EMERGENCE OF COOPERATION IN CIVIL WAR

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Why do some rebel groups fail to unite against a common competitor? To answer this question, I start with the observation that civil wars are complex systems where individuals cooperate to form groups who then cooperate to form alliances. Thus, both group-level and individual-level actors produce behaviors only usefully explained in the context of both levels. I then argue that rebel groups emerge from the interactions of individuals where macro-level distributions of individual preferences aggregate into group-level goals, which play a pivotal role in shaping the cooperation decisions of rebel groups because they are essential to maintain group cohesion. Specifically, I argue that we should expect groups to avoid cooperating with groups with dissimilar goals. This dissertation uses a multi-method research approach to create a cohesive framework that integrates insights from an in-depth case study of the Ethiopian conflict, an original ABM, and Bayesian analysis to further researchers' understanding of civil wars.

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PREFACE

One lesson I learned at the University of Pittsburgh is that it takes a village to write a dissertation. So I would like to express my sincere gratitude to my village, whose support made this project possible.

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1.0 INTRODUCTION

When do rebel groups successfully cooperate in civil wars? Given the potential benefits of joining against a common competitor, particularly the government (Akcinaroglu, 2012; Phillips, 2014), rebel groups have strong incentives to cooperate. However, only 54% of rebel groups between 1946 and 2008 had cooperative relationships with other rebel groups. Further, only 46% of rebel group dyads within civil wars had an alliance relationship at some point in these conflicts.[1] These patterns suggest a set of unresolved puzzles in the literature on civil wars. Why do some rebel groups fail to join together against a common competitor?

The dominant view in the literature suggests that credible commitment problems create a significant barrier to rebel cooperation (Bapat and Bond, 2012). Fearing that alliance partners may renege on their commitments and hence put them in a vulnerable position, groups may forego cooperation with other groups despite the potential benefits of pooling resources. Existent scholarship has identified several factors, such as shared foreign sponsorship (Popovic, 2018), power distribution between groups (Bapat and Bond, 2012), and shared ideology (Blair et al., 2022), that can reduce the severity of commitment problems. While credible commitment problems sometimes prevent groups from cooperating, I argue that the ability to overcome credible commitment problems is not sufficient to explain cooperation in civil war, as there must also be a desire for cooperation. By reifying armed actors instead of focusing on their development, especially the factors that hold them together, current scholarship has offered incomplete explanations of rebel group cooperation.

I argue that to better understand the cooperative behavior of actors in civil wars, such as the formation of alliances between rebel groups, it is important to analyze how these actors

[1] 44% of dyads within civil war years have an alliance relationship. I calculated these values using the replication data from Akcinaroglu (2012).

are formed. The failure to identify mechanisms that lead to the formation of rebel groups limits our understanding of inter-group cooperation to theories that treat the existence of groups as exogenous. This approach inevitably misses processes that link macro-level concepts (such as social structures), micro-level dynamics (such as individual incentives), and group behavior. Further, ignoring these multi-level interactions may lead to theories of group emergence that are unnecessarily in conflict with theories of group interaction. For example, how do strategic survival calculations combine with identities, goals, and grievances to facilitate cooperation at the individual and group levels? This dissertation advances the literature by treating civil wars as complex systems. This approach allows a more thorough treatment of rebel group cooperation that takes into account individuals, groups, macro-structures, and the interactions between these levels.

Holland (2014) defines a complex system as a system that contains interacting agents whose behavior differs from that which one would expect solely based on their characteristics. Such systems are usually tied with hierarchies, where each level has a set of rules that influence other levels. In other words, there is potential leverage in analyzing groups within systems of individual, interacting agents. Braumoeller (2019) makes a similar observation about international systems as complex systems, as it "consists of many countries, which themselves consist of people, and the interactions of those people and those countries in the context of the international system produce behavior that can't be understood or predicted just by examining people or countries in isolation" (47). In this context, civil wars consist of individuals who form groups that form coalitions. Thus, both group-level and individual-level actors produce behaviors that need to be understood in the context of both levels.

One factor I argue is of particular importance to these complex dynamics is the macro-level distribution of individual-level preferences and the way they are aggregated to group-level goals. These group goals in turn serve as a limit on the types of groups that are willing to cooperate. When rebel groups cooperate, they must adjust their policies to coordinate with those of their partner (Oye, 1985, 1986; Keohane, 2005). Yet, at the same time, like all organizations, rebel groups prefer to remain as close to their ideal points/preferences as possible. Because of the influence of individual preferences in the process of group formation, deviating from the group's goals runs the risk of creating discontent among group members

(Axelrod, 1997; Johnson, 2015). In turn, discontent may lead to the desertion of group members and even the disintegration of the group (Ugarriza and Craig, 2013; Oppenheim et al., 2015). Thus, I argue that we should expect groups to avoid cooperating with groups with dissimilar goals.

Further, cooperating with similar groups provides a way to overcome credible commitment problems. Cooperating with similar groups reduces potential costs associated with maintaining cooperation. Shared goals generate trust between actors, which in turn facilitates coordination to achieve a set of goals through collective action (Hardin, 2002; Tarrow, 2011). This low-cost signal to partners that maintaining a cooperative relationship is in the group's best interest. When two actors cooperate and share similar goals, their utility from cooperation is higher because of a decrease in agenda dilution (Leeds, 1999). Cooperative relationships that generate more benefits create incentives for both actors to trust that the other will maintain the relationship (Leeds, 1999; Hardin, 2002). In other words, the partners can credibly expect each other to keep the bargain through self-reinforcing cooperation.

However, the existence of multiple groups with similar goals presents another puzzle in need of explanation. Why do different groups that share similar goals exist in civil wars? Why do individuals sometimes fail to form one united front against a common threat? While Gade et al. (2019) and Blair et al. (2022) consider the role of ideological similarities in explaining rebel cooperation, they take the existence of multiple groups as exogenous. This assumption is problematic considering the complex interactions between individuals and groups that influence cooperative behavior during conflict. As such, they fail to address why these similar ideological groups form multiple groups in the first place. Some recent work has explored these questions.

Most directly, Walter (2019) finds evidence that the number of identifiable ethnic and religious groups and the size of the disgruntled population are the strongest predictors of the number of rebel groups. However, while ethnic and religious identity is correlated with the number of rebel groups, not all rebels are organized around ethnicity or religion. In addition, the identifiability of an ethnic group is related to whether a high-profile political group claims to be representing the putative group's interests.[2] Thus, ethnoreligious identity is a noisy

[2]For example, see the Ethnic Power Relations (EPR) data by Wimmer, Cederman and Min (2009), which

predictor of the number of rebel groups and leaves much to be explained. Another strand of literature examines why rebel movements splinter or factionalize (Mosinger, 2018; Seymour, Bakke and Cunningham, 2016; Tamm, 2016; Woldemariam, 2016). Notably, Mosinger (2018) argues that rebel movements splinter when there are widespread grievances that motivate the formation of many challengers and when groups behave in a predatory manner towards civilians. However, this line of research leaves much of the variance in the number of actors in civil wars unexplained because, as noted by Walter (2019), the vast majority of armed factions form independently from each other. In addition, this view of group formation through splitting is at odds with influential theories of how groups themselves cooperate. For example, Christia (2012) argues that strategic survival and power considerations are paramount, suggesting that any splintering within rebel groups must account for power dynamics rather than grievances.

To address this gap, I introduce an agent-based model (ABM) to analyze the process of group formation and cooperation. I use this framework of the ABM to illustrate how the different levels of this complex system interact. In particular, I show that under certain conditions, multi-sided civil wars emerge such that groups can share similar goals, which facilitates inter-group cooperation. Specifically, the ABM shows that rebel groups tend to form around clusters of individual preferences. However, these clusters are not perfect predictors of the groups that form. Rather, it is also important to account for the correlation between the clusters and their relative sizes. These factors all influence which groups are likely to form in a non-linear way. The model further sheds light on the puzzle of why groups with similar goals emerge in civil wars. When a society is composed of distinct yet similar clusters of individual preferences, which are too small to offer sufficient private benefits to motivate union, groups with similar ideal points can form. In turn, these similar goals facilitate cooperation between the groups by minimizing discontent within the group caused by goal shifts that are necessary for cooperation. These lowered costs in turn increase the trust between the groups, enabling them to overcome commitment problems.

The ABM developed in this dissertation is supported by a historical case study of the

accounts for politically relevant ethnic groups as those who have at least one political organization claiming to support their interests.

Ethiopian Civil War (1974-1991). In this long conflict, the Tigray People's Liberation Front (TPLF) was able to form alliances with the Amhara Democratic Party (ADP), the Oromo Democratic Party (ODP), and the Southern Ethiopian People's Democratic Movement (SEPDM), giving the combined forces sufficient capacity to defeat the militarily powerful Mengistu government in 1991. The case study allows for the validation of some key aspects of the model, such as individual-level behaviors, and it highlights important patterns in group formation and cooperation that can be observed in the ABM.

Further, I use the theory of cooperation in civil wars developed through the ABM to construct a Bayesian latent variable model using existing data on group-level characteristics. The latent Bayesian model applies insights from the framework to leverage group-level data to create a measure of the level of incompatibility in group goals. More specifically, the model uses an ideal-point model to create positions across relevant policy dimensions. These dimensions include democracy, left-right, secessionism, rebel governance approach, and ethnic/religious views. It then leverages the distribution of these dimensions within conflicts to calculate the importance of each dimension. This measure is then used to show that accounting for group goals allows for a better understanding of patterns of cooperation in a sample of post-WWII civil wars.

A more thorough and nuanced understanding of cooperation between rebel actors in civil wars is important not only as a knowledge-building exercise but also for policy making, as cooperative behavior has been shown to have large implications for war outcomes as well as conflict duration (Akcinaroglu, 2012; Cunningham, 2006; Phillips, 2014). The ABM framework that I develop in this dissertation helps facilitate dialogue between formal, quantitative, and qualitative scholarship, leading to new insights and directions for future research. A unique advantage of this framework is that it is not dependent on these particular applications, researchers can use open source software to explore other theories as well as sets of cases. One useful application of the insights derived by this framework is demonstrated through the group distance measure created by the Bayesian latent variable model. While I use this measure to demonstrate the link between group goals and cooperation, it can also be applied to a broad set of dependent variables such as war termination and civilian victimization.

