Harkavy, 2007; Kinne, 2018).

At least for the Interwar period, we find it plausible that many countries' tool of choice was arms transfers and thus expect that sharing a common rival will increase the probability that two countries engage in sending weapons. This is the case because of three prominent features of the period, namely states' motivation to pass the buck and their fears of abandonment and entrapment (Snyder, 1984; Christensen and Snyder, 1990). Given the multipolar system of the period and the very recent experience of World War I, where alliance systems served as chaingangs on the route to war, states in the interwar years sought to pass the costs of tackling rising threats to others while themselves remaining uncommitted and outside a future conflict. Different countries threatened by Germany, for instance, tried to pass the buck of balancing it to each other, instead of joining forces via clear alliance commitments (Waltz, 1979; Posen, 1984; Christensen and Snyder, 1990). This suggests that states did not see the formation of alliances as an efficient policy instrument to deter threats and increase their security, instead hoping to have other states tackle these threats without an own, direct involvement. And additionally, it suggests that even when alliances were formed or existed already, there was a reduced willingness to actually comply with these commitments, implying reduced deterrence effects, and hence efficiency, by these alliances (Smith, 1998) as well as relevant concerns over abandonment (Snyder, 1984).

In this situation, arms transfers arguably present an attractive alternative to alliances which is more compatible with buckpassing: States i and j being rivals with k means that they are interested in decreasing k's relative military capabilities and seeing costs imposed on it. But ideally, they want to avoid doing so themselves as this would likely also entail substantial costs for themselves. Giving someone else the resources to fight or otherwise curtail the rival is a cheaper and thus very attractive option, as shown by countries supporting non-state actors who target their rivals (Findley et al., 2012; Maoz and San-Akca, 2012). If states are concerned about the threat emanating from a rival, but hesitant to tackle this threat themselves, transferring arms thus allows them to give another country the resources to do so but to stay out of the fray themselves. In other words, transferring arms allows a state i to pass the buck while still pursuing its security interests. And what is more, if buckpassing is prevalent, arms transfers should also be a more attractive and efficient way of security cooperation than alliances for i's partner j. This is the case because unlike alliances, arms transfers do not solely entail a promise of future action, thus risking abandonment in the case of war, but instead the timely movement of material military capabilities.

Additionally, transferring arms is an attractive alternative to alliances when states are concerned about entrapment (Snyder, 1984), that is, being pulled into a conflict against a foe they themselves do not perceive as a threat. States i and j being rivals with the same country k indicates that their security interests overlap. But beyond k, both i and j may also have other rivals as well as allies which, unless they perfectly match, only present a relevant military target to one of them or are deemed untenable partners for security cooperation (Yarhi-Milo et al., 2016). If this is the case, i and/or j may fear that the other country will not use the provided security cooperation to act against their shared rival but instead face conflict with another country they themselves do not consider a threat or may even be friendly with. Whether this is a realistic scenario depends on the international state system and context. But if it is, it will reduce the attractiveness of alliance commitments, given that they may commit states to unwanted

conflicts, while arms transfers remain viable (Yarhi-Milo et al., 2016). Given that in the interwar period, states were hesitant to tackle threats concerning their own security, instead trying to pass the buck of doing so to others, it should be unsurprising that they were equally unwilling to commit themselves to fighting threats that did not actually concern them.[4] And more generally, Snyder (1984, p.494) notes that entrapment, just like abandonment, is a very real possibility in multipolar systems given that "high mutual dependence coexists with plausible realignment options". In other words, the absence of a clear block structure means that while *i* and *j* may share a rival *k*, they may very well also share quite different policy positions towards a range of other countries.

In a nutshell, we thus argue that countries sharing a common rival should value working together on their security. They have several foreign policy instruments at their disposal to do so, and we follow existing work on substitutability and alliances with the idea that countries' choice of instruments depends on the international context and the relative efficiency of the available instruments (see Morrow, 1991; Morgan and Palmer, 2000; Yarhi-Milo et al., 2016). In multipolar state systems, such as the Interwar one, countries should generally be concerned about entrapment and abandonment (Snyder, 1984), while there specifically, buckpassing appeared attractive due to the fresh memory of World War I (Christensen and Snyder, 1990). Accordingly, we posit the final, main expectation: A potential supplier *i* is more likely to transfer weapons to a potential recipient *j* if *i* and *j* are both rivals with the same country *k* (see Fig. 1c). All three theorized expectations are visually summarized in Fig. 1.

While we focus on arms transfers, we should note that we do not argue that countries with common rivals do not enter alliances with each other. Instead, our argument is that arms transfers and alliances are substitutable tools of security cooperation, and that in the period we investigate, the former should be a particularly attractive path for countries sharing rivals to work together. Importantly, viewing alliances and arms transfers as mutually substitutable implies that they are closely linked. Morgan and Palmer (2000) point out that substitutability entails not only that countries may choose between these tools, depending on their efficiency in reaching a goal, but also invest in both if the salience of that goal increases. As such, arms transfers and alliances can be complements to each other. Along these lines, arms transfers, due to their more flexible nature as well as the shorter and weaker commitments they entail (see Yarhi-Milo et al. (2016), may be seen as a step towards formalised security cooperation in the form of alliances. Indeed, Beardsley et al. (2020) argue that arms transfer networks constitute security communities, which may also become formalised over time. While we thus focus on arms transfers here, it is very much possible that our argument also applies to other forms of security cooperation, especially when examining other historical periods.

Anecdotally, examples of the dynamics we describe occurred throughout the Interwar period. Most prominently, France began to transfer large amounts of heavy weaponry to Poland right after the termination of World War I as both shared an

[4] For instance, potential entrapment was cited as a key motivation for keeping the United States out of the League of Nations (see Rathbun, 2011) while similar concerns explain Great Britain's reluctance towards continental alliances (see Morrow, 1993).

enmity towards Germany and the USSR. Interestingly, this security cooperation also became more formalized over time, with a defence alliance coming into action in 1922, which, however, limited French military commitments to the case of German aggression whereas the provision of further arms, but no own military intervention, were promised in the event of Polish-Soviet hostilities (Wandycz, 1988). French efforts aimed at Germany were not limited to Poland, as it also armed Czechoslovakia in these years, with the French arms manufacturer Schneider taking over the Czechoslovakian Škoda works in 1919 (Grant, 2018), and signed a defence alliance in 1924 (Wandycz, 1988). Germany, in turn, provided weapons to Hungary as both considered Czechoslovakia a threat to their interests (Grant, 2018). Italy armed Bulgaria in order to keep Yugoslavia in check (Türkeş, 1994). And both the UK and the US emerged as major sources of arms for Nationalist China with the goal of staving off Japanese expansion in East Asia (Xu, 2001).

3 Research design

In order to test these three expectations, we make use of data on the yearly MCW trade networks in the period 1920–1939. These data are sourced from Mehrl and Thurner (2022a), who collected them from historical primary sources as well as a large amount of secondary literature. They cover transfers of military aircraft, fighting ships, as well as armoured fighting vehicles.[5] We consider a directed trade tie from country i to country j in year t to exist if i sent at least one military aircraft, fighting ship, or armoured fighting vehicle to j in that year. This focus on directed, binary transfer ties arises from the three expectations we have formulated above, but is also due to the data lacking an overall comparable measure of transfer volume or intensity. Specifically, Mehrl and Thurner (2022a) report the number of items traded from country i to country j in a given year, but these items include weapons ranging from small tankettes to large military vessels, making their pure number unsuitable for a meaningful comparison in terms of strategic value. We use twenty realizations of the international MCW trade network, one for each year 1920–1939, where countries are the nodes and transfers of at least one weapon the directed ties.

