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Who Joins and Who Fights? Explaining Tacit Coalition Behavior among Civil War Actors

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Which armed organizations form coalitions despite the inherent difficulties of cooperation in civil wars? We introduce the concept of tacit coalitions, which pertains to strategic and informal coalition behavior between civil war actors to address this puzzle. Our theoretical model of coalition behavior takes in theater-wide conflict behavior to allow for predictions that coalitions are more likely to form. It provides novel insights into the way military synergies within potential coalitions affect the trade-off between pooling resources and worrying about the division of gains. The empirical section finds considerable support for our theoretical argument that actors are more likely to engage in tacit coalition behavior (1) if potential coalitions are power balanced, (2) if joint capability of potential coalitions is not too high, and (3) when coalitions can unlock synergies. In addition, it produces evidence for the important role of geography and ethnic ties in generating military synergies.

¿Qué organizaciones armadas forman coaliciones, a pesar de las dificultades inherentes a la cooperación en las guerras civiles? Introducimos el concepto de "coaliciones tácitas," que se refiere al comportamiento estratégico e informal de las coaliciones entre los actores de la guerra civil para abordar este rompecabezas. Nuestro modelo teórico del comportamiento de las coaliciones tiene en cuenta el comportamiento de los conflictos en todo el teatro de operaciones para poder predecir qué coaliciones tienen más probabilidades de formarse. Aporta nuevas ideas sobre el modo en que las sinergias militares dentro de las posibles coaliciones afectan al equilibrio entre la puesta en común de los recursos y la preocupación por el reparto de las ganancias. La sección empírica encuentra un apoyo considerable a nuestro argumento teórico de que es más probable que los actores participen en un comportamiento de coalición tácita a) si las coaliciones potenciales están equilibradas en cuanto al poder, b) si la capacidad conjunta de las coaliciones potenciales no es demasiado alta, y c) cuando las coaliciones pueden activar sinergias. Además, aporta pruebas del importante papel de la geografía y los vínculos étnicos en la generación de sinergias militares.

Quelles sont les organisations armées qui forment des coalitions malgré les difficultés inhérentes à la coopération dans les guerres civiles ? Pour résoudre cette énigme, nous introduisons le concept de coalitions tacites, qui concerne le comportement de coalition stratégique et informelle entre des acteurs de guerre civile. Notre modèle théorique du comportement de coalition prend en compte le comportement des conflits à l'échelle du théâtre des opérations pour permettre de prédire quelles coalitions sont les plus susceptibles de se former. Il offre de nouveaux renseignements sur la manière dont les synergies militaires au sein des coalitions potentielles affectent le compromis entre la mise en commun des ressources et l'inquiétude quant à la répartition des gains. La section empirique de cette étude permet de constater un soutien considérable à notre argument théorique selon lequel les acteurs sont davantage susceptibles de s'engager dans un comportement de coalition tacite si a) les coalitions potentielles sont équilibrées en termes de pouvoir, b) la capacité conjointe des coalitions potentielles n'est pas trop élevée, et c) les coalitions peuvent débloquer des synergies. De plus, elle produit des preuves indiquant le rôle important de la géographie et des liens ethniques dans la génération des synergies militaires.

Introduction

In recent years, scholars have paid increasing attention to the dynamics of multi-actor conflict. This research agenda has produced important insights about not only increased cooperation (such as the pooling of military resources; Akcinaroglu 2012; Bapat and Bond 2012) but also decreased coalition coherence (e.g., outbidding [Cunningham 2011], commitment problems [Christia 2012], information problems [Nygård and Weintraub 2015; Wood and Kathman 2015], and preference divergence [Bakke, Cunningham and Seymour 2012]). Less is known about the characteristics that make rebel groups compatible partners and increase the likelihood that they pool forces, to realize military advantages from cooperation. As Gade et al. (2019a) argue, the focus of the literature has been primarily on *why* rebel organizations cooperate and compete

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(Bakke, Cunningham, and Seymour 2012; Metternich et al. 2013; Quinn, Joshi, and Melander 2019; Walter 2019), but less is known with *whom* they do so (Christia 2012; Gade et al. 2019a; Dorff, Gallop, and Minhas 2020). Addressing this limitation, we move away from an analytic and empirical lens on group and dyad-level characteristic, and instead take in the entire set of potential coalition partners by focusing on conflict theaters. Treating all rebel groups and the government as part of one conflict theater allows for the analysis of strategic interactions and test predictions about the expected patterns of cooperation. To accommodate this shift in perspective, we make two conceptual innovations. Theoretically, we focus on the role of military *synergies* as source of cooperation between civil war actors, and incorporate synergies into a formal model of coalition formation. Empirically, we introduce the idea of *tacit coalitions*, which allows us to study emerging patterns of cooperative behavior across entire conflict theaters.

Scholars have highlighted synergy effects before. For example, Christia (2012, 110) notes that a coalition between various mujaheddin groups in Afghanistan in 1985 "improved their battlefield performance that allowed them to capitalize on the economics of scale of their interactions." Akcinaroglu (2012) formalizes the idea of synergies as providing economies of scale when several groups pool their military capabilities. We start with the same idea, but pay attention to characteristics that provide some groups of actors greater synergies from cooperation than others. Actors join coalitions with the main objective to win armed contests. Synergies arise when a coalition's military capabilities are greater than the sum of capabilities of its constituent members. Importantly though, we argue that these economies of scale are not uniformly distributed, but vary between specific groups of actors. To analyze how these coalition-specific synergies translate into battlefield coalitions, we develop a multi-actor formal model. The model accounts for strategic interactions across all actors, generates predictions for feasible coalition profiles, and allows us to analyze how these predictions vary with different distributions of synergy linkages and military capabilities.

The coalition-specific view allows for infusing the abstract concept of military synergy with empirical content by exploring the role of ethnic ties and geography in explaining battlefield coalitions. For geography, we investigate whether moving from proximity to remoteness of potential coalition partners spans a trade-off between ease of coordination and engaging the opponent over a larger battlefield (Boulding 1962; Gates 2002). We look at a similar dynamic for ethnicity, where ethnic proximity may facilitate coordination (Strachan 2006; Lyall 2010), but cooperation among several ethnic groups unlocks additional resources, and avoids ethnic infighting (Krause 2017) and outbidding dynamics (Bloom 2004).

Empirically, we introduce the concept of *tacit coalitions*, which do not require formal alliances. Tacit coalitions arise when actors simultaneously fight the government (or a coalition containing the government) without a formal cooperation agreement in place. We believe that this approach closely captures the battlefield reality of civil war, where information is scarce, and fighting decisions need to be based on available observations of movements and actions of other actors. Looking at tacit coalitions can account for theater-wide conflict dynamics that otherwise would be difficult to capture. Since our hypotheses make very specific predictions about the characteristics of coalition partners and find support in the data, we are confident that the tacit coalition concept is suitable to distinguish meaningful coalition patterns from randomly arising parallel fighting activity.

Our approach makes a number of additional contributions. Despite extensive alliance theoretical work in the context of international conflict (e.g., Organski 1958; Waltz 1964, 1979; Wagner 1986; Niou, Ordeshook, and Rose 1989; Fordham and Poast 2016), similar dynamics have received less attention in civil war (important formal works on coalition behavior are not civil-war specific, Esteban and Ray 1999, 2008; Niou and Tan 2005). We bring a conflict-system perspective to the study of civil war and provide a multi-actor conflict game to make predictions about how variation in the theater-wide distribution of synergies and military capabilities affects the overall patterns of coalition behavior. At the same time, the paper also highlights how those coalitions differ from interstate alliances, which tend to be more institutionalized and often are formed during peace time.

We also contribute to a burgeoning literature on coalition formation in noninstitutionalized settings, by providing a template of how to combine a multi-actor formal model with a k-adic empirical analysis. This can be applied to coalition behavior in areas such as state-building (Driscoll 2012), terrorism (Nemeth 2014; Phillips 2014; Conrad and Greene 2015), and autocratic regimes (Acemoglu, Egorov, and Sonin 2008; Francois, Rainer, and Trebbi 2015; Bormann 2019).

Who Joins with Whom? Theoretical Considerations

Only a few publications directly address the question of *who* makes good coalition partners for rebel organizations. These break down into those that focus on power relations (e.g., Christia 2012) and those focusing on ideological proximity (e.g., Gade et al. 2019a).[1] While our approach incorporates a power relations perspective, it allows for intergroup linkages such as ideology to influence military synergies.