1.1 COOPERATION IN CIVIL WAR

Following Keohane (2005) and Oye (1985, 1986), I define cooperation as the adjustment of behavior to the actual or anticipated preferences of others, through a process of coordination. While cooperation is a key aspect of many social dynamics, in this dissertation I focus on how macro-level phenomena of cooperation between rebel groups who are fighting in the same civil war emerge through the micro-level decisions of individuals and groups. These decisions are in turn driven by the macro-level structures of the society in place before the onset of conflict. Examples of such cooperative behavior between rebel groups include helping to train each other's recruits, engaging in tactical support, sharing information, receiving material or military support from each other, or carrying out coordinated military operations against the government, as well as establishing formal alliances between rebel groups (Akcinaroglu, 2012; Bapat and Bond, 2012; Popovic, 2018). While these different types of cooperation entail different levels of engagement between actors and thus possible costs to this behavior, I argue that they are still the same phenomena, driven by the same factors. As such, they can be studied under the same framework.

While much work has been done to highlight the positive effects of cooperation between armed actors in civil wars (Phillips, 2014; Akcinaroglu, 2012; Cunningham, 2006), the observed patterns of cooperation between such groups are puzzling. One strand of literature has focused on explaining the lack of cooperation as a result of credible commitment problems. In anarchic environments, actors find it difficult to bargain when there are structural reasons for why they cannot trust one another to uphold any deal that they strike (Fearon, 1995). Conflict researchers have been fast to point to civil war as an inherently anarchic environment due to state collapse and the absence of institutions (Walter, 1997). Because of the benefits of cooperation, and the ability to exploit partners, rebel groups can strategically use cooperation to maximize their position in the conflict regarding other actors. Thus, in civil wars, there are mutual incentives for rebel groups to abuse cooperative ties and improve their security at the expense of the other group.

However, there are several mechanisms through which rebel groups can overcome credible commitment problems to form alliances. First, groups that can survive government attempts

to thwart cooperation and inflict punishment on defecting cooperative partners are more likely to cooperate. This means that stronger rebel groups are more likely to form cooperative relationships. Second, groups that share a common foreign sponsor can overcome credible commitment problems if the sponsor enforces cooperative agreements between the groups. Bapat and Bond (2012) present two game-theoretic models on alliance formation between groups to outline the mechanisms connecting rebel group strength, foreign sponsorship, and cooperation. They find that stronger groups are more open to alliances with other strong groups because they can more credibly reject government attempts to buy them off. Further, due to their capacities, breaking agreements with each other is potentially more costly. In contrast, more vulnerable groups are more likely to form alliances with other groups only through state sponsors. Without outside sponsors, such groups cannot credibly commit not to exploit the relationship. Popovic (2018) also analyzes the role of foreign sponsors to explain alliance decisions between rebel groups and finds that shared sponsors make alliance formation more likely.

While Bapat and Bond (2012) and Popovic (2018) focus on battlefield cooperation, other scholars highlight the problems possible coalitions would face if they were able to win. Christia (2012) argues that alliance formation is a tactical move motivated by concerns with achieving military victory and maximizing wartime return in anticipation of post-war power-sharing. In Christia's theoretical framework, groups concern themselves with their survival and the relative power of warring factions. This logic builds from minimal winning coalition theory (Riker, 1964) to argue that groups want to be in a coalition that is powerful enough to win, yet small enough to ensure maximum political payoffs.

These two theoretical frameworks point to similar salient features, such as the power distributions of groups in the conflict. However, their distinct theoretical mechanisms can lead to contradictory predictions about how rebel attributes influence successful cooperation. Bapat and Bond (2012) predict that cooperation will be more likely between powerful groups, while Christia (2012) predicts that groups will not cooperate if they form too powerful of a coalition given the logic of minimum coalition formation. Under a set of scenarios, the two models have compatible arguments. For example, if groups A and B are both equally strong groups that together can form a minimal coalition, then the models are compatible.

However, if A and B are both strong and cooperation between them leads to an "excess" of power in a minimal coalition logic then their predictions are not compatible. Further, if groups A and B can form a minimal winning coalition, but group A is very powerful while group B is weak, then the two models have contrary predictions of cooperation, as one model predicts an alliance while the other does not. This suggests that more theorizing about the effects of power dynamics on cooperation, or other factors to adjudicate between possibly contradictory findings, is needed.

Further, examples of rebel cooperation across civil wars show that rebel groups form alliances in a variety of power distributions. For example, two strong rebel groups in the Darfur conflict, the Sudan Liberation Movement (SLM) and the Justice and Equality Movement (JEM), formed cooperative ties from 2003-2005 as predicted by Bapat and Bond (2012). Yet, in the Liberian Civil War (1989-1997), the two relatively powerful rebel groups (the National Patriotic Front of Liberia (NPFL) and Independent National Patriotic Front of Liberia (INPFL)) failed to cooperate against the Doe government. Another example concerns the Ethiopian civil conflict. In this case, the Tigray People's Liberation Front (TPLF) was able to form alliances with the Eritrean People's Liberation Front (EPLF), the Ethiopian People's Democratic Movement (EPDM), and the Oromo People's Democratic Organization (OPDO) despite the superior power of the TPFL and EPLF compared to the other coalition members and the powerful opposition of the Ethiopian government. In addition, the data show that two rebel actors sharing sponsorship ties are much less frequent than the formation of cooperative ties between them.[3]

In highlighting the role that power distribution plays in cooperation decisions in civil wars, existing literature either downplays or explicitly argues against the rebel group's goals in preventing or facilitating cooperation. This literature assumes that, if rebel groups are capable of overcoming commitment problems, their dominant strategy is always to cooperate. This assumption, however, is not grounded in the broader conflict literature, which emphasizes the role of rivalries as frequent characteristics of both international and civil conflicts (Colaresi, Rasler and Thompson, 2008; Rasler and Thompson, 2006). Rivalries

[3]According to the data used in this analysis, only 33% of allied dyads have at least one shared outside sponsor, meaning that sharing sponsors are not common for rebel actors. This is reinforced by the data presented in Popovic (2018).

provide an important contrast to the view of cooperation in the existing literature on civil war cooperation, as it highlights the idea that conflicts are often about incompatibilities between material and non-material goals that can sometimes prevent otherwise profitable cooperation. Further, considering that ideological differences are key in explaining and better predicting not only inter-state alliances and conflict termination, but also parliamentary coalition formation, it is important to the role of goals in civil war cooperation (Axelrod, 1997; Lai and Reiter, 2000; Goemans, 2000).[4] This is because groups, organizations, or states wish to reach alignments that minimize frustration caused by the actions taken by all other actors with whom they are involved (Axelrod, 1997).

The inconsistencies in current rebel alliance scholarship suggest that other factors influence the probability of cooperation between rebel groups beyond outside interference and the balance of power between actors. Factors such as goals, which have shown to be important predictors of interstate behavior, might also prove helpful in explaining cooperation in civil wars. As such, this dissertation argues and shows that the distribution of goals between rebel groups can complement and enhance our collective understanding of rebel behavior, especially cooperation. In this framework, rebel groups compete with the government and one another to change the configurations of the status quo policy space to fit their goals.

The literature on rebel organizations has tended to remove goals from any explanation of rebel behavior in civil wars. For example, Christia (2012) and Driscoll (2015) view goals not as a defining characteristic of rebel organizations, but rather as cheap talk. This research argues that identities and objectives change to fit the power distribution of the actors, and are thus cheap talk used to justify alliances and cooperation after the fact. These studies derive their assumptions from the state-building framework described in Wagner (2010), in which predatory groups only seek to maximize their pure economic benefits while ignoring other possible preferences. Although this framework provides a useful model to explain the rise of the modern state, it is less useful in explaining the behavior of rebel groups in civil wars, because these conflicts are explicitly about incompatibilities in the preferred status quo of different groups within states.

[4] Axelrod (1997) describes how models accounting for both minimal winning coalition and party positions outperformed those relying only on the logic of minimal winning coalition when predicting the make-up of parliamentary coalitions in Italy.

A second example of the ways in which the role of goals is ignored in the existing literature can be seen in Bueno De Mesquita et al. (2003), who contends that "crisis stimulates the emergence of a shared mindset or a collective new belief system" (27). According to this view, crisis encourages former competitors to coordinate with one another and put aside their divergent concerns in order to preserve a future political setting in which they can compete over the distribution of goods. Portraying civil wars as a struggle between the might of those inside the selectorate and those outside of the selectorate, this framework marginalizes individual preferences by focusing only on one's position relative to the selectorate. Yet, being in or out of the selectorate is a function of the pre-existing preferences of individuals.

Recent empirical studies acknowledge the role of ideologies and preferences over war outcomes in various forms of conflict. Gade et al. (2019) have shown through analysis of rebel alliance networks that homophily is the major predictor of networks of analysis in the Syrian Civil War.[5] In this framework, networks tend toward homogeneity as ties between dissimilar individuals dissolve more quickly, while similar individuals have a presumption of mutual trust (McPherson, Smith-Lovin and Cook, 2001). Further, Blair et al. (2022) argues that shared ideologies can help groups overcome credible commitment problems by providing community monitoring, authority structures, trust, and transnational networks. Similarly, Balcells, Chen and Pischedda (2022) argues that shared constituencies of supporters based on both ideological and ethnic ties increase the likelihood of cooperation.[6]

While these studies move the literature on cooperation in civil wars in the right direction by acknowledging and demonstrating the importance of preferences in conflict processes, they raise an interesting puzzle. If the groups share preferences such that they are willing to cooperate, especially high levels of cooperation such as formal alliances, then why do groups with similar goals (preferences) emerge in the first place? Similar to Christia (2012) and Bapat and Bond (2012), studies that explicitly model the importance of group preferences in conflict dynamics, such as Gade et al. (2019) and Blair et al. (2022), take the existence of multiple groups as exogenous. These studies blackbox group formation and treat the presence of multiple groups as given. However, because groups in civil war form in a complex system

[5]Homophily is a principle of social networks in which similarity leads to increased connectivity.
[6]These results are strongest and more robust for ideologically similar groups.

through individual-level cooperation, the patterns of group formation also shape the patterns of group-level cooperation.