Following from the idea that the arms trade forms a network of ties with hyperdyadic dependencies, we use two different statistical network models which allow us to model and account for such dependencies: The Temporal Exponential Random Graph Model (TERGMs, Hanneke et al., 2010) and the Additive and Multiplicative Effects (AME) model (Minhas et al., 2019; Hoff, 2021). The TERGM allows us to explicitly specify and test the effect of endogenous network structures, including the expectation that i is more likely to transfer weapons to j if both export arms to the same country k. In contrast, the AME model accounts for such endogenous structures via its additive and multiplicative effects, meaning that the effects of endogenous structures cannot be tested but also that they do not need to be explicitly specified in order to be captured, making the model more robust to network misspecification. However, both the TERGM and the AME model are much more appropriate here than

[5] Mehrl and Thurner (2022a) define the categories and describe the sources consulted for data collection.

conventional regression approaches as they do not assume conditional independence of observations, which, if mistakenly presumed, may lead to biased inference (see e.g. Hoff and Ward, 2004; Cranmer and Desmarais, 2016). Given that we are substantively interested in the effect of one endogenous hyperdyadic dependence, namely whether two countries are more likely to trade arms when they share a receiver, we use the TERGM as our main model. The AME is then an important robustness check which does not allow us to test this effect but can increase our confidence that the TERGM results relating to dyadic and triadic rivalry are not due to network misspecification.[6]

We estimate both the TERGM and the AME model using a moving window approach (see Thurner et al., 2019). This means that we do not have to pool covariate effects over the entire Interwar period and thus does not require assuming that these effects were constant, instead revealing potential time heterogeneity. We use four-year windows and a one-year stride. This results in a series of 14 models, 1923–1926, 1924–1927, ..., 1936–1939, as we include a three-year path dependency term to account for temporal autocorrelation in the arms transfers. The arms trade networks in the years 1920–22 are thus used in the path dependency terms of later models but we cannot model them due to a lack of information on previous transfers. We estimate the TERGM via Markov Chain Monte Carlo (MCMC), which allows us to obtain approximate maximum likelihood estimates for the model parameters (Geyer and Thompson, 1992; Hunter and Handcock, 2006). The AME model is specified with receiver and sender specific (additive) effects and a multiplicative effect of dimension of $R = 1$ to account for triadic dependence in the data.[7] Estimated in a Bayesian framework, posterior samples are obtained by a Gibbs sampler. We present posterior means and credible intervals below and provide a convergence analysis in Appendix A.3.[8] Further details can be found in Minhas et al. (2019).[9]

The TERGM includes three covariates of substantive interest. First, following Thurner et al. (2019), we specify an endogenous network statistic that captures the distribution of "Outgoing Shared Partner" (OSP) triads, i.e. triads where i sends weapons to j and both i and j export arms to the same country k. This statistic could technically be a count but existing research suggests to geometrically weigh this count down in order to avoid degeneracy (Hunter and Handcock, 2006; Hunter, 2007). Following standard practice, we thus include a geometrically weighted version of the OSP statistics.[10] Second, to test the expectation that rivals will be less likely to trade arms, we include a binary indicator that is sourced from Thompson's (2001; see also Thompson and Dreyer, 2011) data on strategic rivalries and takes the value 1 if i and j are rivals. And third, to test the expectation that two countries will be more likely to trade arms

[6] See De Nicola et al. (2023) for a discussion on choosing between TERGM and AME models.

[7] Given the low network density, we choose a conservative level for the multiplicative effect, as a higher dimension greatly increases model complexity. Results do not differ substantially when setting $R = 2$.

[8] The appendix is available online on the Review of International Organizations' webpage.

[9] All analyses and data compilation were done in `R` (R Core Team, 2023) using the `statnet` suite (Handcock et al., 2019). The models were estimated with the `btergm` package (Leifeld et al., 2018) for the TERGM and the `amen` package (Hoff et al., 2020) for the AME model.

[10] The decay parameter of the OSP statistic is set to 0.69 ($\approx \log(2)$).

if they share rivals, we include a count of the number of states that both *i* and *j* are rivals with, again using data from Thompson (2001). The dyadic and triadic rivalry variables, as well as all exogenous control variables, are lagged by one year to ensure temporal order and to account for the temporal gap between the observed arms transfer and the unobserved transfer decision influenced by these covariates (see Perkins and Neumayer, 2010). Of course, the OSP statistic is not included in the AME model while the two rivalry variables are.

In addition to these three variables, we also include several additional endogenous and exogenous covariates from the literature on the arms trade (e.g. Martínez-Zarzoso and Johannsen, 2019; Thurner et al., 2019; Willardson and Johnson, 2022; Mehrl et al., 2022) that may also likely correlate with the three independent variables of interest. First, we thus control for a number of exogenous factors that the literature has proposed to capture the economic and security dimensions of the arms trade. These include the economic wealth of the (potential) sender and receiver using data on countries' GDP per capita from the Maddison project (Bolt and van Zanden, 2020),[11] the log-transformed geographical distance of their capitals as obtained from Schvitz et al. (2022), and a binary indicator of whether they share a common language taken from CEPII (Fouquin and Hugot, 2016). We also account for the (potential) importer's and exporter's difference in terms of military capabilities, as measured by subtracting *j*'s Composite Indicator of National Capability (CINC) of that of *i*, where the CINC captures countries' military expenditures and personnel, energy consumption, iron and steel production, urban population, and total population and comes from Singer et al. (1972). We control for the political distance between sender and receiver by taking the *absolute* difference of their Polity values (Marshall et al., 2016), and finally also include a binary indicator that takes the value 1 if they have an active defence alliance according to Leeds et al. (2002). Including these three measures of politico-strategic considerations also allows us to compare their influence on the arms trade to that of dyadic and triadic rivalries. All these variables appear both in the TERGM and the AME model, we present summary statistics for them in Table 1.

Furthermore, a number of endogenous factors have previously been shown to affect the arms trade network (Thurner et al., 2019). We accordingly include statistics to model them in the TERGM, but not the AME model, where their influence is captured by the additive and multiplicative effects structure. We thus specify nodes' in- and outdegree to capture the popularity effects of importers and exporters, again using geometrically weighted statistics to avoid degeneracy.[12] And we specify endogenous statistics to model network density as well as path dependency. As noted above, the path dependency term indicates whether a transfer occurred in the previous three years as MCW are traded rather infrequently.[13]

[11] The Maddison GDP data include numerous missing observations. We supplement them, where necessary, with GDP estimates from country-specific studies and then linearly interpolate the GDP per capita when sufficiently many actual observations of the variable exist. See Appendix A.1.

[12] The decay parameter of the in- and outdegree terms is set to 0.1.

[13] Thurner et al. (2019) use five years, we choose three as weapons had a shorter time of service in the Interwar period, thus had to be replaced more frequently, but were also technologically simpler and hence quicker to produce. Formal definitions of endogenous statistics are presented in Appendix A.2.

Table 1 Summary statistics

Name	N	Mean	SD	Min	Max
MCW Trade Tie	59400	0.018	0.133	0.000	1.000
GDP per capita (log)	1100	5.474	0.711	3.216	6.815
Difference in Polity (absolute)	59400	7.806	5.647	0.000	20.000
Difference in CINC (Sender-Receiver)	59400	0.000	5.967	-28.957	28.957
Defense Alliance	59400	0.012	0.108	0.000	1.000
Rivalry	59400	0.024	0.154	0.000	1.000
Shared Rivalry	59400	0.048	0.245	0.000	3.000
Common Language	2970	0.133	0.340	0.000	1.000
Distance in km (log)	2970	8.501	1.035	4.424	9.896

Values are pooled over the period of observation 1920–1939. CINC values are scaled to percentage points

4 Descriptive statistics

Before advancing to the results of our inferential analysis, we plot the arms trade network, provide some key descriptives of this network, and present summary statistics for our exogenous covariates to give the reader a better sense of the analyses that follow (for more detailed descriptive analyses of these data and the Interwar arms trade network, see Mehrl and Thurner (2022a, b)). First, Fig. 2 plots the arms trade network for the entire period of observation, 1920–1939, meaning that two countries have a directed tie if *i* transferred weapons to *j* at least once in this period. It is clearly visible that already in the Interwar years, the arms trade was a global phenomenon involving countries in Europe, the Americas, Asia, Oceania, as well as Africa. However, most of the countries appear to have only few ties to others and been active as importers, meaning that they solely acquired, but did not export, weapons and did so from only a single or a few providers. In contrast, Fig. 2 also shows a small number of countries with multiple, outgoing ties, specifically Great Britain (GBR), the US (USA), France (FRA), Italy (ITA), the Netherlands (NLD), and Germany (DEU), identifying them as core exporters of the period. Mirroring the contemporary arms trade, most countries functioned as importers while a small number of countries dominated the export market.