Christia (2012) provides one of the most comprehensive accounts of how power relations shape which rebel organizations can sustain alliances. She assumes that rebel organizations form minimal winning coalitions to (1) win the war and (2) maximize political control after fighting has ended. The main challenge to cooperation is a commitment problem where some actors are concerned to be exploited by stronger coalition partners. The expectation of being weak in a current coalition provides incentives to switch to power-balanced coalitions. Christia (2012) also argues that these power dynamics trump identity as coalition driver. We follow this lead and build our theory of coalition behavior on the notion that rebel organizations combine forces to improve their battlefield success. We also incorporate the idea that coalition members are at risk of infighting after capturing the government and demonstrate that even small changes in expected infighting have important implications for which rebel organizations can form coalitions.

Gade et al. (2019a) challenge the view that cooperation among rebel organizations is purely driven by power dynamics and emphasize the importance of ideology (see also Seymour, Bakke, and Cunningham 2016). Ideological proximity should increase military cooperation, because it defines the conflict cleavages and provides a common vision of the post-conflict order. They also formulate different expectations about power dynamics. Fighting against a powerful government that threatens the survival of rebel or-

[1] A third line of work highlights the role of outside sponsors in coalition behavior (Popovic 2018).

ganizations fosters small and balanced coalitions with few coordination problems. Without a strong government threat, strong rebel organizations form coalitions with many small partners, trading higher coordination costs for increased control over coalition partners. Our approach can incorporate ideological proximity via its effect on military synergies, but we instead focus on the role of ethnic ties and geographic distance. Going beyond Gade et al. (2019a), our model can show how the distribution of linkages among actors affects the power-based coalition logic.

We develop a multi-actor formal model of coalition formation that provides a systematic and conflict theater-wide perspective on coalition formation. The starting assumption is that conflict actors' main objective is to win armed contests. Actors recombine forces to realize synergies, which can result from a number of factors, including ethnic ties and geographic location. This means that coalitions do not only pool military capabilities, but also unlock otherwise unrealized gains. In other words, synergies represent positive economies of scale to the use of force.

We draw on the literature on *conflict games* (or contest games; Dixit 1987; Hirshleifer 1988, 1995; Garfinkel and Skaperdas 2007), which have been used to investigate contests with multiple actors (Esteban and Ray 1999, 2008; Niou and Tan 2005). This framework assumes that actors are fighting over an incompatibility and investigates if effort is exerted efficiently.[2]

An important assumption when formalizing coalition behavior is the rule by which coalition members allocate the spoils from joint efforts. Civil war is beset by commitment problems, and coalition members may find it difficult to honor agreements on how spoils should be shared. Therefore, coalition partners are likely to turn on each other, resulting in continuing conflict (Tan and Wang 2010). The division of spoils then should reflect the relative power of coalition partners. This is an overly pessimistic scenario, as few civil wars feature continuing infighting until only one actor remains. As our analysis shows, a strict division of spoils according to relative power also corresponds to a situation where belonging to *any* coalition is better than fighting alone. Obviously, this does not match the empirical reality of coalition behavior. To gain analytic traction, we allow coalitions to entail some degree of commitment. We follow Ray (2007) and treat coalition membership as being built on mutual assent of all coalition members and a lack of infighting, even if just temporary, without negating the noncooperative nature of the conflict environment (Ray 2007). This narrows the range of feasible coalitions, and we find that powerful actors become more reluctant to join with weaker actors, resulting in more evenly balanced coalitions.

Military Synergies

A central feature of our conflict system theory is the focus on military synergies as driver of coalition behavior. Synergies and economies of scale are synonymous and refer to a situation in which a coalition's military capabilities are greater than the sum of capabilities of its constituent members.

Two major areas that affect the military success of rebel organizations in civil war are geography and collective action problems, respectively.[3] Geography has been studied from the perspective of military advantages that it provides. Collective action problems refer to the ability of rebel organizations to induce their members to expose themselves to the risk of personal harm to advance the organizational objectives. Gates (2002) casts potential members of a rebel group as situated in a latent space, consisting of ethnicity, ideology, and geographic location. Fighting effectiveness is a function of distance between the position of individual fighters and the rebel group, with larger distances resulting in greater collective action problems. We draw on this reasoning to conceptualize military synergies in rebel coalitions as a function of geographic space and ethnicity, leaving aside ideology.

Starting with geography, there is strong evidence that remote locations and mountainous terrain offer military advantages to rebel organizations (Buhaug, Cederman, and Rød 2008; Cunningham, Gleditsch, and Salehyan 2009). Thus, from the perspective of military cooperation between rebel organizations, geographic distance can produce synergies in the groups' fighting effectiveness. Opening up a second remote front divides the opponent's forces and capitalizes on loss of strength associated with operating in geographically apart conflict locations. This perspective might be challenged by insights from Gates (2002) suggesting a trade-off, as commitment problems also increase with distance. However, arguably tacit coalitions require much less internal coordination than individual rebel groups.[4] Whether forming a tacit coalition is subject to diminishing returns of geographic distance is therefore an empirical question. If diminishing returns exist, we should expect military synergies to relate to distance in an inverted U-shape. In the absence of diminishing returns, distance should have a monotonic and increasing effect on synergies.[5]

The second source of synergies is ethnicity. The literature identifies ethnicity as conducive for group coherence and ease of recruitment. For example, ethnicity and identity can be mobilized as political cleavages, especially if these cleavages are characterized by economic and political grievances (Wucherpfennig et al. 2012). Identity markers facilitate identification of potential supporters, foster similar policy preferences, increase ideological coherence (Strachan 2006), and shape social networks that allow for coordination and monitoring (Lyall 2010). Authors including Gade et al. (2019a) stress the coordination advantages of common identities and highlight their importance for military advantages *within* organizations as well as military synergies *across* organizations. For example, cooperation costs in terms of loss of autonomy and internal opposition

[2] The analytic focus on battlefield coalition behavior leaves some questions unexplored. We set aside multi-actor bargaining prior to conflict onset because once fighting starts, some bargaining challenges are resolved. For example, fighting reveals private information about actor resolve and capabilities. In addition, conflict games sidestep analytical challenges that arise in multiplayer bargaining, such as large equilibrium spaces and conflict equilibria with complete information, although we still encounter some of those problems. Ray (2007, section 4.4.3) provides a discussion based on a result by Herrero (1985). Our analysis still can help to inform research on conflict initiation, as actors might condition on anticipated coalition choices after bargaining breakdown.

[3] Tacit coalitions in civil wars not only share similarities but also differ from government coalitions during interstate wars. National governments have a greater ability to coordinate military actions (Morey 2016) and provide side payments to potential coalition partners (Wolford 2015), but they also face potential disagreements on a wider range of policy objectives (Wolford 2015). The ability of rebel organizations to realize synergies is tied to a narrower range of factors (we discuss geographic distance and ethnicity) and a narrower set of policy objectives (territorial or government) and commands fewer resources to affect side payments.

[4] This is reflected in the formal model, which requires no pregame communication and allows for single-player defections.

[5] Note though that Weisiger (2016) finds that more coordination-intensive coalitions between states in interstate war are more likely to disintegrate if one coalition member fights in a geographically remote area.

will decrease if groups share the same ethnic support base (Balcells, Chen, and Pischedda 2022).

However, there are strong arguments that shared ethnic ties across groups can undermine cohesion within coalitions, thereby lowering synergies. Competition dynamics can lead to fragmentation (Cunningham et al. 2012), impeding unified and successful coalitions (Krause 2017). Furthermore, organizations operating beyond ethnic linkages might be able unlock synergies not available to groups drawing on the same ethnic base. For example, coalitions without ethnic ties are able to expand their recruitment base and can do this across social classes in instances where ethnicity is associated with social status (Leventoğlu and Metternich 2018). Likewise, in communities with interdispersed ethnic settlement patterns, cross-ethnic coalitions might be better able tap into civilian support. On balance, we argue that ethnic ties reduce military synergies between armed groups. Our approach is able to shed light on this empirically in a multi-actor setting, while also simultaneously accounting for the role of power dynamics.

A Theory of Conflict Coalition Behavior

In this section, we present our theoretical model of coalition behavior. There are n actors i, including rebel organizations and the government. Each actor has military capability $m_i > 0$. If two actors i, j form a coalition g, their capabilities add up according to the *joint force function*: $(m_i + m_j)^{\alpha ij}$. Synergies arise if $\alpha_{ij} > 1$ (superadditivity).