1.2 GOALS, IDEOLOGY, AND IDENTITY

Both goals and preferences influence micro-level behaviors at the group and individual levels respectively, while the aggregation of these behaviors shapes the macro-level patterns of cooperation observed in conflicts. At the individual level, these decisions may be joining a group, while at the group level this may be forming alliances. While each individual preference and group goal presents a micro-level factor in the decision-making of actors, how the preferences and goals are structured concerning each other are macro-level factors. For example, how individual preferences are correlated creates different types of identities, while the distribution and correlations of these identities are a society's structure.

I define goals as the stated set of policy positions that rebel groups would implement (or maintain) after a conflict if they had no constraints. Goals, therefore, have two characteristics. First, they are group-level attributes. Second, they are positions across relevant, possibly multidimensional, policy spaces. The individual-level version of goals in this framework is individual preferences, which, like goals, are positioned along relevant dimensions.[7] Both group goals and individual preferences are intrinsically accompanied by the importance placed on a specific goal dimension, which can be considered as a weight that informs us how actors will aggregate their goals or preferences with other actors such that more important dimensions have a larger impact on the decision.

Recent research has linked ideology to many types of organized violence such as interstate conflict.[8] Ideology has no simple definition in the literature, however, there is a convergent understanding of the concept. Freeden et al. (1996), for example, has defined ideologies as "systems of political thinking, loose or rigid, deliberate or unintended, through which

[7]This definition of goals focuses on preferences over outcomes and not the processes of how these are fulfilled. These two types of preferences are different, but they are likely to have similar effects on cooperation in conflict.

[8]See Leader Maynard (2019) for a full discussion on the linkage in the literature.

individuals and groups construct an understanding of the political world they, or those who preoccupy their thoughts, inhabit, and then act on that understanding." More recently, focusing on civil wars, Sanín and Wood (2014) defined ideology as a systematic set of ideas that includes the identification of a referent group, an enunciation of the grievances or challenges that the group confronts, the identification of objectives on behalf of that group and a program for action.

Despite this convergence in how ideologies are defined and a growing body of literature connecting ideology and conflict, there is little consensus on the micro-foundations of how ideology influences conflict behavior (Leader Maynard, 2019). The literature is usually split along a presumption that ideology is an instrumental tool for mobilization (e.g., Walter (2017)) or that ideology influences behavior because individuals are sincerely committed to them. (e.g., Sanín and Wood (2014), Gade et al. (2019)). Following Leader Maynard (2019), I argue that the effects of ideology are rooted in complex interactions between different levels of sincere ideological belief and the incentives provided by ideological structures. As such, to specify how this broad concept of ideology influences behavior, especially concerning cooperation between rebel groups, I utilize the concept of goals.

Goals differ from ideology in their specificity and the level of actors that are observed. I draw this distinction for definitional clarity. While ideology refers to a broad set of political thinking through which individuals construct the world they wish to live in, I conceptualize goals as the specific set of policies groups propose to implement across all relevant dimensions in society, and the relative importance of each of these sets of policies. Further, goals are generated by groups through the process of forming the group itself, such that goals are specific to groups. However, both concepts are intrinsically related. Both goals and ideology are conceptualizations of how actors wish their society to be structured. For example, the TPLF had the goal of creating a federal Ethiopia, where each ethno-nationalist group had a large degree of autonomy and more equitable distribution of land through localized community ownership. However, they used a Marxist ideology to conceptualize their goals.

Another related concept that is central to political science is identity.[9] A consensus understanding of identity is that it is a "social category into which people are placed based

[9]See Kalin and Sambanis (2018) for a full review of the literature.

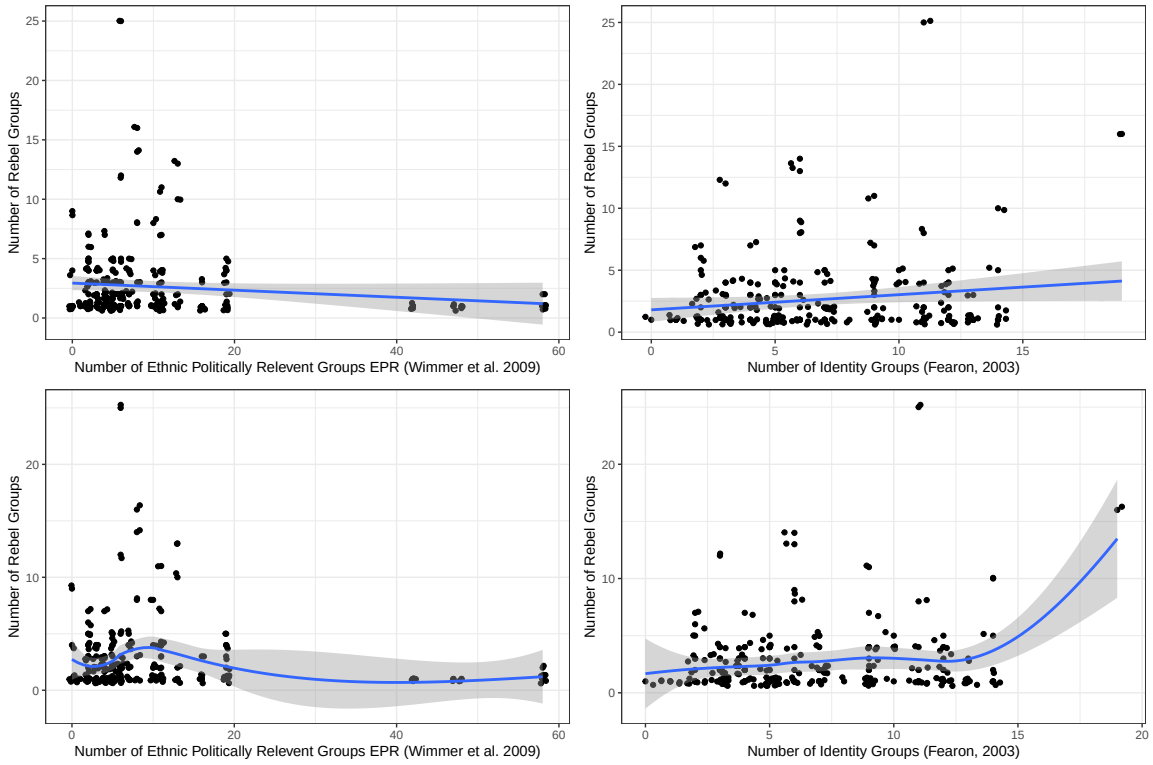
upon one or more individual attributes. Attributes are mapped to identities according to membership rules that say which attributes are necessary for membership in the identity" (Kalin and Sambanis, 2018). While much of the literature on social identities has focused on the degree of "stickiness" of identities, there is a growing consensus that identities, even those that are considered more stable, are prone to change (Chandra, 2006; Chandra et al., 2009). Research has shown that individuals' subjective identities and the salience of those identities are shaped by political institutions such as electoral rules (Posner, 2005) and government census categories (Nobles, 2000). Further, researchers have found that in the case of the United States, backgrounds and upbringing are predictors of an individual's present identities concerning race (Davenport, 2016) and sexual orientation (Egan, 2012).

Complementary findings have linked identity and identity change to ideology and individual preferences. Early studies in social identity theory argue that salient identities define individuals through the characteristics of the identity group (Tajfel et al., 1979; Turner, 2010). In this framework, the preferences and actions of individuals converge towards those of an archetypal group member (Hogg, Terry and White, 1995). In support of these theories, recent work has shown that in the United States identity switching can be predicted by ideology, such that the self-ascribed identities of Americans regarding ethnicity, religion, sexual orientation, and class align with their politics (Egan, 2020). These lines of research indicate a deep connection between preferences and identities and how they shape one another. Burke and Reitzes (1991) connect identity and behavior by suggesting that stress arises when there are incongruities between the two, which people seek to minimize.

Ethnic identity has been the focus of how political science has studied the role of identity in civil wars (e.g., Cederman, Weidmann and Gleditsch (2011); Cunningham (2011); Denny and Walter (2014); Seymour, Bakke and Cunningham (2016)). While often lacking a common definition across all studies, Chandra (2006) broadly defines ethnic identity as the subset of identity categories where membership is determined or at least believed to be associated with descent. This focus on ethnic identity is not surprising given that since 1945, 64% of all civil wars are divided along ethnic lines (Denny and Walter, 2014). However, ethnic identity is not too different from other types of identity, except for the ease through which it can change (Egan, 2020; Kalin and Sambanis, 2018). As such, it is important not to

assume that ethnicity is the main cause or dividing line in how groups form, nor indicative of the goals groups will have. This argument finds support in the literature. For example, Denny and Walter (2014) shows that not all ethnic groups fight for independence, many are center-seeking. Further, ethnic groups are often polarized within themselves. They further argue that although civil wars tend to break down along ethnic identities, the grievances that drive these conflicts are the same as those that drive non-ethnic groups in civil wars. Rather, rebel movements are more likely to organize around ethnicity because ethnic groups are often aggrieved in the same manner, and these groups find it easier to mobilize. This relationship is a result of features related to ethnic identities such as the historical distribution of political power based on ethnicity, geographic concentration of ethnic groups, and that ethnic identity tends to be more fixed than other political identities.

Figure 1: Correlation between Ethnic Identities and the Number of Rebel Groups



Notes: The figures all map the number of rebel groups in the UCDP dataset from 1946-2010 (Gleditsch et al., 2002). The graphs on the left use the number of ethnic politically relevant groups in the EPR data from Wimmer, Cederman and Min (2009), while those on the right use the number of identities (ethnic, religious, cultural groups as measured by Fearon (2003). The top graphs show a linear fit of the data, while the bottom graphs show a non-linear fit. The data comes from the replication material for Walter (2019).