However, the visual, collapsed representation of the arms trade network in Fig. 2 hides relevant details and temporal variation. As such, Fig. 3 graphs the development of four important network measures over time. To begin with, its top-left panel shows how dense the network was, i.e. how many possible directed ties were realised. As may be expected, density was generally low, hovering between ~1.5% and ~3%, while the network was densest in the very last years of the Interwar period, once rearmament had begun in earnest, but also in 1920–21 and in 1929. Whereas only 1.5%-3% of possible ties were realised, many proved durable as shown in the top-right panel of Fig. 3, which graphs dyad-wise correlation in the network, i.e. to what extent dyads' status in the network remained the same from *t-1* to *t*. With dyad-wise correlation

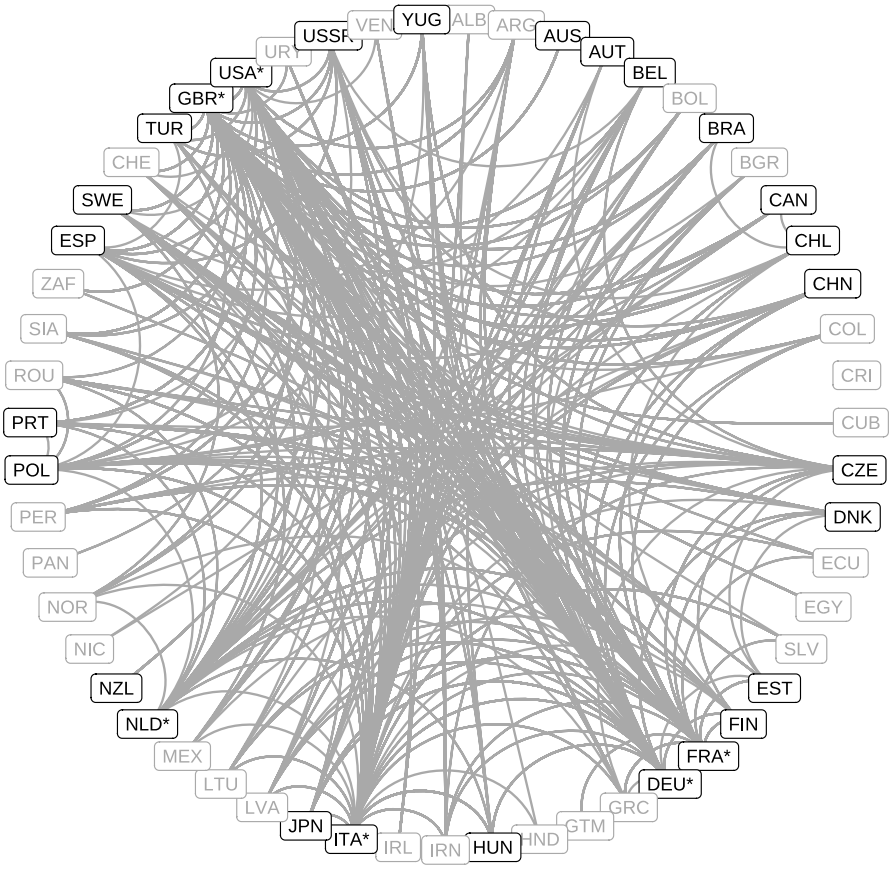


Fig. 2 The Interwar MCW Trade Network. A line between two countries indicates a transfer during the Interwar period. Countries that do not act as weapon exporters are labeled in gray. Exporting countries with an average out-degree greater than 2 are denoted with an asterisk (*). For a full list of the countries and their respective abbreviations included in the figure, please refer to Appendix A.6

ranging between ~0.35 and ~0.55, dyads in the Interwar arms trade can be considered quite stable, especially so in the 1920s. This observation remains the same when using a measure focusing on the persistence of active trade dyads, such as positive autoregression (Leifeld et al., 2018), instead of dyad-wise correlation which covers both active and inactive ties. Interestingly, dyad-wise correlation dipped in 1931–1933 and in 1936, potentially hinting at increased trade activity, but also a realignment of arms transfer ties, in these years.

The bottom row of Fig. 3 shows the average in- and outdegree distributions of the MCW transfer network for three temporal windows, 1920–26, 1927–32, and 1933–39, thus capturing the number of countries in the network respectively importing and exporting weapons to/from a given number of trade partners. Both distributions appear to have remained fairly stable across the Interwar period, but there are also

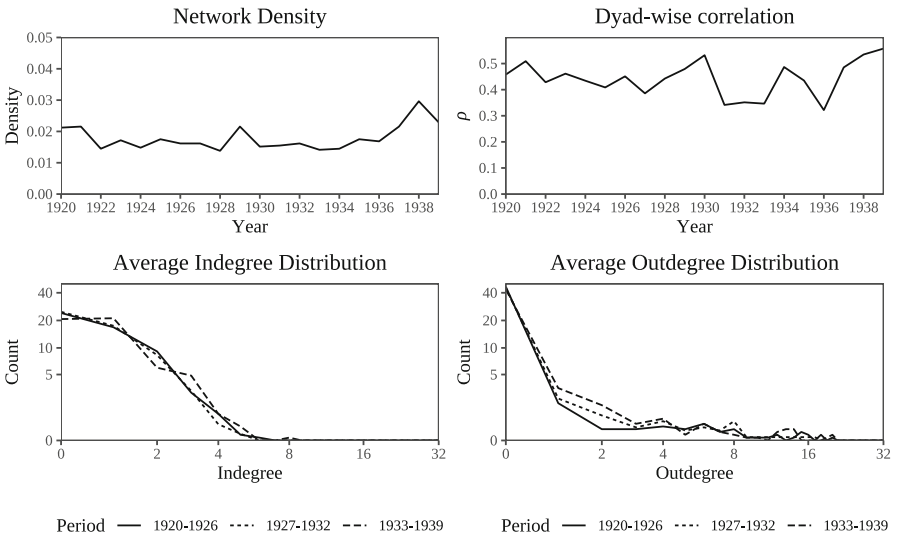


Fig. 3 Descriptive network statistics for the period 1920–1939. Axis values for the degree distributions are on log-scale. Formal definitions of network statistics are reported in Appendix A.2

some notable changes. The outdegree distribution is skewed, with most countries never exporting any weapons and some others exporting to up to 25 different importers. That being said, the number of countries engaging in some exports, i.e. with an outdegree of 1 or 2, increased over the Interwar period, reflecting smaller providers, such as Czechoslovakia or Poland, gaining in prominence. There is also change across time in the indegree distribution as some previous non-importers shifted to importing in the temporal window closest to the onset of World War II. Furthermore, having two sources of MCW was less common in this window as compared to before, while sourcing weapons from three producers was more common.

Finally, Table 1 presents the summary statistics of all exogenous variables we include in the analysis. Importer and exporter GDP are monadic attributes, their reported number of observations is thus the number of country-, not directed-dyad-years. Two countries' language match and distance are time invariant, their number of observations is hence the number of directed-dyads. The statistics reported in Table 1 indicate that both interstate rivalries and arms transfers occur relatively rarely. We observe countries having up to three shared rivals. However, out of the 2458 directed dyads where the shared rivalry indicator is non-zero, 2098 (85%) exhibit *i* and *j* sharing a single rival. A further 326 include two shared rivals while *i* and *j* having three rivals in common is the case in only 34 directed dyads.[14]

[14] We binarize this indicator in Appendix A.4, our substantive results remain unchanged.