In coalitions $n > 2$, there could be synergies that are subject to higher order effects (e.g., threeway interactions). We do not have any theoretical expectations about these effects, and therefore average across all binary synergies for pairs of actors in the coalition. A coalition g has an aggregated military capability of

$$\left(\sum_{i \in g} m_i\right)^{1/(|g|-1)\sum_{\{i,j\}\in g}\alpha_{i,j}} \quad \text{(joint force function of coalition } g\text{)}, \tag{1}$$

where $|g|$ is the number of actors in g.

An actor's utility is a function of its expected performance on the battlefield, which depends on the distribution of capabilities in the theater, including the aggregate capabilities of the actor's coalition, and the capabilities of opposing actors and coalitions. The arrangement of coalitions in the conflict theater is denoted as coalition profile $G = \{g_1, \ldots, g_k\}$, with individual coalitions in G denoted as g_r. The probability of battlefield success for any coalition g_r, denoted as P_{g_r}, is governed by the *conflict success function* (CSF), which translates aggregate military capabilities into winning probabilities according to

$$P_{g_r} = \frac{\left(\sum_{i \in g_r} m_i\right)^{1/(|g_r|-1)\sum_{\{i,j\}\in g_r}\alpha_{i,j}}}{\sum_{r \in G}\left(\sum_{i \in g_r} m_i\right)^{1/(|g_r|-1)\sum_{\{i,j\}\in g_r}\alpha_{i,j}}} \quad \text{(conflict success function)}. \tag{2}$$

Thus, the probability of coalition g_r winning is a function of its military capabilities relative to the total capabilities of all coalitions in theater G. Holding the prize over which actors fight constant at 1,[6] equation (2) also gives g_r's expected utility of fighting.[7]

For utilities of individual actors i, we need to consider how the spoils from victory are distributed among members of the winning coalition. We discussed above the two ideal typical scenarios, sharing according to relative power as a reflection of payoffs from future infighting (Tan and Wang 2010)[8] and equal sharing of spoils among all coalition members as an expression of the ability to commit to binding agreements. The following expected utility formulas show how the different rules divide the spoils from fighting as part of a specific coalition g_r:

Relative power:

$$U_i\ (g_r | i \in g_r) = \frac{m_i}{\sum_{j \in g_r} m_j} P_{g_r}, \tag{3}$$

Equal sharing:

$$U_i\ (g_r | i \in g_r) = \frac{1}{|g_r|} P_{g_r}. \tag{4}$$

Realistically, we expect sharing rules to fall somewhere in the middle, and likely fairly close to the relative power rule. Mixtures between the extremes are achieved by taking a convex combination of the boundary cases.[9]

Structure and Strategies

The model treats coalition formation as coordination game in normal form. A strategy for actor i is a choice of an *unrealized* coalition γ that contains i itself, that is, $\gamma \subseteq N$, $i \in \gamma$. A *realized* coalition is called g, and the set of all realized coalitions forms a coalition structure G, where G perfectly partitions N. A coalition g is realized only if all members contained in g ascend to its membership. In other words, all members of g must propose $\gamma = g$. Otherwise they default to fighting by themselves, that is, singleton coalitions. To illustrate this, the coalition $g_r = (A, B, D)$ only forms if A, B, and D each propose $\gamma = (A, B, D)$ but not if either A, B, or D propose any $\gamma \neq g_r$ (even if $\gamma \subset g_r$, the prosed coalition is a strict subset of g_r).

Analyzing coalition formation as a coordination problem sets aside the interactions that precede coalition formation,

[6] The CSF illustrates that in conflict games, superadditivity works differently than in cooperative game-theoretic treatments of coalition behavior (e.g., Bloch 1997). In the latter, superadditivity increases the utility of coalition members, which provides incentives to form grand coalitions. In our setup, superadditivity affects payoffs only through increasing the winning probability, while the prize is fixed. Hence, marginal contributions of adding coalition members decline once a coalition becomes too big, limiting which coalitions are feasible in equilibrium.

[7] Deviating from traditional conflict games, we treat effort as a parameter determined by military capabilities. This assumes that there is no free-riding by coalition partners. The simplification allows focus on coalition behavior and has two substantive justifications. First, synergies are only realized if effort is expended. Free-riding incentives arise when a coalition partner's actions are substitutes, which is not the case under synergies. Second, tacit coalitions are informal and happen under low information. Under these conditions, it is difficult to monitor effort and free-riding incentives are reduced (Sandler, Sterbenz and Posnett 1987).

[8] Here, we deviate from Tan and Wang (2010) by ignoring the possibility of coalition formation during infighting between winning coalition members. Analytically, their approach constitutes an equilibrium refinement, which we ignore because of analytic convenience. However, there is also a strong case for cognitive limitations of militant groups regarding future coalition behavior ("fog of war"), i.e., fundamental uncertainty about possible battlefield outcomes. Support for this limitation comes from accounts of how coalition partners shift the perceptions of their allies as joint victory comes into sight (Christia 2012).

[9] This takes the form $\beta U_i^{\text{Relative Power}} + (1-\beta)\, U_i^{\text{Equal Sharing}\,g}$, where $\beta \in [0,1]$.

such as informal communications, negotiations, and displays of threat. These interactions are typically difficult to observe and potentially very complex. Instead, the analysis characterizes which sets of coalitions are feasible on the basis of military capabilities and synergies, without generating point predictions which particular coalition will be realized and when. As important conceptual implication, the coordination game approach captures the self-enforcing nature of cooperation in a conflict environment. We rely on Nash equilibrium as solution concept, where larger groups of actors only cohere as a whole when no single group has an incentive to go it alone. Hence, coalition behavior is not "baked into" the modeling assumptions.[10] This setup also allows for the incorporation of cooperative elements, such as the notion of enforceability of contracts between coalition members. This is similar to how Ray (2007) conceptualizes mutual assent of all coalition members as prerequisite to exploring the consequences of a cooperative setup (transferable utility) in a noncooperative bargaining environment.

Analyzing Coalition Behavior with Synergies

Key to our theory are capabilities and synergies that help unlock military advantages. To analyze their effects, we use the formal model to simulate coalition choices while varying these parameters.[11] We examine the four players' case.[12]

For the power distribution, the resulting grid features 849 different profiles. It is created by incrementing the capabilities of all actors in 5 percent steps, and collecting all combinations that respect the constraint that total power must sum to 100 percent. The synergy parameter α varies between 1.01 and 1.20, in 0.01 steps (we begin with homogeneous synergies across all groups). The choice of range of α follows pragmatic considerations. At the upper end, with $\alpha = 1.2$, synergies increase the military capability of an unopposed coalition that captures 50 percent of raw capabilities to about 67 percent.[13] This 17 percentage point gain represents a 28 percent increase in fighting power. While ultimately arbitrary, larger synergy effects appear unrealistic.

An additional choice involves the sharing rule. Using the pure relative power rule (equation 3), *any* coalition becomes feasible as a Nash equilibrium. This is because it is always better to combine forces, reap aggregate gains from synergies, and then share according to relative power than going alone without the gains from forming a coalition. In the real world, obviously not every possible coalition is equally likely to form. However, as we describe in detail in the online appendix, even small deviations from the relative power rule reduce the equilibrium space. For generating predictions, we go to the other extreme and assume equal sharing. This assumption is empirically highly unrealistic, but it cuts down the equilibrium space the most and therefore generates the sharpest predictions. In reality, sharing rules within tacit coalitions will be much less redistributive, even if they involve a small element of redistribution. Thus, coalition patterns should still follow the logic of our theory, but will be less pronounced. This in turn will attenuate our ability to detect them empirically. Thus, our theoretical approach generates predictions that are subject to difficult empirical tests. It is worth pointing out that we do not seek to empirically identify the sharing rule itself.

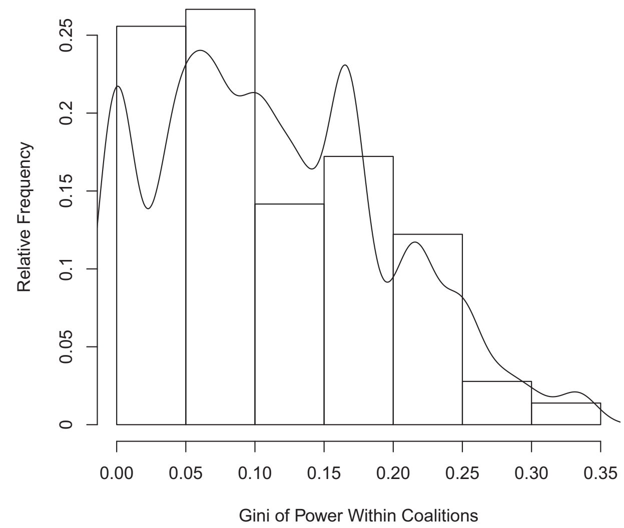


Figure 1. Within coalition power balance. Based on Gini coefficient of power shares within equilibrium coalitions.