Like other types of identities, ethnicity correlates highly with preferences due to shared economic, political, cultural, and regional situations as well as physical marks of group identity. Ethnicity is an important identity through which goals can be formed and groups mobilized. Yet, it is important to unpack the underlying distributions of individual preferences that make up ethnic groups in society. It cannot be assumed that ethnicity perfectly maps on to the clusters of individual preferences in any given society, even if that society is ethnically defined. This is in part demonstrated by Figure 1. The graphs show that there is no clear and distinct correlation between ethnic (and ethno-religious) identities and the

number of groups that fight in a civil war. For example, when looking at the EPR data, there is a weak negative correlation between the number of identity groups and rebel groups, while using the identity measure gathered by Fearon (2003) there is a weak positive correlation. Further, the bottom graphs suggest a potential nonlinear relationship.

Rather, I argue that to understand the process of group formation, and the impact it has on rebel group behavior, the underlying preferences of the individuals that make up such groups must be unpacked. Other relevant preference dimensions like wealth, land distribution, labor status, religious views, political ideology, secessionist desires, and physical appearance may or may not correlate with the markings of an ethnicity. As a result, some groups will form around ethnic identities, while in other cases groups will form around sub- or cross-ethnic identities.

Therefore, in this study, I do not treat group identities as goals or individual preferences. I acknowledge the deep connection and correlation between preferences and identities. As stated by Sambanis and Shayo (2013), "identities shape interests, and interests shape identities." While I do not theorize mechanisms directly connecting identity to group formation and behavior, I argue that identities are key to explaining how individual preferences are structured in any society. I treat discrete identities as defined by a set of clustered preferences of the identity group members in a multi-dimensional policy space. These macro-level societal structures are crucial in the complex system through which individuals organize into groups, and alliances to fight in civil wars.[10]

1.3 OVERVIEW OF THE DISSERTATION

The remainder of this dissertation is divided into five chapters. In Chapter 2, I present the Ethiopian Civil War (1974-1991) as a supporting case used throughout this dissertation. I trace the development of the Tigrayan People's Liberation Front (TPLF) and its cooperation with other groups active in Tigray. Next, in Chapter 3, I propose a theory of rebel group

[10]To be clear, I do not equate identity, ideology, and goals. Rather, each is a separate, if contested, concept. However, the framework I develop links identity and preferences in one particular, but flexible, way.

formation. I explore this theory using an ABM. The ABM shows that individual preferences are sufficient to produce multiple groups in a civil war. In contrast, focusing only on power distributions fails to reproduce observed patterns in the number of groups in civil wars. I then build on the ABM to explain how groups tend to form around clusters of individual preferences and theorize how these clusters are structured in societies. I further show how distinct yet similar clusters of individuals can create separate groups with similar goals. Lastly, I demonstrate how the behavior of agents in the first level of the model mirrors the observed behavior of individuals and groups in the Ethiopian Civil War.

Chapter 4 theorizes how the process of rebel group cooperation both mirrors and differs from rebel group formation. I then build on the ABM framework to incorporate alliance behaviors and demonstrate that the individual preferences of group members constrain and influence the cooperative ties that groups can form. Further, I show that only when group goals are taken into account can the ABM generate data that is consistent with data on the number of groups that form in conflicts and existing analysis of rebel group cooperation. I then use the patterns of alliance formation of the TPLF during the Ethiopian conflict to highlight relevant aspects of the second stage of the ABM and the theory presented in this chapter. Building on my theory of cooperation to construct a measure of distance between group goals across civil wars, Chapter 5 constructs a measure of the goal distance between groups using a Bayesian latent variable model. I then use simulated data to validate the model, demonstrating that it can capture the relevant parameters in the data. Next, I use the model to analyze the effects of the distance between rebel group goals and the likelihood of cooperation. The result of the model demonstrates that as the distance between the goals of two groups increases, cooperation becomes less likely. Further, I compare the proposed model with other models of rebel group cooperation. This comparison demonstrates that the proposed model outperforms other models of cooperation in an out-of-sample predictive capacity, suggesting that the measure captures underlying characteristics of alliance decisions of rebel groups. Lastly, Chapter 6 concludes the findings of my dissertation and discusses implications for future research.

2.0 OVERVIEW OF THE ETHIOPIAN CIVIL WAR 1974-1991 AND THE TPLF

Now I present the case of the Ethiopian Civil War (1974 to 1991). More precisely, I follow the formation of the Tigray People's Liberation Front (TPFL) and their interactions with other groups in the conflict. The aim of this analysis is not to test any aspects of the theory or the model; neither is this meant as a history of the conflict or its rebel groups.[1] Instead, I aim to illustrate the dynamics of cooperation in civil wars that will act as a connective glue between the models, theory, and analysis I present. In this chapter, I provide an overview of the history of the conflict with a focus on the TPLF. In the following chapters, I refer back to this case to provide the theoretical foundations and connect them to the empirical results of the modeling framework I develop to validate the model and highlight the role of goals in cooperation during civil wars.

The Ethiopian Civil War was a long and drawn-out conflict. It culminated with the Ethiopian People's Revolutionary Democratic Front (EPRDF), a coalition of many rebel groups, defeating the Derg regime in 1991 and restructuring the Ethiopian state and society, most obviously in the independence of Eritrea. An appropriate starting point to analyze how the relevant groups in the conflict formed is the fall of the Haile Selassie monarchy in 1974. The monarchy fell as a result of a revolution led by a variety of urban groups, including secondary and university students and teachers, organized labor and trade unions, and, most importantly, the armed forces (Clapham, 1990).[2] The crisis spiraled into a series of mutinies, strikes, and demonstrations which mobilized all elements of the urban opposition

[1] Writing such a history is beyond the scope of this project. I leave such a difficult task to the many scholars whose work I have relied on for building this narrative and those whose work has eluded my grasp.

[2] The first known incident that culminated in the regime's overthrow was a mutiny in January 1974 by soldiers and NCOs in a small garrison at Neghelle in southern Sidamo (Tareke, 2009).

to the Ethiopian monarchy. By August 1975 Haille Selassie was declared dead, most of the previous regime had been assassinated or fled the country, and the military under the Derg began to consolidate its power over the Ethiopian state.[3] The end of the monarchical regime and the new policies of the Derg combined with pre-existing conflicts within the country to mobilize all sectors of the Ethiopian society, either in support or opposition to the Derg (Clapham, 1990; Zewde, 2002).

The Ethiopian Civil War is a particularly helpful case for this project for two key reasons. First, as a result of various factors, which possibly include the rebel victory which established many former members in high government positions in Eritrea and Ethiopia, the origins of key movements in university student movements which resulted in many members of different groups becoming academics, and a general scholarly interest in the region due to its long and rich history, there is a wealth of information to analyze about the conflict. This is particularly true of the early stages of the mobilization process of the group, which are often poorly recorded. Second, the conflict is usually portrayed as an ethno-nationalist conflict. This provides a hard test of my theory as I must show that ethnicity alone cannot explain the patterns of mobilization and alliances in the conflict.

In some ways, the Ethiopian is not an average case of civil war. The conflicts following the fall of the Selassie regime have been labeled as the largest and most violent revolution in the second half of the 20th century (Berhe, 2009; Young, 2006). Further, the conflict is composed of two intrinsically tied but distinct conflicts. The first was the war for Eritrean Independence War which started in the 1960s. The second was the anti-Derg movement which started around 1974. However, both conflicts are inseparable as they shared the same resolution, and the groups fighting in them were deeply involved in cooperative and conflictual relations with each other. However, in other ways, the conflict in Ethiopia is comparable to many other cases. The conflict lasted for 17 years which is within the 3rd quartile of conflict duration according to UCDP data (Gleditsch et al., 2002) from 1946-2010 and very distant from the longest lasting conflict in the data at 59 years.[4] Further, like all societies, Ethiopia pre-1974 has its particular structure, but there is no reason to believe

[3]Haille Selassie was most likely assassinated by the military forces controlling the government.
[4]Refer to Table 35 in the Appendix.

that this structure is an outlier. For example the EPR data (Wimmer, Cederman and Min, 2009) codes Ethiopia as having 10 politically relevant dyads in 1974 while the average for all conflicts is 10.49.[5] Similarly, Fearon (2003) codes Ethiopia in 1974 as having 11 identity groups, which is higher than the average at 6.75 but is not an outlier.[6]

One successful group in mobilizing support against the Derg regime was the TPLF. By 1991, the TPLF formed a coalition with other anti-Derg forces in Ethiopia and won the conflict. In the first part of this case study, I outline the conditions in Tigray immediately preceding the outbreak of conflict. Next, I track the rise of the TPLF and highlight the process through which they successfully formed their organization and mobilized support. Next, I provide a brief overview of other groups active in the Tigray region. Subsequently, I discuss the extent of cooperation or lack thereof between the TPLF and these groups. In particular, I delve into the collaboration with the Eritrean People's Liberation Front (EPLF), which ultimately resulted in the formation of the Ethiopian People's Revolutionary Front (EPRDF), a coalition primarily led by the TPLF and EPLF.

In this analysis, I concentrate on Tigray and the TPLF rather than provide a comprehensive coverage of the conflict, or focus on other actors that mobilized in the region. The choice of Tigray was partially because the two major actors in the EPDRF coalition (the TPLF and EPLF) predominantly emerged from the Tigrigna-speaking Highland areas of Ethiopia and Eritrea. As such, much of the scholarly work and first-hand accounts of the conflict revolve around these two organizations. These resources are crucial in allowing for a more in-depth exploration of the underlying processes influencing cooperation choices made by various actors, both at the individual and group levels, rather than a broader examination. A second reason is that because of the longevity of the TPLF as a force in the conflict, there are significant changes both internally to the group and also in the conflict and broader international situations, which presents interesting variance to group goals and behavior. This variance is an important factor in gaining leverage to explore the role of group goals in cooperation at the individual and group levels.

[5]This value is also very distant from the maximum observed value in conflict states at 59.
[6]The highest coded conflict has 19.