5 Empirical results

The empirical results of the TERGM testing our three expectations are presented in Fig. 4. There, it is visible that, in contrast to our expectations, neither the Outgoing Shared Partner (OSP) statistic nor a dyadic rivalry between *i* and *j* systematically affect the MCW trade between *i* and *j*. The coefficient of OSP constellations is mostly negative, indicating that they are less common than in a random network of the same size, but its 95%-Confidence Intervals exclude zero only in one model, that for 1926–29. This is in strong contrast to the results presented by Thurner et al. (2019), where this effect is consistently significant and *positive* for the years 1956–2013, indicating that the MCW trade network of the Interwar period was structured very differently from that of the Cold War and post-Cold War years. Surprisingly, two countries being rivals also does not affect their probability of trading weapons as, again, this coefficient is mostly negative but statistically insignificant. One potential explanation for this may be that for most of the Interwar period, governments had little actual control over their arms producers' weapons exports, resulting in, e.g., the USA still exporting military aircraft to Japan in 1938 (Harkavy, 1975, p.33). Governments may thus simply have been unable to stop arms exports to rivals, even if they wished to do so, while being able to encourage exports to partner countries they shared rivals with by, for instance, providing financial help for these deals (see Grant, 2018; Mehrl et al., 2022). Alternatively, it may be the case that, as both rivalries and arms transfers are empirically rare, not being rivals is not a sufficient condition for weapons being traded. Along these lines, many country-dyads where rivalry is absent may simply be politically irrelevant and inactive (see Quackenbush, 2006), thus also making defence cooperation in the form of arms transfers of little interest to the countries within them. In other words, defence cooperation may not only require the absence of opposite interests, but also the presence of shared interests. As such, these empirical results do not provide any support for the first two expectations formulated above, one taken from existing studies on international weapons transfers and the second one a straightforward extension of existing operationalizations of security factors in the arms trade.

That being said, the results in Fig. 4 do provide support for our third, main expectation: Countries are consistently found to be more likely to transfer weapons when sharing common rivals. The coefficient of the shared rivalry indicator is consistently positive and its 95%-Confidence Intervals always exclude zero. While *i* and *j* *being* rivals, contrary to intuition, does not *decrease* their propensity to trade MCW with each other, this result indicates that them *sharing* one or more common rivals *increases* it. This is in line with the idea that for defence cooperation to occur, countries' security interests should not only not be opposed, but instead shared, such as undermining a mutual rival. Hyperdyadic constellations in the rivalry network thus not only affect rivalry accommodations and terminations (Akcinaroglu et al., 2014; Lee, 2022), but also security cooperation between the states sharing rivals. In line with theories on networked international politics (Maoz, 2010), states thus consider information beyond their own dyad as well as across networks when assessing which states are potential security threats or partners and deciding accordingly who to send weapons to. As shown in Fig. 5, where we present the average marginal effect of shared rivalries, this effect is also substantively sizeable. One additional shared rival increases the

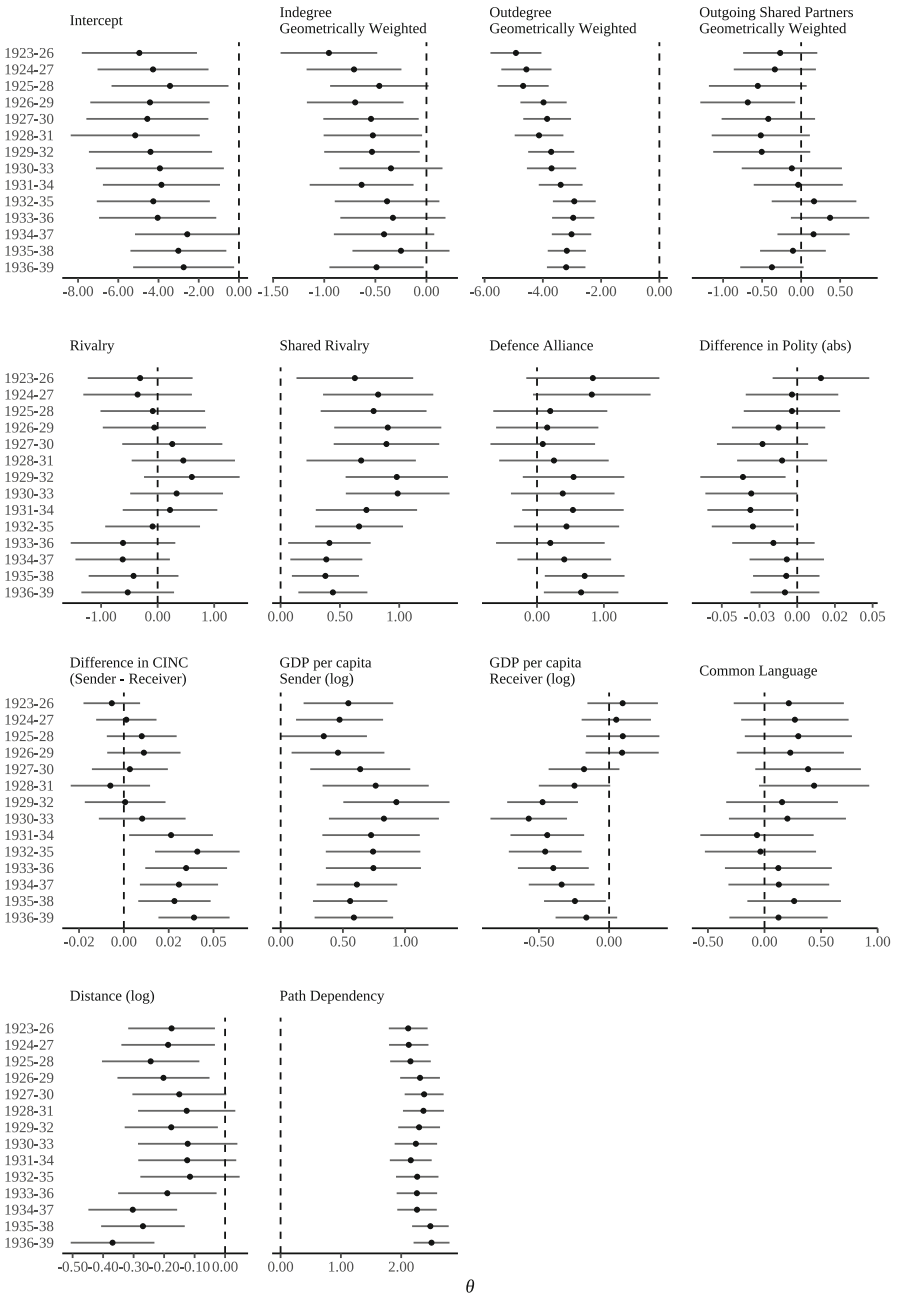


Fig. 4 Results for the Interwar MCW trade network.
TERGM estimates for four-year moving windows as dependent variable. All exogenous covariates are lagged by one period and CINC is included in percentage points. Lines indicate 95%-confidence intervals. We use geometrically weighted statistics for in/out-degree and the outgoing shared partner statistic

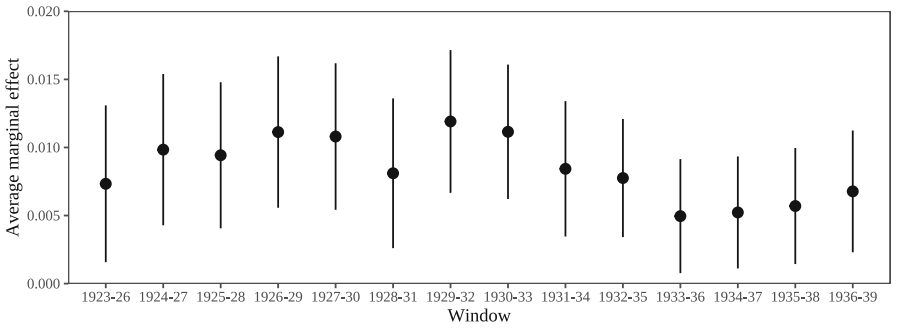


Fig. 5 Average marginal effect of shared rivalry. Results for the TERGM model. The average marginal effect captures the average change in tie probability when the independent variable increases by 1 (Duxbury, 2021). Lines indicate 95% confidence intervals

probability of an arms transfer occurring in the directed dyad by up to 1 percentage point; this effect is small but relevant because arms transfers are generally rare and this is the average estimate per *dyad* (Duxbury, 2021).