Symmetric Synergies

We start summarizing the simulation results by focusing on the distribution of power, assuming symmetric synergies for all actors.[14] Figure 1 shows how common different power distributions are in feasible coalitions. For each coalition that can form in equilibrium, we calculate the Gini coefficient of the power distribution of its members. The Gini coefficient ranges between 0 and 1, with higher values indicating greater inequality. The results show that highly unequal coalitions (Gini coefficients > 0.25) are much less common than balanced coalitions. Drilling deeper, we evaluate coalition behavior of individual armed groups with details in the online appendix. We find that actors of equal power are more likely to form coalitions, because they do not face distributional conflicts over spoils of victory. This arises because for sufficiently large actors joining forces, realizing synergies does not compensate for sharing even a small part of the spoils. The tendency of individual groups to seek coalition partners of similar size explains the scarcity of relatively unbalanced coalitions at the aggregate level shown in figure 1. We therefore arrive at the following prediction:

H1: *Coalitions are less likely to form as power asymmetries among coalition members increase.*

We note that this prediction is not in line with findings from the interstate alliance literature, especially the claim

[10] Refinements such as strong Nash equilibrium or coalition-proof Nash allow for multilateral deviations, but rely on differing degrees of cooperative behavior (communication) prior to play. In addition, although we do not consider them in the analysis, the Nash approach is also particularly justified if there are third-order network effects that give rise to nonlinearities in which military synergies are aggregated across coalition members. For example, a coalition between two actors might only be beneficial in the presence of a third actor, but not in its absence.

[11] We use a simulation approach to overcome the lack of closed form solutions to the comparative statics, which arises from the non-linear nature of the utilities.

[12] Despite its simple setup, the coalition formation game presents considerable computational hurdles. Its strategy space is of size $2^{n(n-1)}$ and therefore grows exponentially in the number of players. With $n = 5$ there would be already 1,048,576 strategy combinations, hence the focus on the four-actor case. This is also substantively justified, as the average number of conflict actors in our data, including the government, is 3.1. We expect our results to hold for $n > 4$, as the logic tying actor size (H1 and H2) and heterogeneity of synergies (H3) to coalition behavior should not be affected by absolute number of actors. Gambit software is used to retrieve pure strategy equilibria (McKelvey, McLennan, and Turocy 2013).

[13] Unopposed in the sense that no other coalition forms.

[14] That is, all actors enjoy the same gains from joining forces, with $\alpha_{i,j}$ being the same for all pairs *i, j*.

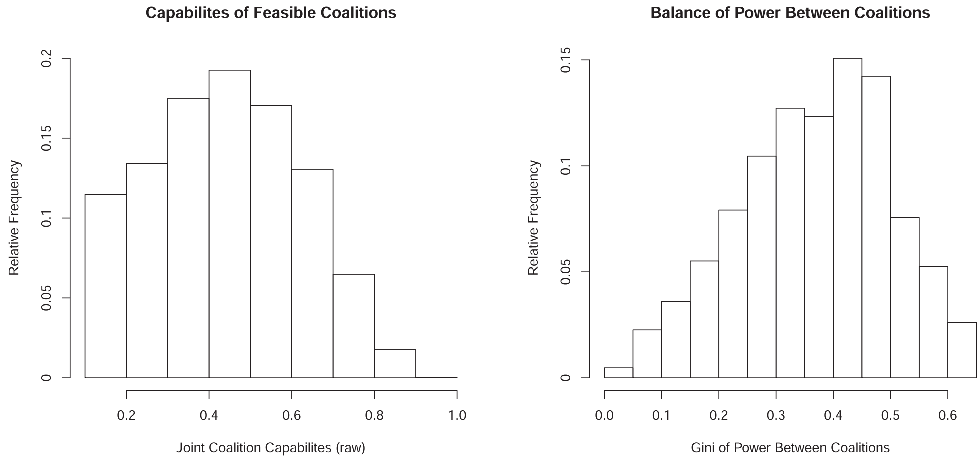


Figure 2. Coalition capabilities and balance of power between coalitions. Left panel is based on sum of power shares of all equilibrium coalitions (excluding singletons). Right panel is based on Gini of power shares of coalitions in an equilibrium coalition profile.

that alliances are more likely to form among states with asymmetric capabilities (Morrow 1991). However, in Morrow's theory, political side payments (especially increased autonomy) play a prominent role. In civil wars such side payments seem unrealistic, as actors seek to ensure their immediate survival through battlefield success.[15]

What about the absolute size of coalitions? Riker's size principle (Riker 1962) suggests that there are trade-offs between maximizing the chances of winning (which would be one in the boundary case, the grand coalition) and having to share the spoils of victory. Our theory generates similar predictions, but for subtly different reasons, which stem from the contest environment of civil war.

The left panel of figure 2 shows how the joint capabilities of all feasible coalitions are distributed.[16] The average lies at 46 percent of system-wide capabilities (34 percent when not counting singletons), and coalitions that combine more than 50 percent of capabilities become increasingly rare. However, such supersized coalitions still account for about 38 percent of what is feasible in equilibrium (19 percent without singletons), more than would be expected under strict operation of Riker's size principle. Still, empirically we would expect supersized coalitions to be rare. We also observe that weaker coalitions also occur with less frequency. This results from the pressures that turn groups of equal power into more likely coalition partners, as discussed in H1.

The standard account for why supersizing of coalitions is rare revolves around the idea of balancing. For example, Fordham and Poast (2016) find that alliances between state actors are most likely to form when they combine around 30 percent of system-wide capabilities. They argue that

> [a]n alliance of this size would have …the capabilities to compete with any state in the system. (Fordham and Poast 2016, 857)

This makes sense in the context of interstate alliance politics, where the security concerns of individual states translate into a need to balance the power relations in the international system as a whole.

In contrast, our theory suggests that during civil war, supersizing is rare because of the limited appetite of large actors to join forces with smaller ones. The right panel in figure 2 illustrates that theater-wide balancing is relatively rare. It is based on entire coalition profiles and shows that coalitions frequently face much weaker or stronger adversaries. In other words, it pays to join forces even if doing so does not bring the chances of winning close to 50 percent. To illustrate, the median Gini coefficient is 0.38, which corresponds to division of power of 12.5–87.5 percent (if there are only two parties).

As empirical prediction, we take away from this discussion that both small and large coalitions should be relatively rare, but we do not expect that there is a well-defined cutoff beyond which coalitions do not form.

H2: *Coalitions are most likely to form for a middle range of joint capabilities and less likely to form for low or high joint capabilities.*

Asymmetric Synergies

We now look into the role of military synergies in more detail. The analysis so far assumed that all military groups can realize identical synergies, regardless of coalition partner. Turning attention to the identity of actors, we now allow specific pairs of military groups to generate greater synergies than other pairs. Technically, this involves assigning heterogeneous values of the synergy parameter α across actor pairs.

We evaluate equilibrium coalition behavior for four different scenarios. With $n = 4$ players, there exist six pairs of players, each pair with its own α. As a baseline scenario, all six values of α are set to 1.1 (the homogeneous case). We then give player 1 higher synergies with a varying number of other players, ranging from one other player to all three of them. For each such high synergy link, α is set to 1.2.

Figure 3 does not look at aggregate coalition behavior, but focuses on a specific armed group, called player 1. It illustrates how likely player 1 is to enter into coalition with other actors. The graph shows which share of all equilibrium coalitions contain player 1, as a function of player 1's power and its possession of high synergy links to other players. Endowing player 1 with more high synergy links has a clear effect, as the player gets included into a greater share of coalitions. The advantage of high synergy links is substantively large, and the most so when player 1 has low power. With 10 percent of power resources, moving from no to

[15] However, alliances *during* interstate war, as opposed to peacetime, are more likely to exhibit the characteristics described by our theory, as battlefield success becomes the primary concern and the sharing of the spoils of victory moves into focus. We thank an anonymous reviewer for pointing this out.

[16] This is the "raw" sum in the sense of not accounting for synergies. Singletons are excluded.