2.1 TIGRAY IN 1974

To better understand the mobilization of Tigray during the conflict, I present a summary of Ethiopia's pre-revolution society, with a particular focus on the region of Tigray. The society and relevant policy dimensions which I outline in this section provide the social fabric in which the TPLF, but also other actors such as the newly formed Derg regime, would mobilize support from different sectors of the population. Understanding this social backdrop defined by the different sectors of the population and their preferences is crucial to understand the mobilization of all groups in the Ethiopian conflict.

Before the revolution, Tigray, like the rest of Ethiopia, was characterized by the "trinity of noble, priest, peasant". The main distinguishing factor was their relationship to the land. Peasants held land under the risti tenure system which ensured that every Christian Abyssinian was entitled to claim land through descent from a founding father.[7] Although it was not private ownership, the system was similar and made peasants entitled to their land (Markakis, 1987; Zewde, 2002).[8] This system promoted smallholdings, and except for religious minorities, it prevented the emergence of a significant landless class (Berhe, 2009). However, due to small farm sizes, lowering soil quality, and few opportunities in towns, peasants from Tigray were increasingly forced to find seasonal employment, frequently on plantations and commercial farms outside Tigray. Inter-regional migration carried out in 1969-70 showed that the largest net outflow came from Tigray with 31,100 temporary emigrants, followed by Wollo with 6,960. These rough estimates, give some impression of the role of seasonal migration for many of Tigray's peasant population (Clapham, 1990).

The nobility was distinguishable through the holding of gulti rights (Markakis, 1987). These were rights given directly by the emperor based on service. It allowed individuals to collect tribute from the peasantry in their allocated area. Except for church gulti rights, these rights were not generally inherited and reverted to the crown with the death of the holder. One result of this system is that the nobility was not self-perpetuating and even

[7] Another type of land tenure that co-existed along with risti was the deisaa system where land is based on membership in a community. Every member of the community is entitled to a piece of land. Differently from rist land, deisaa land is not inheritable and the community retains the rights to the land.

[8] They could plant what was desired, commit land in agrarian contracts, lease it for farming by a tenant, give the land as security for a loan, or exchange it temporarily for another parcel.

commoners could join its rank. However, it is important to note that this nobility monopolized the control of the administration and military structure of the state (Young, 1996; Markakis, 1987; Zewde, 2002). As a result of this system, there were strong bonds between nobles and peasants based on family relations, and a low degree of differentiation between peasants and the lower ranks of the nobility. The last sector of this society was the Ethiopian Orthodox church. The church was divided like the secular sectors, with the top hierarchy being politically dominant and wealthy while monks and parish priests often shared more in common with the underprivileged peasants (Young, 2006).

The population of the province of Tigray in 1974 is estimated to be about 4 million, 95% of which were Tigrinya-speaking Christian and 4-5% of which were Muslim according to the 1994 National Census data (Berhe, 2009).[9] The Tigrinya-speaking Christians lived mostly in the rural areas of the highlands, while the lowlands are sparsely populated by pastoralist Muslims, mostly of the Afar ethnic group. Most of the Muslims specialized in trade and crafts. Thus, the Muslim community in Tigray controlled a large part of the business and service sector of the economy and many lived in towns (Berhe, 2009). As a result of these limited contacts, the Afar retained their language and Islamic faith and have not intermarried with non-Afars (Young, 2006). In the region, religion was deeply intertwined in the social, cultural, and political life of the community. As a result, it influenced the lifestyle, norms, and standards of behavior and the general patterns of social interaction in communities (Ali, 1996). Other extremely small minorities that live in the province include the Agaw, Kunama, and Oromo. These are somewhat assimilated, correlating with their religion, into the highland Tigray culture (Tareke, 2009).

Further, Tigray was extremely underdeveloped. The region had no manufacturing, only a couple of commercial farms, and no mines. It contained about 0.3% of the country's industrial employment (Young, 2006). Trade was mostly cattle and grain exports and the import of basic goods, mostly through Eritrea. The region was very rural, as less than 3% of people lived in towns and 91% engaged in agriculture.[10] Also, the province had no secondary

[9] It is possible that the number of Muslims was higher in the 1970s but only marginally.

[10] The people living in towns included most merchants, teachers, students, and civil servants. Mekele, the capital of Tigray, and its largest town had a population of only 47,000 people.

education and only 5 primary schools (Young, 2006; Tareke, 2009).[11] This underdevelopment was not limited to Tigray as development was usually reserved for the Shoan-Amarah areas and Eritrea.[12]

While Tigray was marginalized before the revolution, the fall of the regime in 1974 reinforced many of these grievances and created new ones. While Tigrayans are part of the Abyssinian family of ethnicities, they are separated from the dominant Amarah branch of to south through linguistic differences. Amarigna is spoken in all Abyssinian provinces save Tigray (Markakis, 1987). Tigrayans have agitated for more self-governance, especially since the death of Emperor Yohannes IV, the only Emperor of the Tigrayan cadet branch of the Solomonic dynasty. Many felt that Tigray, due to its historical relevance to Ethiopia, deserved much more than what the current state offered. The anti-central government sentiments within Tigray were further encouraged by the educated class of teachers and university students who came from the region. The nationality question which was central in the student movement was decided by many in Tigray in favor of self-determination. While the extent of the meaning of self-determination varied from less central government to full independence, it correlated heavily with much of the population's dislike of the central government (Berhe, 2009).

These tendencies would be further inflamed by the continuation of assimilation policies such as the banning of the Tigrigna language by the Derg. This is especially relevant in a region where by 1974 only about 12.3% spoke Amarigna, and even fewer could read it (Berhe, 2009). While language is a tangible sign of ethnicity, and it creates a bond between mutual speakers, it also has more tangible effects. The use of a specific language in mass media, schools, financial and banking institutions, government offices, and general communication provides opportunities for participation in the economy and politics, while its prohibition inhibits this participation (Ali, 1996). For example, entry into Addis Ababa University was contingent on examinations that were taken in Amharigna, a structure maintained by the Derg. Further, in the eyes of many the dismissal of Ras Mengesha (a descendant of Yohannes

[11]Despite this, Tigray had one of the highest literacy rates in Ethiopia at 6.4% (12.1% for males and 5% for females).

[12]Despite this systemic marginalization, Tigrayans never faced the loss of land and slavery-like conditions like many non-Abyssinian peoples.

IV) as the province's Governor demonstrated the Derg's even more centralizing tendencies compared to the Imperial regime. In his fieldwork, Young (2006) recounts the view of a peasant who claimed, "he (Mengesha) is from Tigray and because of this people were loyal until he escaped; they were loyal to their governor, his name is "son of our cow". He was a Tigrayan leader."[13]

Further, the Derg's economic policies, especially the land reform, provided new grievances for the inhabitants of not only Tigray but also those of other Abyssinian highland areas. The Land Reform Proclamation of 1975 mobilized both peasants and the feudal landowning class. While the land reform was successful in mobilizing large portions of Ethiopia to support the Derg. It provided most Ethiopians, especially the landless peasants of the south, west, and central region, with a benefit that no opposition group could hope to outbid, land. Clapham (1990) speculates that farmers in the south gained a continuous income increase of up to 50% due to the removal of rent. This measure secured the loyalty of a large part of the population, especially of many of the Oromo, Ethiopia's largest ethnic group. However, the reform had opposite effects on other sectors of the population. The peasants in the north who owned their land or enjoyed risti rights were threatened by this measure as it removed their main source of stability out of their own hands and put them on an equal basis as the landless class (Berhe, 2009; Clapham, 1990; Markakis, 1987).

Another area of contention was articles 4.5, 6, and 7 of the Land Reform (Provisional Military Administration Council, 1975). Article 4.5 abolished the hiring of farm labor and article 7 dissolved all commercial farms not operated by the state. Together, these measures abolished seasonal work. This was especially damaging to Tigray's peasant population who depended on this to supplement the poor income (Clapham, 1990). In an interview conducted with Young (2006), Meles Zenawi[14] claims that the policy affected 200,000 Tigrayans and was a major stimulus of peasant discontent in the province. Further, article 6 banned tenancy or land rental, which unlike in the south of Ethiopia, in Tigray was not associated with exploitation. Rather it was a means for poor farmers (those who did not own oxen to work

[13]Although this view was not uniform amongst all peasants as many still saw him as part of the feudal establishment, a view that was more prevalent amongst the younger and more educated peasants.

[14]High-ranking member of the TPLF and founder of the Marxist-Leninist League of Tigray (MLLT), President of Ethiopia 1991-95 and Prime Minister 1995-2012.

the land) to increase their income by renting land to those with the means (oxen) to work it (Hendrie, 1999). The negative reception of the Derg government's land reform does not mean that land reform was not desired by many in Tigray. Rather, they desired a different type of land reform. The other losers from the reform were former landlords from all parts of Ethiopia. The feudal class was stripped of not only their political power by the fall of the monarchy but also their economic base (Tareke, 2009). While many in Tigray were happy to see the end of the feudal system, and with it the possibility of more modern governance, this was not always the case with all Tigrayan peasants. Further, the land reform did little for the pastoralist populations in much of Ethiopia's low lands, as their wealth was in cattle rather than land (Young, 2006).

The last policy that raised the grievances of many in Ethiopia was the Derg's approach to the Orthodox Church. The abolition of gulti rights and re-distribution of church land, while disliked by the high-ranking members of the priestly class, was welcomed by most peasants and some parish priests (Berhe, 2009). However, the atheism of the state and attacks on church dogma and practices, coupled with the violence against priests were abhorred by many peasants who held deep ties with the Church. Some examples include preventing baptisms and religious grieving ceremonies, the sale of grapes for communal wine, and the assassination of high-ranking church leaders including the patriarch of the Ethiopian Orthodox Church, Abune Tewoflos (Young, 1996; Berhe, 2009). On the other hand, the increased distance between the Ethiopian church and state was welcomed by the Muslim population who were no longer considered second-class citizens as a result of their religion. The Derg also appealed to them by raising the status of their religion within Ethiopia. For example, the Derg gave official recognition to three Muslim holidays Markakis (1987).