This result is all the more important as the other commonly used indicators of arms being transferred due to politico-strategic considerations – a shared defence alliance, political similarity, and the sender's military advantage (see Martínez-Zarzoso and Johannsen, 2019; Thurner et al., 2019; Willardson and Johnson, 2022; Mehrl et al., 2022) – exhibit inconsistent results that also vary quite substantially across the period of observation. The existence of a defence alliance between *i* and *j* is found to increase the probability of arms being transferred only in the late 1930s as before, its coefficient is also positive but smaller and its confidence intervals consistently include zero. In contrast, the difference in the Polity score of *i* and *j*, capturing the effect of their political similarity, exhibits the expected negative effect only in the period 1929–1935 while its confidence intervals clearly include zero before and after. Finally, *i*'s advantage in CINC over *j*, measuring how much militarily more powerful it is, is found to increase the probability of *i* transferring weapons to *j* throughout the 1930s but not in the 1920s. Taken together, the results of these three variables thus mirror the finding that countries' security considerations, if anything, only played a small role in the arms trade in the second half of the 1920s but that their importance grew in the 1930s (Mehrl et al., 2022). However, the influence of defence alliances and political similarity appears inconsistent as it is found to be statistically insignificant even for large parts of the 1930s here. In contrast, the shared rivalry indicator exhibits the expected positive effect on a statistically significant level not only consistently throughout the 1930s, but even in the Locarno years of the mid and late 1920s when we would expect security considerations in the international arms trade to have been the least relevant (Mehrl et al., 2022). At least for the Interwar period, shared rivalries thus appear to be a more consistent predictor of whether two countries will transfer weapons than the three alternative politico-strategic variables.

The results for the additional endogenous covariates included in the model largely mirror those reported by work on the more contemporary arms trade (see Thurner et al., 2019). Accordingly, the in- and outdegree effects are found to be negative, but stronger

and more consistent for the latter. Mirroring the descriptive analysis above, there is strong path dependency in the arms trade network. And the negative, statistically significant estimate for the intercept underscores the low network density throughout the Interwar period. Interestingly, the intercept estimates are somewhat less negative for the last three windows, matching the idea that the arms transfer network became denser following the failure of the World Disarmament Conference in 1933.

In the next step, we present the results of an AME model which, in terms of exogenous variables, is specified identically to the TERGM presented in Fig. 4 but accounts for network dependencies not by explicitly including endogenous statistics such as the OSP or degree terms, but instead via its additive and multiplicative effects structure. We thus cannot substantively interpret these dependencies but decrease the risk of our results being driven by network misspecificiation which, in the TERGM, may

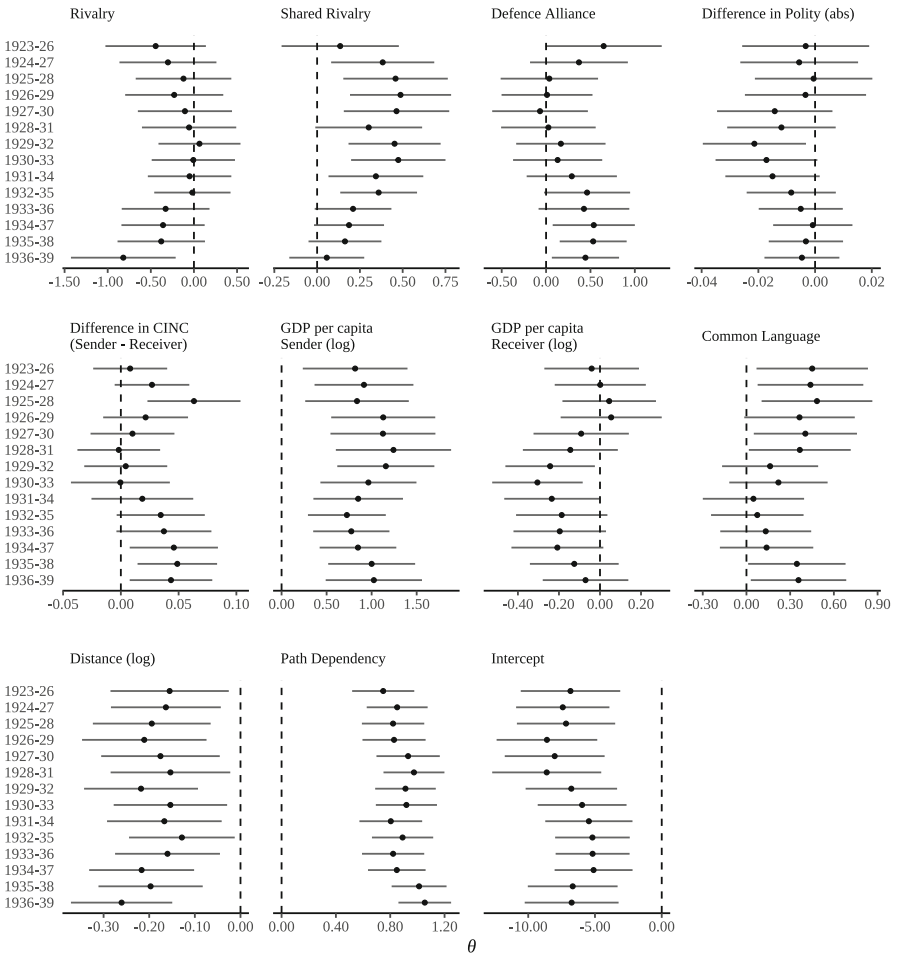


Fig. 6 Results for the Interwar MCW trade network. AME model estimates for four-year moving windows as dependent variable. All exogenous covariates are lagged by one period and CINC is included in percentage points. Points and Lines indicate posterior mean and 95% credible intervals, respectively

occur when we omit endogenous statistics capturing dynamics that mattered in the data generating process. The results of the AME model are presented in Fig. 6. We cannot retrieve the influence of OSP constellations from the AME model but Fig. 6 speaks to the two expectations regarding the influence of dyadic and triadic rivalries on the international arms trade. Just like in the TERGM, countries being rivals does not generally affect the probability of arms being transferred between them though the AME model does find a negative and statistically significant effect for this variable in the very last window, 1936–1939. With this exception, the effect of dyadic rivalry on arms transfers reported in Fig. 6 is again statistically indistinguishable from zero. In contrast, the effect of two countries sharing common rivals is always positive and generally also statistically significant. Though the AME model finds this effect to be weaker than the TERGM, the substantive takeaway that shared rivalries matter for arms transfers between two countries remains unchanged. We should, however, note that in the AME model, the effect of shared rivalry is statistically indistinguishable from zero in the first and, somewhat surprisingly, very last estimation windows and only borderline significant in the mid-late 1930s. The results for shared defence alliances and the difference in countries' military capabilities reported in Fig. 6 are fairly similar to those from Fig. 4, implying that they affected countries' propensity to trade arms mainly in the second half of the 1930s. But for states' political differences, the AME model departs from the TERGM as it reports a statistically significant effect on the arms trade only for one estimation window, 1929–1932. On the whole, however, the substantive results of the AME model mirror those of the TERGM and support its main finding, i.e. that countries are more likely to trade MCW if they share common rivals.

We present additional analyses that support our findings in the appendix. Following Hunter et al. (2008), we investigate the goodness of fit of the TERGM presented in Fig. 4 in Appendix A.3 by simulating networks from it, computing their corresponding statistics, and assessing in how far their distribution includes the observed statistics. There is a good match between the observed and simulated network statistics, implying a satisfactory goodness of fit. Beyond estimating the AME model presented in Fig. 6, we want to further ensure that our results are not due to modelling choices and hence run several additional model specifications (A.4). First, we re-estimate the TERGM with alternative decay parameters. Second, we use the *number* of shared rivals in the main specification and thus present an additional model where this number is binarized, with all non-zero values taking the value 1, in the appendix. Third, Willardson and Johnson (2022) theorize shared membership in international governmental organizations (IGOs) as a driving factor of the arms trade. As this membership could also correlate with the existence of rivalries, we include the number of IGOs i and j are both members in as an additional control. Fourth, we use three- and five- instead of four-year moving windows to ensure that the choice of window length does not substantially affect our results. And fifth, we want to make sure that the results we observe are really about rivalries, not closely related phenomena such as territorial contestation, and thus replace the dyadic and triadic rivalry indicators with equivalent variables on territorial conflict coded from the Issue Correlates of War data (see Frederick et al., 2017). Across these additional specifications, our substantive results

remain unchanged while, interestingly, neither dyadic nor triadic territorial conflict is found to consistently affect states' propensity to trade arms.