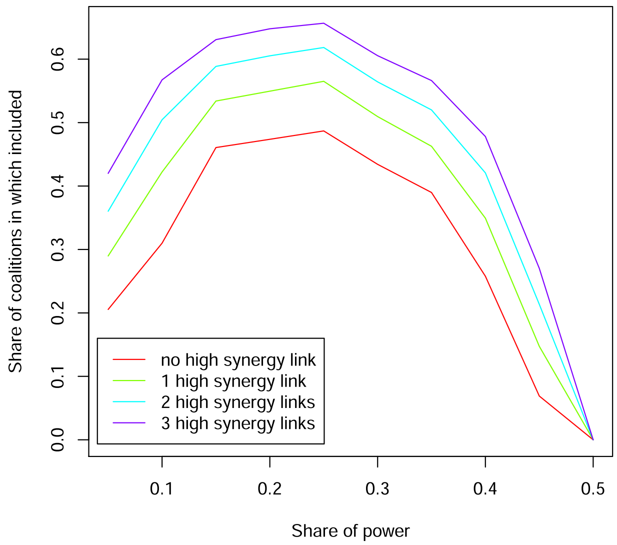


Figure 3. Illustration of how heterogeneous synergies affect whether an actor forms part of a coalition. It shows the share of all feasible coalitions that include player 1, as a function of player 1's relative power. The number of high synergy links (α =1.2) and low synergy links (α =1.1) to other actors varies.

one high synergy link increases the share of feasible coalitions in which player 1 is included by 10 percentage points, from 31 to 41 percent. While less in absolute terms, relative gains are even greater when it is the least powerful, holding only 5 percent of capabilities. In this scenario, the participation share increases by 8.5 percentage points from 20.5 to 29 percent, constituting a 41 percent gain. Going in the different direction, as player 1 amasses more power, the benefits from high synergy linkages decrease. They remain noticeable though until player 1 reaches 50 percent of power resources. After this point, joining coalitions does not lead to additional utility gains and synergies stop to matter. Adding a second or third high synergy link produces additional participation gains, but the effect is decreasing in size. Overall, the simulation produces a clear expectation that in a conflict system with heterogeneous synergies, those actor pairs that have the highest synergies and who therefore can realize the most military advantages are most likely to be part of the same coalition. This generates a system-level prediction about coalition behavior:

H3: *With increasing differences in synergies, actor pairs with higher synergies are more likely to form a coalition.*

Empirics

The empirical section investigates conditions under which tacit coalitions are realized in the context of civil war and their internal makeup. We test our propositions on the coalition level using a k-adic approach (Poast 2010). The analysis explores the role of relative strength and heterogeneity in synergies for determining which rebel groups form tacit coalitions.

Outcome Variable: Tacit Coalitions

While we frequently observe coalition behavior among rebel organizations, formal coalitions are rare. For example, the Uppsala Conflict Data Project (UCDP) only identifies four coalitions in Africa between 1989 and 2014 that are based on a codified and public commitment to work together. Similarly, Akcinaroglu (2012) finds that formal rebel coalitions are relatively rare. Hence, to measure coalitions, we take a behavioral approach (Metternich et al. 2013). We use the UCDP-Georeferenced Event Data version 18.1 (UCDP-GED; Sundberg and Melander 2013), which covers violent events during civil conflicts in Africa (1989–2017). For each violent event, UCDP-GED identifies actors A and B that are involved in fighting activities. We begin by identifying all actors that were involved in state-based conflict, that is, the government and all rebel organizations fighting a government. We then extract all events that involve the identified actors and measure which actors fought the same actor in a month.

Table 1. Example for unit of observation

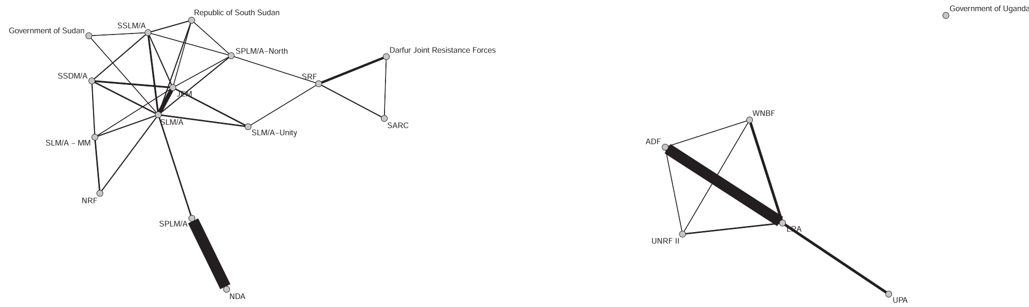
Year	*Country*	*Coalition ID*	*Count*
1996	112	112-467	0
1996	112	466-467	2
1996	112	112-466	0
1996	112	112-466-467	0

Notes: In Sudan in 1996 there were three actors, coded as 112 = Government of Sudan, 466 = SPLM/A, and 467 = NDA, resulting in four potential coalitions. The only realized coalition involved the SPLM/A and NDA that fought together for 2 months.

To illustrate our coding, imagine three rebel organizations (A, B, C) that are active against the government (G). They can form the following potential coalitions: A, B, C, AB, AC, BC, ABC. If A and C fight the government in month t and B does not fight the government, tacit coalition AC is realized. We then aggregate the monthly realizations to the yearly level. Thus, our dependent variable is a count ranging from zero to twelve, indicating the number of months in which a tacit coalition has been realized. We identify realized coalitions through the concept of subgraphs, allowing for multiple coalitions to be realized in a particular month. If A and C fight the government in month t and B would join the government G to fight against C, tacit coalitions AC and BG are realized. As an example, table 1 shows all possible and all realized coalitions for Sudan in 1996. The relevant actors are the Sudanese government, the National Democratic Alliance (NDA), and the Sudan People's Liberation Movement/Army (SPLM/A). Of these, only the SPLM/A and the NDA join forces during two months of the year.

Visualizing the dependent variable, we aggregate the number of months that two actors form a tacit coalition over the total observation period. While in the analysis the dependent variable varies over time, the aggregate visualization helps establish face validity of our measure. Figure 4 shows the aggregate number of tacit coalition months for Sudan in the left panel and Uganda on the right. In Sudan, the rebel organizations that have fought the government most often in the same month are the NDA and the SPLM/A. In Uganda, this applies to the Allied Democratic Forces and the Lord's Resistance Army (LRA). In both countries, there is evidence that these tacit coalitions were underpinned by alliance-like relationships.[17]

[17] There is widespread agreement that the NDA and the SPLM/A acted as allies in Sudan's civil war (Young 2005). The ADF and the LRA were both supported by Sudan (Prunier 2004), and there are several reports of cooperation between the two rebel organizations. *Sources*: *Sahara Reporters*, "Is the War on Terror Shifting to Africa?," October 26, 2011, accessed on March 28, 2017, at http://saharareporters.com/2011/10/26/war-terror-shifting-africa; *Uganda Radio Network*, "LRA and ADF Rebels Form an Alliance," March 26, 2011, accessed on March 28, 2017, at http://ugandaradionetwork.com/story/lra-and-adf-rebels-form-an-alliance.



(a) Sudan (b) Uganda

Figure 4. Tacit coalitions: having fought the same actor in a particular month. Number of months of commonly fighting an other actors aggregated for 1989–2017. Edge thickness represents realized coalition months.

While our behavioral approach to the measurement of coalitions has the advantage of picking up nonformal coalition behavior across a large number of cases, there are also some limitations. First, some tacit coalitions could be "accidental" coalitions as actors might just happen to fight the government in the same month. However, it seems unlikely that repeated patterns of fighting the same actor in the same month arise purely by chance.[18] We therefore take such patterns as indicative of a willingness to jointly bring down the opposing force. Second, the GED data do not identify the directionality of attacks. Thus, an attack of the government against two rebel organizations in the same month would make them a tacit coalition in that month. While we agree that this is potentially problematic for validity purposes in a particular month, we argue that over time even common attacks by the same actor demonstrate that two or more actors are willing to jointly withstand another actor and not separately enter an agreement with this actor.

Estimation

Our theoretical framework highlights that tacit coalition behavior is driven by actor *and* coalition characteristics. Accounting for this, we implement a k-adic research design (Poast 2010), which allows us to include characteristics of potential coalitions. This approach has advantages as it allows us to more directly test hypotheses about the characteristics of coalitions and particularly about the joint gains a coalition can realize, whereas other network estimators put more emphasis on the formation of dyadic ties, the structural characteristics of actor configurations, and the diffusion of, for example, information given network characteristics. Furthermore, we are dealing with small coalitions that are not connected beyond country boundaries leading to sparsity, which the k-adic approach allows us to effectively address (compared to, e.g., exponential random graph models [ERGMs]). As our dependent variable is a time-varying count variable, we estimate negative binomial models and capture time dependency with lagged dependent variables and unobserved country-specific factors with random effects.