The pre-revolution society of Tigray as described here, coupled with the streams of thought in the student movements and the reforms instituted by the Derg in their bid to take full control of the Ethiopian state, provide the social backdrop for the mobilization of different sectors of the population that initiated the civil war in Tigray. This backdrop provides the preferences that individuals had concerning the future of Ethiopia.[15] Now I

[15]While I have excluded other regions from the direct study here for conciseness, they were also mobilized by different groups such as the Derg, the Afar Liberation Front (ALF), and the Oromo Liberation Front (OLF) based on their preferences.

will track the evolution of the TPLF as a group focusing on their bid to win over support in Tigray, their merger with the TLF, and their failure to do so with other contenders such as the EDU and the EPRP.

2.2 MOBILIZATION IN TIGRAY

Tigray and the Tigrigna-speaking regions of the highlands served as one of the main areas of mobilization during the conflict. A series of groups such as the TPLF, EDU, and EPRP used this region as a base of operation during the conflict. Further, both Eritrean groups (ELF and EPLF) drew supporters from the highland areas of Eritrea which shared a language and culture with Tigray. In this section I highlight the mobilization process of these groups, focusing on the TPLF to highlight how individual preferences and the goals espoused by the groups are shaped in this process. In summary, I highlight both how the goals of the TPLF allowed them to mobilize some, but not all, sectors of Tigray. But at the same time, as these sectors joined the group, the goals espoused by the TPLF changed to accommodate their new membership.

2.2.1 TPLF

The rise of this small group of Tigrayan university students to a large rebel organization that mobilized hundreds of thousands was driven by the goals which the group formed by responding to the needs and desires of their constituency, which was mostly composed of peasants from the province of Tigray. While other contenders in the conflict, notably the EDU, the EPRP, and the Derg, were able to mobilize many Tigrayans, they failed to mobilize this same constituency as a result of incompatible goals. Some of these dimensions were inherited from conflicts within the student movement and the Selassie regime, such as the "nationality question," while others were a result of the revolution such as the land reform, religiosity, and the destruction of the feudal segments of the society that took different shapes in Tigray.

The TPLF originated in the student movement that dominated Ethiopia's higher education system before 1974. The first organization that can be traced as influential to the founding of the TPLF was the Tigrayan University Students Association (TUSA), which was formed in the early 1970s. Many Tigrayan university students, including all the founding members of the TNO —the precursor of the TPLF—, were involved in the association's activities. These individuals also participated in the broader Ethiopian student movement and, in most cases, took a leading role (Tareke, 2009; Berhe, 2009).[16]

At the center of the debates within the student movements at the time was whether the revolution should focus on the class or national contradictions. This was often named the "Nationalities Question." It centered on the extent that injustice in Ethiopia could be solved by self-determination of nationalities, and on the meaning of self-determination. In general, Tigrigna-speaking students embraced the view that the Shoan-Amhara feudal class dominated Ethiopia. They maintained that the resolution of this contradiction was a prerequisite to class emancipation (Young, 1996). This divide represents more than just theoretical and ideological differences; it was at the center of different views of Ethiopia's future would be shaped. The nationalities question would become one of the most long-lasting disputes between all participants during the war and even today. The other members of the student movement split themselves between two rival Marxist-Leninist organizations the Ethiopian People's Revolutionary Party (EPRP) and the All-Ethiopia Socialist Movement (acronym in Amharic, MAISON). These groups differed on several substantive issues, such as their views on democracy, centralization of the state, and the nature of land ownership (Tareke, 2009; Joireman, 1997).[17]

On 14 September 1974, seven university students held a meeting in Addis Ababa (Berhe, 2009).[18] The students were all part of the educated and rich peasantry and the lower local nobility. However, the members of these classes did not usually have the resources to live a

[16]Prominent members included Abbay Tsehaye, who still survives in the EPRDF leadership, Aregawi Berhe, one of the founding members of the TPLF, and Berhane Eyasu, a leading member of the competing Ethiopian People's Revolutionary Party (EPRP), who was killed fighting the Derg.

[17]MAISON supported state ownership with usufructuary rights and EPRP supported individual ownership.

[18]The students were Zeru Gessese, Fantahun Zeratsion, Mulugeta Hagos, Ambay Mesfin, Alemseged Mengesha, Amaha Tsehaye, and Aregawi Berhe. Ato Gessesew Ayele (Sihul), twice an MP and a popular representative of the Tigrayans, who was outside the student movement, was also a part of the group but could not attend the meeting for security reasons.

lifestyle that set them apart from that of the lower classes with whom they were more likely to be aligned than with than with the higher noble class (Young, 2006). The meeting aimed to consolidate the goals of the TNO, and determine how best to achieve them. In summary, the participants decided to form a leftist group with a socialist democratic movement that viewed the self-determination of ethnicities within Ethiopia, particularly the Tigrayan people, as the central component of their struggle. (Berhe, 2009; Young, 2006).

By February of 1975, the group was joined by other members totaling eleven men and began their conflict against the Derg. Except for the elder Sihul, his brother Berhane Ayele, and Asghede Gabre Selassie, a former enlistee in the Ethiopian army, all were university students (Tareke, 2009). Another group was sent to train with the EPLF. This group would then be joined by a few other Tigrayns, mostly former EPLF fighters.[19] In late April of 1975 the contingent departed Eritrea to join the rest of the TPLF. They totaled 21 fighters but only half of them were armed with a few rifles (Berhe, 2009).

By May 1975, the members of the TPLF training in Eritrea had rejoined the group in Tigray. Now numbering 43 combatants, they spent the next few months training and raising support in nearby villages (Berhe, 2009). However, at this time the first crisis in the TPLF took place. Berhe (2009) describes his first-hand account of the crisis between the few peasants that had joined the group and the students who had created it.[20] The peasants were discontent with the student's leadership. Particularly, they disliked the notions of equality and collective leadership in the movement as it put Sihul, a long-standing Tigrayan leader who they viewed as a more traditional leader, on equal footing with the students. This group did not want the traditional relationship they had with their leaders, which they considered a better one, to be eroded. Thus, they attempted a take-over of the group, which failed. According to Berhe (2009), the peasant leaders of this movement escaped, while the remaining peasants were given a choice of leaving or staying in the group, accepting the group's positions. This early crisis depicts the difficulty the TPLF had in mobilizing support from peasants. While anti-central government sentiments, desire for self-determination for Tigray and general discontent against the Derg drew in support from the peasants, it was

[19]For example, Yemane Kidane, Girmay Jabir, Dirfo, Wodi Ala, and Kokeb.

[20]Aregawi Berhe, who until 2018 was a history professor at the University of Leiden, and now is the chairperson of the Tigray Democratic Coalition Party, was a founding member of the TPLF.

clear that the more traditional Tigrayan peasants differed from the students with the more modern/Marxist worldview. This fact was likely not missed by the TPLF's leadership, as they held meetings to access the situation and embarked on a new plan to grow the group (Berhe, 2009).

By September 1975, the group had undertaken its first operations against the Derg (Markakis, 1987).[21] They further began talks with the TLF to discuss merging the two movements. There is little information about the TLF as it stopped existing as a group early in the conflict. However, it is known that it was founded in the early 1970s by two university graduates, Yohannes Tekle-Haimanot and Gebre- Kidan Asfaha, around the urban centers of northeastern Tigray. While they were successful in mobilizing some urban elements they had a hard time mobilizing peasant support (Young, 1996). Unlike other groups created by university students, the TLF was not part of the student movement. Berhe (2009) speculates that this is due to their extreme position concerning the nationality question. The one manifesto from the group Kiya Tigrai (History of Tigray) argued for the complete independence of Tigray. Further, there are some indications that the group wished to create a greater Tigray incorporating the Tigrinya-speaking regions of Eritrea (Tareke, 2009).

The accounts of the interaction between the two groups are not clear. In his first-hand account of the events, Berhe (2009) claims that despite some differences in the two group's goals, the meeting was a success and there was a mutual desire to merge. A second meeting was set to finalize the details, namely the scope of self-determination, and the centralized nature of the TLF's leadership compared to the elected nature of the TPLF's leadership. However, following the meeting the TLF split into 3 sides. The reasons for the split are not clear, but some former TLF fighters claim it was displeasure with Yohannes Tekle-Haimanot's leadership (Berhe, 2009). The group led by Yohannes had killed some members of the TLF, thus the TPLF decided to overpower this small faction and allowed other TLF fighters to join the TPLF.[22] While some observers claim the TPLF liquidated the TLF, it is more apt to describe this as a merger, with the elimination of those who disagreed with the merger, this view is supported by Young (2006).

[21] Notably, they broke into a prison in the Shire Police station to free one of their leaders, Mussie, and a raid in the Aksum where they captured weapons and money on September 4th.

[22] Young (2006) provides a similar narrative.

Following the merger, the TPLF continued its process of consolidation and preparation for the first "Fighters Congress". The congress was held in February 1976 and was attended by all 170 members, most of which were students (Young, 1996). In this congress, the group clarified some of its positions, most notably on the question of self-determination of Tigray. Until this time, the TPLF organized itself under the TNO's foundational document which stated the group's main goal was to realize the self-determination of Tigray within the bounds of a democratic Ethiopia. However, the manifesto published after the congress was altered such that the self-determination of Tigray (and other nations) included secession (Berhe, 2009). This shift towards a more extreme interpretation of the nationalities' questions is most likely a result of the preferences of newer members of TPLF that had joined after the group began its armed struggle. For example, members of the TLF, which held more extreme views in this regard, joined the group a few months earlier. While it is not clear if this was the reason behind the goal shift, Berhe (2009) notes that this shift was a result of "more parochial nationalists" in the movement. In 1978, the TPLF again flipped on its views on secession, removing it as an option. This seems to be a result of pressure from internal and external opposition. However, this was a point of contention within the movement for the remainder of the conflict (Young, 1996; Reid, 2003).