Finally, we investigate to what extent our theory and results transfer beyond the Interwar period. As discussed above, we believe that our theory applies to the Interwar years in particular. This is due to the multipolar structure the state system exhibited then and the consequences this specific structure has for states' security cooperation. But clearly, both international arms transfers and rivalries similarly existed during the bipolar Cold War years, with rivalries, such as that between the superpowers USA and USSR, potentially even being more salient. And while states are considered to be particularly concerned over abandonment, entrapment, and buckpassing under multipolarity, this does not mean that these downsides of security cooperation do not exist under bipolarity as well (Snyder, 1984; Christensen and Snyder, 1990). Indeed, Yarhi-Milo et al. (2016) show how during the Cold War, the USA shifted to a policy of arms transfers to Taiwan, ending their earlier defence alliance, due to changes in the two countries' common security interests which otherwise would have increased the risk of entrapment. As such, it is possible and very much an empirical question whether our theory also applies outside of the multipolar Interwar years. To begin answering this question, we use data on MCW transfers collected by the Stockholm International Peace Research Institute (SIPRI, 2022) to re-estimate our main TERGM

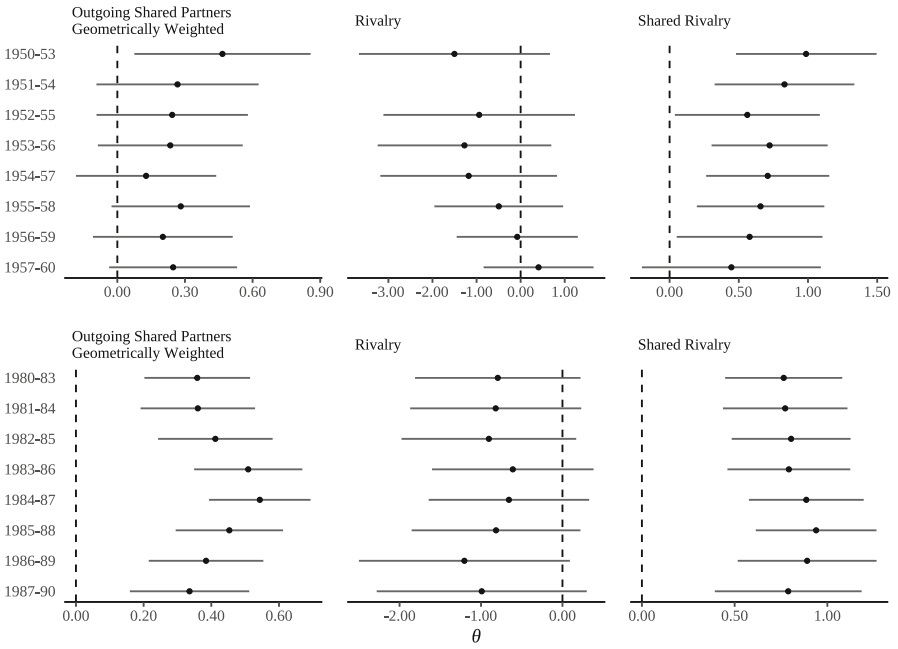


Fig. 7 Results for the Postwar MCW trade network. TERGM estimates of the hypothesized coefficients for the 1950s (first row) and 1980s (second row). The research design follows the Interwar analysis, and the full results can be found in the Appendix A.5. The rivalry variable was dropped from estimation in the 1951–54 window due to perfect separation

specification on two Cold War decades, the 1950s and the 1980s.[15] The core results, pertaining to our three theoretical expectations, are presented in Fig. 7. There, it is notable that, first, the results for the Outgoing Shared Partner term are in line with those reported by Thurner et al. (2019) for the Cold War period. And second, the results of the two rivalry terms are very similar to those we report in our main models. These results should be considered as preliminary, as the model was developed for the Interwar arms trade network, does not make theoretically potentially appropriate changes to the path dependency parameter or covariate selection (e.g. including UN voting similarity), and is now fitted to much larger networks including a different set of countries. Keeping these points in mind, however, the additional specifications suggest that sharing a common rival also increased two countries' probability of trading weapons in the 1950s and 1980s, not only during the Interwar period, while a bilateral rivalry between them again exhibits no statistically significant effect. While further research, both on the Cold War period but also the following years, clearly remains necessary, these results do suggest that our theory and results apply beyond the context of the Interwar period.

6 Conclusion

The theory and empirical results presented here suggest that rivalry between states influenced the Interwar international arms trade. However, this influence does not appear in a dyadic manner, with two states being less (or more) likely to transfer weapons if they are rivals, but instead beyond the dyad: We find consistent evidence that two states are more likely to trade arms with each other if they share one or more common rivals. This positive effect exists throughout the Interwar period, is unaffected by controlling for dyadic rivalries, and persists throughout a series of robustness checks that use alternative network models, different estimation windows, and additional controls. This is in line with the idea that, beyond the focal dyad itself, states consider their own and potential recipients' rivalry portfolio when deciding who to arm as common rivalries indicate similar security interests. Shared rivals indicate to a sender that transferring weapons will not result in security costs but instead security synergies, allowing it to benefit from the recipient's increased military strength *vis-à-vis* the common rival without being entrapped in an unwanted conflict. Additional specifications suggest that these results also apply to contexts beyond the Interwar period. In contrast, we do not find evidence supporting the expectation that countries who export arms to the same recipient also traded amongst each other in the Interwar period. This contrasts with the results of Thurner et al. (2019), who investigate the Cold War and post-Cold War years, and hints at the relevance of systemic differences across historical periods.

These findings on the roles of common rivals and common recipients in the international arms trade have several implications. First, they should firmly add indicators of

[15] We focus on the Cold War due to both theoretical and methodological reasons. Theoretically, it is not clear to us to what extent rivalries as well as the dilemmas of security cooperation are salient if the state system is as unipolar as it was for much the 1990s and 2000s. And methodologically, the network grows even more in the 1990s as new states become independent, creating further hurdles for fitting a model that was initially specified for the much smaller Interwar period system.

latent threat, specifically rivalry, to how we conceptualize and operationalize exporters' security considerations in the international arms trade. As shown by our results, rivalry exhibits an effect which is independent of and, at least in the Interwar period, more consistent than the sender's and potential recipient's military balance, political similarity, or common defence alliance. But, second, the effect of rivalry is not dyadic but, as it involves more states than just the exporter and importer, hyperdyadic, further emphasizing the idea, developed in recent research (Valeriano and Powers, 2016; Thurner et al., 2019; Lee, 2022), that states beyond the focal dyad matter for outcomes in international relations and, in particular, rivalries and the arms trade. Adding to this research, however, we show that these hyperdyadic structures matter not only in their own network, but also across them, with rivalry triads not only influencing other rivalries (Akcinaroglu et al., 2014; Allen et al., 2016; Lee, 2022), but also whether countries trade arms. Facing existing security structures, and the threat that emanates from them, states actively attempt to redraw these structures by transferring arms to countries threatened by the same, shared rival. Security agency and structure are thus closely intertwined (see Wendt, 1987). Third, by showing that the endogenous network processes at play in the Interwar and post-World War II arms trade networks were different ones, this research points to the importance of historical context, with systemic structure potentially being an important scope condition for network theories, dynamics, and the generalizability of results (Fordham, 2020). This insight, and research on periods that were not bi- or unipolar, promises to become all the more relevant if the international system develops towards a new multipolarity (Posen, 2011). And finally, this research highlights the close connection between arms transfers and alliances as substitutable tools of security cooperation (Most and Starr, 1984; Morgan and Palmer, 2000; Yarhi-Milo et al., 2016), thus bridging research on arms transfers within International Political Economy and on alliances within International Relations, pointing to the need for further interaction between these fields in theorising and studying states' pursuit of security in the international system.