Overall, our analysis includes 482 realized coalition observations pertaining to 328 potential tacit coalitions. We only include potential coalitions if there are at least three actors (including the government) active in a given country. Online appendix table A1 presents both the distribution of our dependent variable and how often unique tacit coalitions are realized in our data.

Explanatory Variables

Our theory suggests that tacit coalition behavior is a function of power relationships, overall coalition strength, and synergies. We expect that potential coalitions with equal distributions of power are more likely to be realized. Temporal change in this distribution should affect the formation and fragility of tacit coalitions, resulting in the empirical challenge of measuring the military power of rebel organizations over time. While there exist attempts to measure the military power of rebel organizations (e.g., Cunningham, Gleditsch, and Salehyan 2009), these projects do not focus on variation over time. Therefore, we suggest a measure that draws on geographic data to infer rebel characteristics and conflict dynamics (Beardsley, Gleditsch, and Lo 2015; Greig 2015).

To capture the military strength of rebel organizations, we calculate the geographic area of activity. First, we extract, for each rebel organization in a particular year, all locations that are recorded in UCDP-GED. This produces a yearly list of coordinates for each rebel organization, which we use to compute a convex hull (Eddy 1977). The resulting polygons are projected on the earth's surface, providing us with the actual geographic area of the convex hulls. Figure 5 shows plots for the active areas of two Sudanese rebel organizations according to our measure, SPLM/A (left panel) and NDA (right panel), over time. We normalize the geographic area of each actor, by the sum of all actor areas in a country. Hence, the geographic area of an actor can vary between zero and one.

We use our geographic measure of actor strength to calculate the power distribution within each potential tacit coalition, based on the Gini coefficient of power shares. The Gini coefficient is zero when all members of a potential coalition are active in similarly sized areas and one at the most unequal distribution of power.

We argue that the realization of a tacit coalition is dependent on not only the distribution of power within the coalition, but also the joint power of a coalition compared to other actors and coalitions. Hence, we sum the active areas of all actors in a potential coalition. This measure allows us to capture the overall coalition strength and identify tacit coalitions that have a greater chance of succeeding in a conflict. In line with H2, we expect that coalitions are less likely to form at very low or high joint capabilities.

[18] This statement is supported by the empirical analysis in section "Different operationalizations of outcome variable," in which the dependent variable accounts for more temporally sustained coalition behavior.

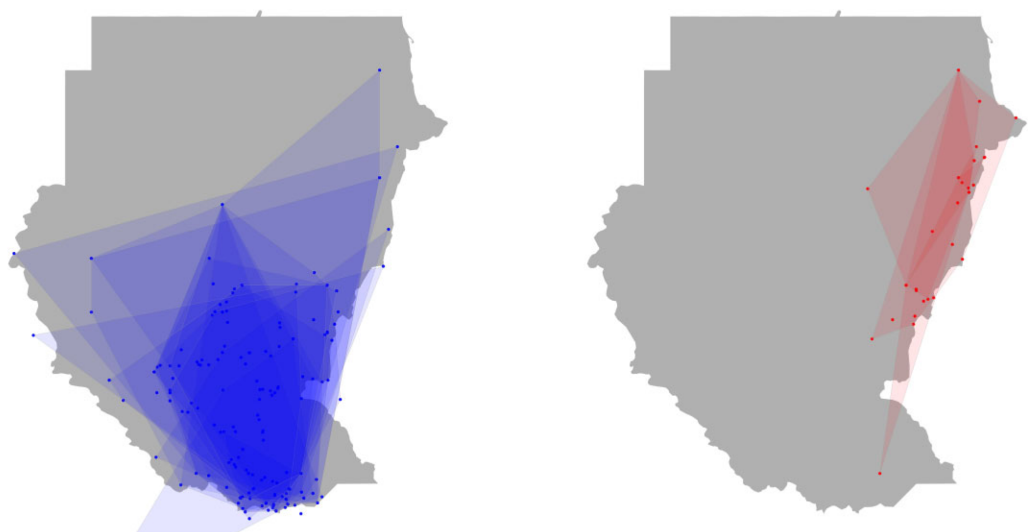

(a) SPLM/A (b) NDA

Figure 5. Visualization of the rebel strength measure: Overlay of yearly active areas of the SPLM/A (left) and NDA (right) in Sudan. Points represent UCDP-GED events, which provide the edges of the convex hull calculations.

Our theoretical model builds on the insight that coalition power is a function of synergies. We highlight two important sources of synergies: first, geographic distance that can allow coalition members to engage the opposition from different sides and second, different ethnic bases that impact the ability to recruit and gain support from a greater share of the population.

We argue that geographic distance between rebel organizations is an important determinant of synergies, because rebel organizations that fight in different locations can engage the government on different fronts, forcing it to spread out its forces. In the context of international wars, it is widely accepted that states engaged on multiple fronts face a far greater challenge to succeed, and we transfer this notion to intra-state conflicts. However, there may be not only benefits from fighting the opposition from different fronts. In interstate conflict, coordination may suffer if coalition partners fight in geographically remote areas (Weisiger 2016), and individual rebel organizations suffer from internal coordination problems if they are spread out too thinly (Gates 2002). In contrast to this, tacit coalitions should depend much less on coordination. In addition, conflict areas are comparatively small compared to international wars. Whether the ability to engage the opposition at different locations outweighs the coordination costs is ultimately an empirical question. In line with this reasoning, we measure the average distance of the rebels' mean fighting locations within potential coalitions. We first calculate the mean fighting location for each rebel organization taking the mean longitude and latitude of all their fighting locations, resulting in a matrix W. We then calculate average distances between mean fighting locations for each w_{ij} and also include the square of this term into the analysis.

As a second source of synergies, we consider ethnicity and focus particularly on the role of identity for recruitment and support. Identity is important for recruitment in civil wars, because it allows organized groups to leverage existing cleavages for mobilization (Sambanis, Schulhofer-Wohl, and Shayo 2012). This mobilization is thought to be particularly successful if ethnic identities intersect with existing grievances (Wucherpfennig et al. 2012). In addition, ethnic identities also allow the identification of potential supporters, which facilitates recruitment of fighters (Denny and Walter 2014). We argue that synergies between rebel organizations are greater if they are able to recruit from different ethnic groups and gain their support. Hence, similar to geographic distance, ethnic linkages may provide operational military advantages through pooling of resources (compare Akcinaroglu 2012). This implies that coalitions that recruit or have support from different ethnic groups are more likely to realize synergies and should therefore be more likely to form tacit coalitions (see related argument for informal coalitions; Balcells, Chen, and Pischedda 2022). This argument is different from Gade et al.'s (2019a) who stress coordination advantages of common identities and also Christia's (2012) who largely discounts the role of identity in coalition formation.

We leverage information from the Actor Conflict Data to Ethnic Power Relations dataset (ACD2EPR Version 2014) (Wucherpfennig et al. 2012; Vogt et al. 2015) to identify which rebel organizations recruited or fought on behalf of the same ethnic groups. We aggregate this information to the coalition level and calculate the relative density of ethnic linkages in a coalition compared to the country-level density, which is the potential grand coalition. This measure is formulated as

$$\frac{l_g}{|g|^2 - |g|} / \frac{l_n}{n^2 - n} \tag{5}$$

where $|g|$ is the number of actors in a potential coalition and n includes all actors in a country. The number of linkages in the potential coalition (l_g) and on the country level l_n is then divided by the number of possible linkages ($|g|^2 - |g|$ and $|n|^2 - |n|$, respectively).