Another development of the congress was the creation of committees to facilitate the managing of the group. Of particular importance in this analysis are the political and socio-economic committees. Through these committees, the TPLF underwent a process of larger and more systematic engagement with the population of Tigray, and eventually succeed in mobilizing large numbers of peasants to join their movement. Young (1996) notes from his interviews that many within the TPLF refer to this period as the "social work" stage of the movement, where they attempted to engage with the peasantry and solve practical issues of importance to them. The TPLFs social work focused on differentiating themselves from the Derg and other movements in two main ways, their governance of local communities, and land reform.

The TPLF engaged local communities by promoting self-governance. This included not only the creation and empowerment of separate associations of different groups such as men, women, and youths but also holding elections for local government. Anyone over the age

of 18 and a member of a mass association could stand for elections for district government (Young, 2006). Segers et al. (2009) conclude that a good summary of the TPLFs governance is that they engaged in consensus building based on communal collective participation and discussion led by the TPLF's leadership. Another institution that the TPLF reformed was the courts. Although there was variation in the local courts in TPLF territories, Young (2006) notes that in general they were accountable, accessible, and operated by local people, decisions were made promptly and costs were minimal. While this system may not necessarily constitute high levels of democracy as understood by political scientists, it is clear that it was more of a representative government than the peasants had under both the Selassie and Derg regimes, and more than other organizations such as the EDU and EPRP offered.

The TPLF's governance also demonstrated its commitment to operating within the religious peasant culture. The movement recognized that the Ethiopian Church was a major component of feudalism, but also that many churches were not wealthy and that parish priests were often as impoverished as the peasants. Thus, they made efforts to gain the support of these parish priests. Further, their refrain from imposing anti-church policies like the Derg and overtly atheist rhetoric like many other Marxist movements gained them the goodwill amongst both the Church structure and the religious peasants. Young (2006) For example interviews two priests, who claimed membership in the TPLF for 17 years as political cadres, by "agitating" people in newly liberated territories. He further estimates that many lay priests and deacons joined the movement as fighters. While the TPLF did argue for changes within the Church they took care to not push away its religious supporters. This is crucial as outside the largely secular leadership, most Tigrayan peasants and many fighters were devoted (Berhe, 2009).

Another goal used to mobilize support for the TPLF was land reform. While the Derg's reform gained support in other parts of Ethiopia, it did little for the highland free peasants, and removed a major source of income for many, especially in Tigray through the ban on seasonal migration to work in commercial farms and land rental. The TPLF thus aimed to create its version of land reform to engage the peasantry. The TPLFs reform took many of the popular portions from Derg's reform, particularly the abolition of gulti rights, the redistribution of church land, and abolishing the risti system which often led to expensive

court disputes over land.

Unlike other parts of Ethiopia, in Tigray, the major problem was land scarcity rather than land concentration (Tareke, 2009). This meant that redistributing land was not an effective goal. Thus, the TPLF pressed their land reform slogan as "the land belongs to the community" which was generally understood as communal ownership rather than state ownership. This was operationalized as the reform being carried out by the local communities with the guidance of the TPLF. Thus, there were different approaches in different districts. Another key aspect of the reform is that the TPL maintained two critical economic practices that the Derg abolished, land rental, and seasonal labor (Hendrie, 1999; Chiari, 1996). The last major difference between the two reforms is that while the Derg placed land rights on the household, the TPLF vested it on individuals. Every person, regardless of sex, religion, or ethnicity, was eligible to receive land upon reaching adulthood, with minimum ages stipulated by law. This had profound implications for the status of women, marriage and divorce practices, and how the young separate from their parent's households (Hendrie, 1999). The status of women in the TPLFs Tigray is especially relevant as by the mid-1980s they constituted 25-30 % of the fighters, and held positions as high as company-level commands (Tareke, 2009).

The key aspect of the TPLF's mobilization is that the land reform and their system of governance were shaped by the individuals that supported the group, mainly the peasants. Both in the way they governed Tigray and in their main economic policy, the land reform, the TPLF deferred to their base of support. One example is that at first, the TPLF attempted to closely control trade, prices, merchandising, and levy taxes. This resulted in shortages, and dissent among not only merchants in towns but also many peasants, who engaged in trade to supplement their earnings from their plots.Young (1996) notes that the TPLF consulted with their base, which led to the policy change of voluntary contributions and low interference, with the exceptions being necessities export, luxuries import, and cattle trade to Eritrea. Further, Berhe (2009) argues that the leadership's main concern with these policies was in not losing the confidence of the base, especially since at the time they could still easily switch their support for the regime or a rival front.

Overall, the TPLFs mobilization of the Tigray demonstrates the importance of individual

preferences in shaping group formation, and the group's goals. Differences in these preferences lead to some early struggles within the group For example the early crisis between the peasants and students. Further, similarities in goals allowed the TPLF to merge, although with some dissent, with the TLF. Although the TLF did have slightly more extreme views concerning Tigrayan independence, the two groups were very similar in most regards, and many of the TLF's fighters stayed with the TPLF. However, it could be argued that this merging empowered more extreme sectors with the TPLF which pushed the TPLF towards naming independence as a goal. Although this would alter again in a short period as the movement grew. Lastly, the way the TPLF governed and implemented land reform showed deep concern for the preferences of its supporters. In other words, this sector of society was able to shape and constrain some of the group's policies. Of further importance is the observation that the goals of the group changed dynamically as it grew and expended. As the group gained in power and incorporated more constituent groups of Tigrayan society, their goals changed to accommodate them, but not always perfectly matching the preferences.

2.2.2 Other Contenders in Tigray

Despite the success in mobilizing many peasants in Tigray, the TPLF was not initially able to mobilize all sectors of Tigrayan and Ethiopian society. Notably, due to differences in goals, they failed to mobilize the previous feudal sector and the peasants with ties to them, especially in Tigray. Other sectors of Tigray such as urban centers tend to support the EPLP in the early stages of the conflict. Also, many peasants, especially those engaged in seasonal work, led by local nobles joined the EDU. Further, the TPLF could not gain the direct allegiance of their ethnic brothers in the neighboring then-province of Eritrea. The TPLF could not mobilize these sectors due to differences in preferences, and the group's lack of strength. However, through military success, the group became stronger which later allowed them to incorporate some of these sectors later in the conflict.

The EDU was a counterrevolutionary force that emerged with the end of the Selassie regime. It was formed by loyalist army officers, Amhara and Tigrayan nobles, and local

shfitas.[23] It was led by the prince and former governor of Tigray, Ras Mengesha. The group claimed its goal was to reinstate the former pro-western government but in a reformed, democratic setup (Berhe, 2009). This drew support from many peasants who still had traditional ties with the feudal regime and disliked Derg's anti-religious policies. More importantly, the EDU's early dismissal of the Land Proclamation of 1975 drew many supporters from the commercial farming areas.[24] Supporters included both those who ran the farms and also their workers who saw their livelihood threatened (Young, 2006). The EDU also appealed to a broader Ethiopian nationalism, it stressed its membership came from all regions of Ethiopia.[25] As such, it could neither support the more regionalist goals of some Tigrayan and Eritrean separatists. Nor did the group gain the support of many of the educated youth, which was early supporters of the TPLF, and the EPRP, as they could not accommodate their leftist leanings Young (1996). Thus, while both the TPLF and EDU gained support from peasants, they also had very distinct early bases of support.

Like the EDU, the EPRP also appealed to a broader Ethiopian nationalism. However, like the TPLF its origins are in the Ethiopian student movements. The EPRP was especially successful in mobilizing members of the trade union federation, the Teachers Association, the University Teachers Forum, and student organizations, all of which were strongly opposed to military rule (Markakis, 1987). The group made a definite split with the rest of the movement under MAISON following the "Programme of the National Democratic Revolution" Wiebel (2015). MAISON joined with the Derg military regime and supplied it with the socialist language it would use for its duration. Joireman (1997) The student groups differed on key issues such as the nature of democracy, state centralization, and land rights. However, the proclamation did seem to also win over some EPRP members as eight of the founders deserted the group and took a substantial number of weapons and ammunition (Young, 2006). This split devolved into the "Red Terror" which would eventually claim thousands of lives all around Ethiopia and Eritrea. However, its more immediate effect was to drive the urban opposition led by the EPRP into the countryside by 1978 Wiebel (2015).

[23] Armed gangs that operated in the remote highland areas as a mix of bandit and militias.

[24] For example, Humera and Wolkait in the far west, and Metemma in the extreme west of neighboring Gondar province

[25] Although, mostly their support came from Tigray and its neighbors to the South, such as Gondar.

Following their retreat from the urban centers, the EPRP set up in Tigray to rebuild their movement. The consensus on why the group moved to Tigray was their proximity to Eritrea, whose larger and better-equipped groups supported the EPRP, and that many of the group's leadership were Tigrayan ethnics (Tareke, 2009). However, despite some ethnic links with the peasants, the EPRP struggled to mobilize support in the region. This struggle to win over the Tigrayan peasants can be shown by a meeting that took place in Sobia woreda in 1978 described by Young (2006). The goal of the meeting was to decide if the district would support the TPLF or the EPRP. The peasants decided to support the TPLF. One spectator, Mabrato Adhana described their decision as: "People supported the TPLF because they felt that two political organizations in one area were not desirable... also the Tigrayan people have the same culture and same problems, and the EPRP should go to its homeland and fight for their poor and oppressed." Another, peasant stated that "they [EPRP] were not interested in staying in rural areas to help the people struggles"(Young, 2006).[26] This event highlights the inability of the EPRP to mobilize support from Tigrayan peasants, despite many in leadership being Tigrayans. This failure is a result of their stance on the nationality question, and their lack of appeal to issues important to the peasants.