These implications also hint at several opportunities for future research. First, we showed that sharing rivals increased countries' probability of transferring weapons in the Interwar period but only offer preliminary evidence that this result also applies to the Cold War arms trade, while disregarding its contemporary iteration. Investigating both of these more recent periods in further detail thus remains as a task for future studies, especially as in the Cold War, it may not be triads but quartets including the US, USSR, and two opposing client states that matter (Kinsella, 1995). Second, we have shown that constellations from the rivalry network affect the arms trade but it is also possible that weapons transfers contribute to the formation and dissolution of rivalries. For instance, two rivals may be more likely to resolve their rivalry if they keep receiving weapons from the same supplier (see Beardsley et al., 2020) while Kinsella (1994) suggests that arms transfers affect conflict severity between rivals. This would imply simultaneous dependencies between the rivalry and the arms trade network, methods for modelling these are fortunately becoming available (see Chen, 2021). Third and similarly, the substitutability argument we make implies that future research may look to model the co-evolution of these two networks with states' alliance ties. Fourth, future work may extend this research to the intensive margin of trade, investigating whether dyadic or triadic rivalry affects the volume of arms transfers

between countries. And finally, this research more generally emphasizes the importance of cross-network influences and modelling these in an empirically principled fashion. Future research should thus follow earlier work on the influences across different networks in international relations, such as those formed by alliances, conflict, memberships in international organizations, or trade (see Dorussen and Ward, 2008, 2010; Maoz, 2010), but, empirically, use appropriate network models and, theoretically, broaden its scope to include more of the several ties linking countries in the international system.

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Data Availability The full replication data and code can be found on the website of the Review of International Organizations.

Declarations

Conflict of Interest The authors declare no conflict of interest.

References

Akcinaroglu, S., & Radziszewski, E. (2017). Web of links: Rival connections and strategic accommodation in response to threats. *Journal of Global Security Studies, 2*(3), 237–252.

Akcinaroglu, S., Radziszewski, E., & Diehl, P. F. (2014). The effects of rivalry on rivalry: Accommodation and the management of threats. *Foreign Policy Analysis, 10*(1), 81–100.

Allen, M. A., Bell, S. R., & Clay, K. C. (2016). Deadly triangles: The implications of regional competition on interactions in asymmetric dyads. *Foreign Policy Analysis, 14*(2), 169–190.

Beardsley, K., Liu, H., Mucha, P. J., Siegel, D. A., & Tellez, J. F. (2020). Hierarchy and the provision of order in international politics. *Journal of Politics, 82*(2), 731–746.

Bolt, J., & van Zanden, J. L. (2020). Maddison style estimates of the evolution of the world economy. A new 2020 update. Maddison-Project Working Paper WP-15.

Chen, T. H. Y. (2021). Statistical inference for multilayer networks in political science. *Political Science Research and Methods, 9*(2), 380–397.

Christensen, T. J., & Snyder, J. (1990). Chain gangs and passed bucks: Predicting alliance patterns in multipolarity. *International Organization, 44*(2), 137–168.

Colaresi, M., & Thompson, W. R. (2002). Strategic rivalries, protracted conflict, and crisis escalation. *Journal of Peace Research, 39*(3), 263–287.
Craft, C., & Smaldone, J. P. (2002). The arms trade and the incidence of political violence in sub-saharan Africa, 1967–97. *Journal of Peace Research, 39*(6), 693–710.
Cranmer, S. J., & Desmarais, B. A. (2016). A critique of dyadic design. *International Studies Quarterly, 60*(2), 355–362.
De Nicola, G., Fritz, C., Mehrl, C., & Kauermann, G. (2023). Dependence matters: Statistical models to identify the drivers of tie formation in economic networks.
Dorussen, H., & Ward, H. (2008). Intergovernmental organizations and the kantian peace: A network perspective. *Journal of Conflict Resolution, 52*(2), 189–212.
Dorussen, H., & Ward, H. (2010). Trade networks and the kantian peace. *Journal of Peace Research, 47*(1), 29–42.
Duxbury, S. W. (2021). The problem of scaling in exponential random graph models. *Sociological Methods & Research*, 004912412098617
Findley, M. G., Piazza, J. A., & Young, J. K. (2012). Games rivals play: Terrorism in international rivalries. *Journal of Politics, 74*(1), 235–248.
Fordham, B. O. (2020). History and quantitative conflict research: A case for limiting the historical scope of our theoretical arguments. *Conflict Management and Peace Science, 37*(1), 3–15.
Fouquin, M., & Hugot, J. (2016). Two centuries of bilateral trade and gravity data: 1827–2014. CEPII Working Paper 2016–14
Frederick, B. A., Hensel, P. R., & Macaulay, C. (2017). The issue correlates of war territorial claims data, 1816–20011. *Journal of Peace Research, 54*(1), 99–108.
Fritz, C., Mehrl, M., Thurner, P. W., & Kauermann, G. (2022a). Exponential random graph models for dynamic signed networks: An application to international relations. arXiv e-prints, arXiv:-2205
Fritz, C., Mehrl, M., Thurner, P. W., & Kauermann, G. (2022). The role of governmental weapons procurements in forecasting monthly fatalities in intrastate conflicts: A semiparametric hierarchical hurdle model. *International Interactions, 48*(4), 778–799.
García-Alonso, M. D., & Levine, P. (2007). Arms trade and arms races: A strategic analysis. In: T. Sandler and K. Hartley (Eds.), *Handbook of Defense Economics* (Volume 2, pp. 941–971). Elsevier
Gartzke, E. A., & Gleditsch, K. S. (2022). Ties that bias in international conflict: A spatial approach to dyadic dependence from alliance ties and inbetweenness. *International Studies Quarterly, 66*(1), sqab082
Geyer, C. J., & Thompson, E. A. (1992). Constrained Monte Carlo Maximum likelihood for dependent data. *Journal of the Royal Statistical Society Series B Methodological, 54*(3), 657–699.
Grant, J. A. (2018). *Between Depression and Disarmament: The International Armaments Business, 1919–1939*. Cambridge University Press.
Handcock, M. S., Hunter, D. R., Butts, C. T., Goodreau, S. M., Krivitsky, P. N., BenderdeMoll, S., & Morris, M. (2019). statnet: Software Tools for the Statistical Analysis of Network Data.
Hanneke, S., Fu, W., & Xing, E. P. (2010). Discrete temporal models of social networks. *Electronic Journal of Statistics, 4*, 585–605.
Harkavy, R. E. (1975). *The arms trade and international systems*. Co: Ballinger Pub.
Harkavy, R. E. (2007). *Strategic basing and the great powers, 1200–2000*. Routledge.
Hoff, P. (2021). Additive and multiplicative effects network models. *Statistical Science, 36*(1), 34–50.
Hoff, P., Fosdick, B., Volfovsky, A., & He, Y. (2020). Amen: Additive and multiplicative effects models for networks and relational data. Version: 1.4.4.
Hoff, P. D., & Ward, M. D. (2004). Modeling dependencies in international relations networks. *Political Analysis, 12*(2), 160–175.
Hunter, D. R. (2007). Curved exponential family models for social networks. *Social Networks, 29*(2), 216–230.
Hunter, D. R., Goodreau, S. M., & Handcock, M. S. (2008). Goodness of fit of social network model. *Journal of the American Statistical Association, 103*(481), 248–258.
Hunter, D. R., & Handcock, M. S. (2006). Inference in curved exponential family models for networks. *Journal of Computational and Graphical Statistics, 15*(3), 565–583.
Johnson, J. C. (2017). External threat and alliance formation. *International Studies Quarterly, 61*(3), 736–745.
Kinne, B. J. (2018). Defense cooperation agreements and the emergence of a global security network. *International Organization, 72*(4), 799–837.