Control Variables

We also include a number of control variables whose exclusion could potentially lead to omitted variable bias. First, we include the coalition size as the number of coalition members could impact the probability of being realized and be

Table 2. Estimates for the k-adic negative binomial models

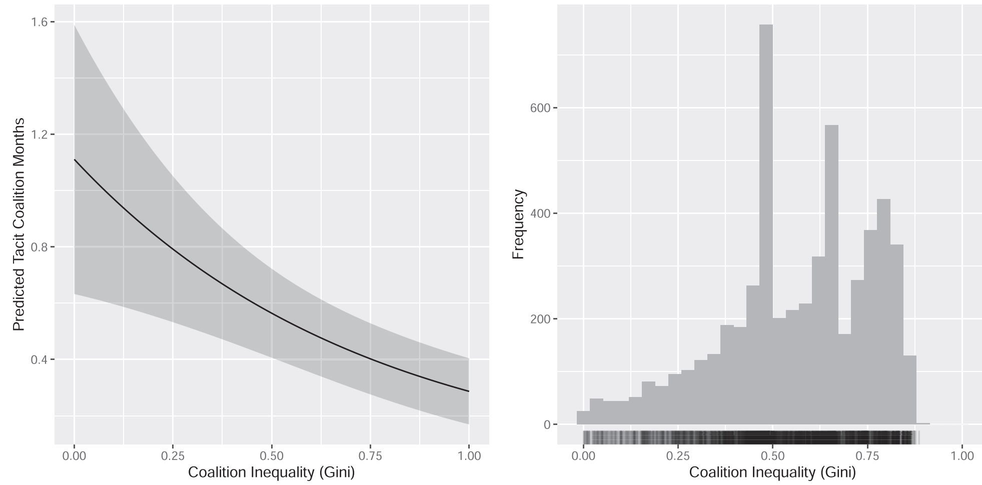
	Base model	*DV-lag model*	*Main model*	*RE*	*SQ model*
Intercept	3.92^{***}	3.19^{***}	2.82^{***}	2.82^{***}	2.79^{***}
	(0.23)	(0.23)	(0.25)	(0.27)	(0.25)
Coalition Gini	-1.47^{***}	-1.40^{***}	-1.35^{***}	-1.57^{***}	-1.42^{***}
	(0.33)	(0.32)	(0.32)	(0.34)	(0.32)
Proportion of area active	−0.11	−0.04	1.93^{***}	2.19^{***}	2.12^{***}
	(0.20)	(0.19)	(0.58)	(0.65)	(0.60)
Average distance in coalition	0.34^{***}	0.29^{**}	0.40^{***}	0.46^{***}	0.69^{**}
	(0.10)	(0.10)	(0.10)	(0.11)	(0.25)
Ethnic linkage	-0.14^{***}	-0.13^{***}	-0.12^{**}	-0.11^{**}	-0.11^{**}
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Coalition size	0.29^{***}	0.30^{***}	0.30^{***}	0.33^{***}	0.28^{***}
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Infighting	0.05^{***}	0.04^{***}	0.05^{***}	0.04^{***}	0.05^{***}
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Government coalition	-3.84^{***}	-3.47^{***}	-3.35^{***}	-3.33^{***}	-3.35^{***}
	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
Possible coalitions	-0.87^{***}	-0.78^{***}	-0.77^{***}	-0.78^{***}	-0.77^{***}
	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)
Dependent lag		0.24^{***}	0.23^{***}	0.24^{***}	0.23^{***}
		(0.03)	(0.03)	(0.03)	(0.03)
Squared proportion of area active			-2.05^{***}	-2.38^{***}	-2.19^{***}
			(0.58)	(0.63)	(0.60)
Squared average distance in coalition					−0.08
					(0.07)
AIC	3654.25	3592.27	3581.98	3575.32	3582.41
BIC	3720.29	3664.92	3661.23	3661.17	3668.27
Log likelihood	−1817.12	−1785.14	−1778.99	−1774.66	−1778.21
Number of observations	5,454	5,454	5,454	5,454	5,454
Number of countries				39	

Notes: Unit of analysis is a potential coalition-year. Outcome variables are the months a potential coalition is realized as a tacit coalition in a given year. Models include country-years with at least three actors (including the government).
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$.

more unequal in size at the same time. Second, we control for infighting between potential coalition members (number of fighting events in coalition) as fighting among rebels is likely to affect coalition realization and could be driven by power relations among actors (Bakke, Cunningham, and Seymour 2012; Fjelde and Nilsson 2012; Pischedda 2018; Gade et al. 2019b). Third, we code whether a potential coalition includes the government as this is likely to decrease the probability of coalition formation and correlate with power distribution with the potential coalition. Forth, we include a lagged measure of our main outcome variable to account for autocorrelation over time. Finally, we control for the number of potential coalitions as this is likely to affect the baseline probability that a specific coalition can be realized.

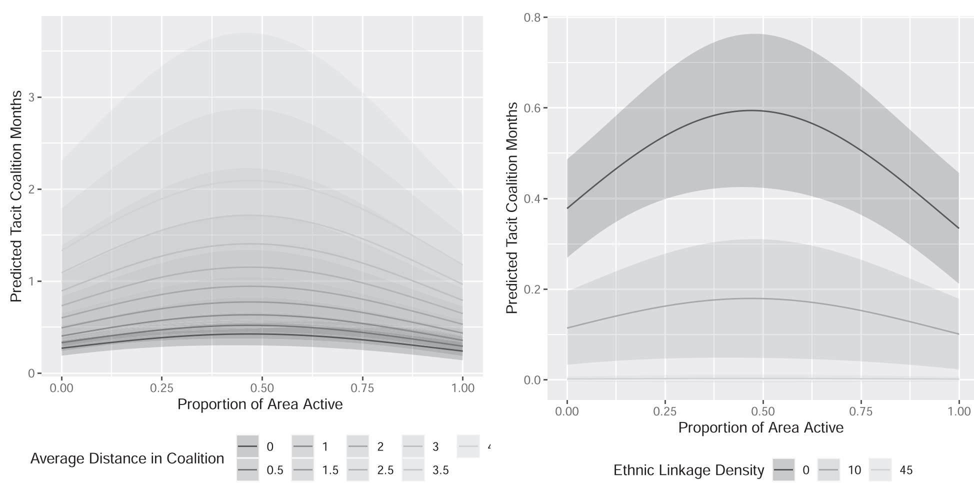
K-Adic Negative Binomial Results

Table 2 summarizes results from the k-adic negative binomial analysis. The k-adic approach is especially useful to shed light on the internal composition of coalitions. H1 states that realized tacit coalitions likely consist of partners of similar strength, H2 proposes that potential coalitions with very low and high joint capabilities are unlikely to form, and H3 predicts that rebel organizations with greater synergies are more likely to form coalitions. We first provide a baseline model that does not account for any temporal dynamics (base model) and the second model (DV-lag model) includes a lagged dependent variable. The third model (main model) includes the squared term of the potential coalitions' proportion of area active, while the fourth model (RE model) includes country random effects. We also estimate a separate version of the main model that features the squared average fighting distance in potential coalitions, assessing potential nonlinear effects of this variable. We begin the discussion of our results by focusing on the effect of the internal balance of power on the realization of tacit coalitions (H1). Across all models in table 2, the estimated effect of the coalition Gini coefficient is negative and significant at conventional levels, implying that unbalanced coalitions are less likely to be realized. The most conservative estimates for the coalition Gini coefficient are derived from the third model in table 2. We will refer to this as our main model in the discussion. Estimating the same model specification with random effects on the country level provides similar estimates. In order to obtain a substantive interpretation of the estimated effects, we plot the predicted number of tacit coalition months per year at different levels of the coalition Gini coefficient (figure 6) holding all other variables at their mean values. The predictions are based on our main model for a rebel organization coalition (no government actor included) that has been realized for two months in the past year. Based on the model estimates, we demonstrate, for example, that moving from a relative unbalanced (Gini = 0.5) to a very balanced coalition (Gini = 0) increases the number of months per year in a tacit coalition by about 0.5 months on average. Thus, the left panel in figure 6 provides support to H1 that potential coalitions with decreasing power balances are less likely to be realized. The right panel shows the empirical distribution of the Gini coalition coefficient in the data. Since our results are robust



(a) Effect (b) Distribution

Figure 6. Left panel: effect of the coalition Gini (coalition power distribution) on tacit coalition behavior with 95% confidence band. Right panel: histogram of the empirical coalition Gini distribution.



(a) Distance (b) Ethnic

Figure 7. Effect of the geographic area a potential coalition is active in on the probability of coalition realization. Left panel plots the effect at different average distances in the coalition. Right panel plots the effect at different levels of ethnic linkage density. Effects on tacit coalition realization with 95% confidence band.

to a DV-lag and random effects specification on the potential coalition level, we conclude that we have strong support for H1.

H2 implies that potential coalitions are less likely to be realized at low joint and very high joint capabilities. We measure joint capability as the sum of individual capacity within the coalition over the sum of all individual capacity. Individual capacity is measured by the convex hull around all events of an actor within a year. The main model and the random effect model in table 2 test the direct implication of H2. The estimated effect is as expected nonlinear with an inverse U-shaped pattern. Hence, the main model in table 2 demonstrates that greater joint active areas initially increase the probability of coalition realization, but that larger values are associated with a decrease in realization probability. This pattern is in line with the left panel of figure 2, which informed H2. Interestingly, as discussed further below, the estimated effect for the main model plotted in the left panel of figure 7 also almost exactly replicates the additional simulations in theoretical figure 3.

Next, we test the empirical implication of H3 that coalitions with higher synergies are more likely to realize. We conceptualize synergies through the ability to form a heterogeneous ethnic recruitment base (low ethnic linkage density in coalition) and the ability to engage the opposition from different geographic locations (higher geographic distance in coalition). In regard to ethnic synergies, table 2 provides support for our argument that rebel organizations that recruit from different ethnic groups are more likely to generate synergies and therefore are more likely to form tacit coalitions. The estimated negative effect implies that coalitions with similar ethnic recruitment patterns are less likely being realized. In figure 7, the effect of a coalition's active area (H2) is plotted conditional on ethnic linkage density. As ethnic linkage density increases, the realization probability of a potential coalition decreases (H3).

Our second measure of synergies is the average fighting distance between rebel groups. We argued that actors that are able to attack the enemy from different geographic positions should enjoy greater synergies and therefore be more likely to form tacit coalitions. The results in table 2 provide empirical support that a larger average fighting distance increases the instances of tacit coalition behavior. In the left panel of figure 7, we replicate the theoretically derived figure 3 based on our main model.[19] As the geographic distance within a potential coalition increases, the greater is its realization probability. In figure 7, the effect of a coalition's active area (H2) is plotted conditional on different average distances in a coalition (in kilometer). The greater the average distance in a potential coalition, the more likely a coalition will be realized (H3). To test whether there are diminishing returns to distance within a coalition because of coordination issues, we include a square term of the distance variable (*Sq Model* in table 2). Although the coefficient is negatively signed, it is estimated with a great amount of uncertainty, providing no evidence of diminishing returns to distance.

Turning to the control variables, we find that coalition size (cardinality) is positively associated with the realization of rebel coalitions. Coalitions with fewer members are less likely to form than larger tacit coalitions. Second, we find evidence that tacit coalition members display some infighting, but these effects are relatively small. Third, potential coalitions that include the government are less likely to form. This is not surprising as the majority of rebel organizations have the goal to confront the government, even though instances of side switching are possible (Otto 2018). Finally, the results demonstrate that coalitions that have been realized in the past year are likely to be realized again, and that environments with a larger number of possible coalitions decrease the probability of any one coalition being realized. This latter effect is driven by the logic of k-adic research design. The year-on-year persistence of tacit coalitions provides assurance that our coalition measure is picking up a structurally important phenomenon.[20]

K-Adic Zero-Inflated Negative Binomial Results

The empirical results could be affected by coalitions that are "immune" to formation. This means coalitions that are not realized could stem from two different data-generating processes (see, e.g., Zorn 1998): (1) coalitions with nonzero formation probability but not realized in the observation period and (2) coalitions with features that render them impossible to form. Through an additional logit link function, zero-inflated negative binomial models account for factors contributing to being "immune." While our theoretical analysis does not make predictions about "immune" coalitions, there is a reason to believe that coalitions including the government are less likely to form and might even make coalition formation impossible. There might also be temporal dependencies (e.g., previously unrealized coalitions) that indicate otherwise unobserved features related to "immune" coalitions. In addition, there could be state characteristics (e.g., regime type, type of conflict, state repression) that make formation less likely for specific coalitions. Given these considerations, we specify the zero-inflation equation by including an indicator for whether a coalition includes the government and how often a coalition was realized in the previous year, and we include country fixed effects to account for time-invariant state and government characteristics.[21] Table A2 provides the estimates from the zero-inflated negative binomial models. The first model includes the coalition features (government coalition and temporal dependency) while the second model adds the country dummies into the zero-inflated equation. Our findings remain substantively unchanged. The coalition Gini coefficient is slightly reduced in size, but remains statistically significant, while the estimates for ethnic linkage and average distance in coalition remain unchanged.

Different Operationalizations of Outcome Variable

Our theoretical analysis sheds light on which coalitions should be more or less likely to form, but makes no explicit predictions about the durability of realized coalitions. From an empirical perspective, confidence in our ability to capture tacit coalition behavior might be greater if joint fighting is observed in consecutive months. Hence, we change the outcome variable by requiring that organizations need to jointly fight the same opposition in two or more consecutive months (not just a single month) and only count those instances as contributing to the number of realized tacit coalition events per year. We estimate two additional sets of models with the outcome variables reflecting two consecutive months (e.g., Jan–Feb, Aug–Sep) or three consecutive months (e.g., Oct–Nov–Dec) of fighting. Both alternative operationalizations decrease the number of realized coalitions considerably (e.g., 167 realized coalition observations in the two-consecutive month operationalization compared to 482 in the main operationalization).

Tables A3 and A4 provide estimates for the consecutive month models. Comparing the estimates to the main and random effects model in table 2, the coefficient magnitudes for the coalition Gini coefficient slightly increase across the consecutive month models. The estimated effect for the proportion of area active decreases in size (estimates still describe a curvilinear relationship) and except for the random effect model specifications are not significant at standard levels of significance. The average distance in coalition effect size remains almost unchanged across the two alternative outcome variables, although coefficients are recovered with less certainty in the three-consecutive months' specification. For ethnic linkages, we observe a similar pattern, with effect sizes slightly increasing in the two-consecutive month model. In the three-consecutive month model, the ethnic linkage estimate is still negative, but we cannot reliably reject the null hypothesis. We conclude that our main results are robust to the two-consecutive month operationalization of the dependent variable, while in the three-consecutive month models we see greater uncertainty for some of our estimates. Theoretically, this could point to different dynamics explaining whether tacit coalitions form compared to their duration, while empirically the consecutive month outcome discriminates against organizations that only fight in very few months per year, thus restricting certain coalitions to form in less intense fighting periods.[22]

[19] Figure 3 maps an actor's individual capabilities into the share of equilibrium coalitions, not joint capabilities. However, since realized coalitions are more likely to be formed between equal-sized actors, the resulting predicted relationship is very similar.

[20] See online appendix figure A4 for goodness of fit analysis.

[21] Including country dummies instead of actual measures of, for example, regime type or type of conflict allows us to circumvent coding or missing data issues on many government- and state-related indicators during periods of civil war and prolonged armed conflict.

[22] See the online appendix for additional robustness tests.

Conclusion

Formal civil war coalitions are rare and we therefore focus on the explanation of tacit coalition behavior. Tacit coalitions are based on observable fighting activity and thus allow us to draw conclusions about when and how actors join or fight other warring parties. Our theoretical approach focuses on military synergies between actors. Actors not only pool resources, but also strategically enter coalitions that can unlock synergies to defeat the opposition. Overall, we make three important theoretical contributions. First, we show that for powerful actors, the marginal benefit from realizing synergies with an additional coalition partner declines. Because of this, very powerful actors will not join coalitions if there is any degree of commitment to sharing the spoils of victory in a way that deviates from the balance of power within the coalition. Thus, stronger actors are unwilling to join with weaker actors. Second, we demonstrate that this decreasing willingness of powerful groups to join coalitions and a lack of viable coalition partners for less powerful groups explain balancing in coalitions. Third, our theory illustrates conditions under which powerful groups (e.g., government actors) nonetheless align with smaller rebel organizations to form supersized coalitions.

Empirically, we find strong evidence that rebel organizations of similar strength are more likely to join tacit coalitions. Powerful rebel groups are more likely to fight alone, while evenly matched groups tend to join forces. At the same time, smaller rebel groups are less likely to engage in coalition behavior. These patterns suggest that balancing dynamics play an important role within tacit coalitions. We also find that the overall distribution of power in a conflict is an important driver of tacit coalition behavior. Relatively small and especially large coalitions are less likely being realized. Finally, we demonstrate that pairs with higher synergies in a conflict are more likely to form coalitions. Taken together, these results are in line with our theoretical expectations and generate important new insights about the internal makeup of coalitions in civil war.

More broadly, our research contributes to the growing network analytic approach to the study of civil war. While we uncover some of the empirical variation in coalition behavior, our empirical analysis also shows that there remains a large amount of unmodeled variation in coalition formation. This implies that future research has much potential to further add to the explanation of coalition formation and breakup. This pertains especially to the conclusion of international actors, whose role has not been included in this research. This also indicates that we are still at the very beginning of understanding one of the most persistent and pertinent features of armed civil conflict. We very much believe that in addressing these important processes, researchers need to use theories and empirical approaches that take strategic incentives and the networked environment of armed groups seriously.

Supplementary Information

Supplementary information is available at the *International Studies Quarterly* data archive.

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