Kinsella, D. (1994). Conflict in context: Arms transfers and third world rivalries during the cold war. *American Journal of Political Science, 38*(3), 557–581.
Kinsella, D. (1995). Nested rivalries: Superpower competition, arms transfers, and regional conflict, 1950-1990. *International Interactions, 21*(2), 109–125.
Kinsella, D. (1998). Arms transfer dependence and foreign policy conflict. *Journal of Peace Research, 35*(1), 7–23.
Krause, K. (1991). Military statecraft: Power and influence in soviet and american arms transfer relationships. *International Studies Quarterly, 35*(3), 313–336.
Krause, V. (2004). Hazardous weapons? effects of arms transfers and defense pacts on militarized disputes, 1950–1995. *International Interactions, 30*(4), 349–371.
Lee, B. K. (2022). Triangles, major powers, and rivalry duration. *Journal of Conflict Resolution*.
Leeds, B., Ritter, J., Mitchell, S., & Long, A. (2002). Alliance treaty obligations and provisions, 1815–1944. *International Interactions, 28*(3), 237–260.
Leifeld, P., Cranmer, S. J., & Desmarais, B. A. (2018). Temporal exponential random graph models with btergm: Estimation and bootstrap confidence intervals. *Journal of Statistical Software, 83*(6), 1–36.
Lerner, J. (2016). Structural balance in signed networks: Separating the probability to interact from the tendency to fight. *Social Networks, 45*, 66–77.
Levine, P., Sen, S., & Smith, R. (1994). A model of the international arms market. *Defence and Peace Economics, 5*(1), 1–18.
Maoz, Z. (2010). *Networks of nations: The Evolution, structure, and impact of international networks, 1816–2001*. Cambridge: Cambridge University Press.
Maoz, Z., & San-Akca, B. (2012). Rivalry and state support of non-state armed groups (nags), 1946–2001. *International Studies Quarterly, 56*(4), 720–734.
Maoz, Z., Terris, L. G., Kuperman, R. D., & Talmud, I. (2007). What is the enemy of my enemy? causes and consequences of imbalanced international relations, 1816–2001. *Journal of Politics, 69*(1), 100–115.
Marshall, M. G., Gurr, T. R., & Jaggers, K. (2016). *Polity iv project: Political regime characteristics and transitions, 1800–2015*. Center for Systemic Peace: Dataset users manual.
Martínez-Zarzoso, I., & Johannsen, F. (2019). The gravity of arms. *Defence and Peace Economics, 30*(1), 2–26.
Mehrl, M., & Choulis, I. (2021). Diversionary politics and territorial disputes: Evidence from turkish airspace incursions. *Foreign Policy Analysis, 17*(3), orab007
Mehrl, M., Seussler, D., & Thurner, P. W. (2022). Money first? strategic and economic interests in the international arms trade. 1920–1936
Mehrl, M., & Thurner, P. W. (2020). Military technology and human loss in intrastate conflict: The conditional impact of arms imports. *Journal of Conflict Resolution, 64*(6), 1172–1196.
Mehrl, M., & Thurner, P. W. (2022a). The interwar period international trade in arms (ipita): A new dataset
Mehrl, M., & Thurner, P. W. (2022b). Multipolar arms trade: Military technology transfers in the interwar period. 1920–1939.
Minhas, S., Hoff, P. D., & Ward, M. D. (2019). Inferential approaches for network analysis: Amen for latent factor models. *Political Analysis, 27*(2), 208–222.
Mitchell, S. M., & Prins, B. C. (2004). Rivalry and diversionary uses of force. *Journal of Conflict Resolution, 48*(6), 937–961.
Moore, M. (2012). Selling to both sides: The effects of major conventional weapons transfers on civil war severity and duration. *International Interactions, 38*(3), 325–347.
Morgan, T. C., & Palmer, G. (2000). A model of foreign policy substitutability: Selecting the right tools for the job(s). *Journal of Conflict Resolution, 44*(1), 11–32.
Morrow, J. D. (1991). Alliances and asymmetry: An alternative to the capability aggregation model of alliances. *American Journal of Political Science, 35*(4), 904–933.
Morrow, J. D. (1993). Arms versus allies: trade-offs in the search for security. *International Organization, 47*(2), 207–233.
Most, B. A., & Starr, H. (1984). International relations theory, foreign policy substitutability, and nice laws. *World Politics, 36*(3), 383–406.
Nieman, M. D., Martinez Machain, C., Chyzh, O. V., & Bell, S. R. (2021). An international game of risk: Troop placement and major power competition. *Journal of Politics, 83*(4), 1307–1321.
Pamp, O., Lebacher, M., Thurner, P. W., & Ziegler, E. (2021). Explaining destinations and volumes of international arms transfers: A novel network-heckman-selection model. *European Journal of Political Economy, 69*, 102033.

Pamp, O., Rudolph, L., Thurner, P. W., Mehltretter, A., & Primus, S. (2018). The buildup of coercive capacities: Arms imports and the outbreak of violent intrastate conflicts. *Journal of Peace Research, 55*(4), 430–444.

Perkins, R., & Neumayer, E. (2010). The organized hypocrisy of ethical foreign policy: Human rights, democracy and western arms sales. *Geoforum, 41*(2), 247–256.

Posen, B. R. (1984). *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars*. Cornell University Press.

Posen, B. R. (2011). From unipolarity to multipolarity: transition in sight? In G. J. Ikenberry, M. Mastanduno, & W. C. Wolforth (Eds.), *International relations theory and the consequences of unipolarity* (pp. 317) Cambridge University Press.

Quackenbush, S. L. (2006). Identifying opportunity for conflict: Politically active dyads. *Conflict Management and Peace Science, 23*(1), 37–51.

R Core Team. (2023). *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rasler, K. A., & Thompson, W. R. (2006). Contested territory, strategic rivalries, and conflict escalation. *International Studies Quarterly, 50*(1), 145–167.

Rathbun, B. C. (2011). Before hegemony: Generalized trust and the creation and design of international security organizations. *International Organization, 65*(2), 243–273.

Rider, T. J., Findley, M. G., & Diehl, P. F. (2011). Just part of the game? arms races, rivalry, and war. *Journal of Peace Research, 48*(1), 85–100.

Schvitz, G., Girardin, L., Rüegger, S. Weidmann, N. B., Cederman, L.-E., & Gleditsch, K. S. (2022). Mapping the international system, 1886–2019: The cshapes 2.0 dataset. *Journal of Conflict Resolution, 66*,(1), 144–161

Singer, J. D., Bremer, S., & Stuckey, J. (1972). Capability distribution, uncertainty, and major power war, 1820–1965. In B. Russett (Ed.), *Peace, War, and Numbers* (pp. 1948). Sage.

SIPRI (2022). Arms transfers. data retrieved from the SIPRI Arms Transfers Database. https://www.sipri.org/databases/armstransfers.

Smith, A. (1998). Extended deterrence and alliance formation. *International Interactions, 24*(4), 315–343.

Snyder, G. H. (1984). The security dilemma in alliance politics. *World Politics, 36*(4), 461–495.

Thompson, W., & Dreyer, D. (2011). *Handbook of international rivalries*. CQ Press.

Thompson, W. R. (2001). Identifying rivals and rivalries in world politics. *International Studies Quarterly, 45*(4), 557–586.

Thurner, P. W., Schmid, C. S., Cranmer, S. J., & Kauermann, G. (2019). Network interdependencies and the evolution of the international arms trade. *Journal of Conflict Resolution, 63*(7), 1736–1764.

Türkeş, M. (1994). The balkan pact and its immediate implications for the balkan states, 1930–34. *Middle Eastern Studies, 30*(1), 123–144.

Valeriano, B., & Powers, M. (2016). Complex interstate rivals. *Foreign Policy Analysis, 12*(4), 552–570.

Waltz, K. N. (1979). *Theory of International Politics*. Reading, MA: Addison–Wesley.

Wandycz, P. S. (1988). *The twilight of French eastern alliances, 1926–1936: French-Czechoslovak-Polish relations from Locarno to the remilitarization of the Rhineland*. Princeton, N.J: Princeton University Press.

Wendt, A. E. (1987). The agent-structure problem in international relations theory. *International Organization, 41*(3), 335–370.

Willardson, S. L., & Johnson, R. A. (2022). Arms transfers and international relations theory: Situating military aircraft sales in the broader ir context. *Conflict Management and Peace Science, 39*(2), 191–213.

Xu, G. (2001). American-british aircraft competition in South China, 1926–1936. *Modern Asian Studies, 35*(1), 157–193.

Yarhi-Milo, K., Lanoszka, A., & Cooper, Z. (2016). To arm or to ally? the patrons dilemma and the strategic logic of arms transfers and alliances. *International Security, 41*(2), 90–139.