The EPRP's origin as an urban group led by ethnically diverse students was effective in mobilizing support in the urban centers of central Ethiopia, and as such, it developed a political program with this sector in mind. However, this social group also did not see the peasantry as a revolutionary force (Young, 2006). They pursued goals that were not attractive to most Tigrayan peasants and attempted to control peasant organizations in an authoritarian manner. Further, the EPRP's broad Ethiopian appeal, while attractive to some more urban and educated sectors of Tigrayan society, did not resonate with many peasants. While it is clear that the EPRP was less dogmatic than MAISON and the Derg in regards to the nationality question, it is also clear that they did not use ethnic nationalism to mobilize support. For example, Tareke (2009) states that the EPRP "saw Tigrayan identity and Trigray's past as important components of Ethiopian identity. Its understanding of ethnicity and territoriality was anchored in material conditions and class relations." This

[26]This event took place during a period where Berhe (2009) claims peasants had a large degree of freedom in selecting which front to support.

view can be attributed to the EPRP's fear of the proliferation of nationalist movements to free Ethiopia as it could lead to the disintegration of the Ethiopian state (Markakis, 1987). These differences would eventually lead to conflict between the TPLF and the EPRP which would eliminate the EPRP as a competitor in the conflict. Despite their defeat, it is clear that the EPRP did succeed in mobilizing much support outside Tigray in the urban centers and also some support from more educated, urbanized, and less anti-Amarahan Tigrayans. For instance, Berhe (2009) notes that once the EPRP program was initially declared in 1975, many TPLF members seriously considered joining the EPRP as a united front.

Other fronts that succeeded in mobilizing many Tigrayans-speaking highlanders against the Derg were the Eritrean fronts, the ELF, and the EPLF. In many ways, the central highlands of Eritrea are an extension of Tigray and it accounts for slightly over 50% of Eritrea's population. It is mostly inhabited by Tigrignya-speaking Christians, who are mostly cultivators. Further, the region has a long shared history with Tigray as part of Abyssinia until Italian colonization. (Markakis, 1987; Reid, 2003) However, in other ways, it presents a different demographic makeup. The period of Italian colonial rule from 1890-1942, transformed the region in ways not experienced by those in Tigray.[27] The colonial regime introduced a cash economy and a significant amount of infrastructures such as schools, hospitals, a central postal service, telephone systems, and a railway connecting Asmara, the largest city in the highlands and capital of Eritrea, with the important ports of Massawa and Kassala. Further, they built commercial agriculture and industrial plants which attracted many peasants, including those from Tigray to the urban centers (Clapham, 1990). The lowlands of Eritrea in contrast are inhabited by Muslim pastoralists, and except for the port towns, the region was much less urbanized.[28] The lowlands are inhabited by a few different ethnic groups, most notably the Tigre,[29] Beja, Afar, and Saho. There is little evidence of mixing between the two regions with the highlanders being mostly farmers having little interest in the pastoralist lowlands and vice versa. Urban centers were the exception to the segregation between pastoralist Muslims and Christian cultivators, as both groups were equally repre-

[27] Italian colonial rule was followed by British rule until 1952.

[28] Other small ethnic groups like the Bilen and Kunama also inhabit the region, however, they are more religiously diverse with members practicing Islam, Christianity, and Animist religions.

[29] Not to be confused with the Tigray. They speak Tigre a related language to Tigrignya and are overwhelmingly Muslim paternalists.

sented in towns. However, there were still divisions with Christians making up the majority of industrial workers and Muslims the majority of the service and trade sectors (Markakis, 1987).

The conflict in Eritrea began in 1961 as a struggle for Eritrean Independence. Here I skip over much of the conflict's history to highlight that two main forces emerged in Eritrea. The first was the ELF, which was founded by mostly Muslim exiles in July 1960 as a response to the Government's disregard for the Federal relation Eritrea had with the rest of Ethiopia, and its overt Orthodox Christian leaning. The ELF operated in the lowlands and identified itself within the Arab world in political, economic, and cultural factors. The group held a view of an Independent Arab-Islamic Eritrea and even went as far as to establish Arab as the group's official language. In fact, until 1965 there were no Christians in the group's leadership and hardly any members (Woldemariam, 2016; Clapham, 1990; Markakis, 1987). This overt Arab worldview drove away many Christians and some Muslim components who believed in Eritrean independence. In 1973, three splinter groups mostly made up of highland Christians and a few Muslims merged to form the EPLF. The rise of the EPLF, coupled with the fall of the Selassie regime and the red terror led to a mobilization of the mostly Tigrayan highland society which until then had been marginal in the Eritrean struggle (Woldemariam, 2016; Tareke, 2009). The EPLF proposed a different future for Eritrea where while independent of Ethiopia, the relationship between the two states would be indispensable. Further, the group believed that forming a relationship with what was perceived as the feudal regimes in the Gulf region went against the more Marxist worldview of the EPLF. Lastly, the group attempted to de-emphasized religion and ethnicity going as far as to recognize both Tigrigna and Tigre as official languages (Markakis, 1987; Berhe, 2009). While the two groups fought for an independent Eritrea, the divergent goals of the groups would lead to a series of conflicts between them.

Both Eritrean fronts were able to mobilize components of the Tigrayan society during the Ethiopian Civil War. While the ELF was able to mobilize some Tigrayans early on, its overtly Arab-centered worldview drove them away and led to the formation of the EPLF which mobilized the Tigrayan highlands of Eritrea to a much greater extent. This group however mobilized a very different Tigrayan society than that which was mobilized by the

TPLF in Tigray. Not only was the Eritrean identity, which was mostly developed as a result of colonial rule, relevant in this sector but also the Eritrean-Tigrayan population experienced much higher levels of development and industrialization and as such had different concerns from the peasants in Tigray. For example, while between 1976 and 1978 the EPLF did carry out land reform, its main goal was not the fair and equal distribution of land, nor its nationalization, but rather to maintain production and eliminate landlessness (Markakis, 1987). Further, Young (2006) notes that there is little evidence that familial and commercial ties between the two Tigrayan communities increased political consciousness. Rather, the peasants in Tigray believed that the issues in Eritrea were only significant to Tigrayan intellectuals.

Together with the TPLF, these groups represented the anti-Derg movement in the Tigrayan regions of Ethiopia (including modern-day Eritrea). Each of these groups mobilized different sectors of the population in that region by offering different and sometimes competing goals or policies to implement after the conflict (and when possible during it). The interaction between these groups, both conflictual and cooperative is partially driven by these different goals. In the next section, I recount these interactions.

2.3 THE TPLF AND ITS ALLIES

The various groups operating in Tigray during the Ethiopian Civil War have a lengthy and intricate history of interactions, which have had significant consequences. In this section, I focus on recounting one of the most consequential cooperative interactions among them, the intermittent alliance between the TPLF and EPLF. I further outline the creation of the EPRDF coalition which included the TPLF and EPLF as well as other smaller groups, most prominently the EPDM. This coalition ultimately defeated the Derg regime, and the TPLF and EPLF emerged as the leading forces, subsequently governing their respective countries post-war. Various factors, including the capabilities of each group and the government, influence the cooperative behaviors of these groups. However, I would like to emphasize how shared goals played a crucial role in facilitating initial cooperation, while changes in the

goals of both groups contributed, at least in part, to the alliance's dissolution in 1985 and its subsequent reinstatement in 1988. Additionally, I would like to underscore the significance of goals in bringing together the EPLF, TPLF, and other organizations within the EPRDF coalition.

2.3.1 The TPLF and the EPLF

Cooperation between the Tigrayan and Eritrean liberation movements existed before the onset of the TPLF's conflict against the Derg regime in 1975. Tigrayans in the student movement, especially in the University of Asmara in Eritrea, had ties with the EPLF and ELF. However, due to a shared cultural identity and better Marxist credentials, these ties were closer with the EPLF (Young, 1996).[30] These ties were critical to the initial phase of the conflict for the TPLF. The role of the EPLF in training, arming, and even allowing its fighters to join the TPLF in 1975,[31] are some examples of the benefits of cooperation with the EPLF for the TPLF (Berhe, 2009). Cooperation was also beneficial for EPLF as the TPLF opened a new front against the Derg which greatly hindered their lines of supply to fight in Eritrea which often passed through Tigray, and allowed the EPLF to use the recruits from TPLF it trained in combat.[32] In short, two groups cooperated from the onset of the TPLF. This cooperation was so close that by the early 1980s, their leadership maintained daily radio contracts to coordinate political and military activities (Young, 1996).

This cooperation with the EPLF was possible as the two groups shared much in common. Besides their opposition to Ethiopian absolutism in both the Salassie and Derg regimes, both groups had ties to the student movements and the Marxist outlook it entailed and shared cultural (linguistic and religious) ties (Plaut, 2016). For the EPLF, its support to any group rested ultimately on the acceptance that Eritrea was a colony of Ethiopia and therefore had the right to secede from it (Young, 1996). This was a view that at face value was not an issue for the TPLF and its membership, and especially at the early stages of the conflict

[30]Further, some members of the EPLF were also former members of the broader Ethiopian university student movement from which the TPLF originated.

[31]Examples of EPLF veterans joining the TPLF in that early stage include Mahari Haile who became the first military commander of the group and Yemane Kidane who became a member of the Ethiopian government after the war (Plaut, 2016).

[32]This was especially relevant during Operation Red Star in the 1982 (Young, 1996; Tareke, 2009).

was seen as a similarity as it seemed in line with the TPLF's position of self-determination of Ethiopia's nationalities. Similar cooperation was considered but never reached with the EPRP and never considered with the EDU, over larger and perceived as insurmountable differences. Namely, the EPRP's view on the nationalities questions as subsidiary to class issues and the impossibility of a peasant revolution, and the EDU's roots in the monarchical regime. Further, while the TPLF also had an early alliance with the ELF, this alliance quickly breakdown over a series of issues, notably their cooperation with the EDU.

The groups, while sharing similar and compatible goals, had significant areas of differences that became more apparent over time as their goals and external factors influencing these goals changed. One major difference is in how they categorized self-determination and their national identities. This issue gained prominence in 1976 after the TPLF's First Fighter's Congress, where a shift in the TPLF's definition of self-determination, possibly influenced by more nationalistic members, included independence (Berhe, 2009). This posed a problem for the EPLF, which framed its conflict as an anti-colonial struggle. This issue highlighted two crucial differences in their goals. First, the concept of an independent Tigray implied aspirations for a greater Tigray, encompassing Tigrinya-speaking areas of Eritrea, which the EPLF found unacceptable (Young, 1996). Second, the EPLF feared that such an interpretation of the nationalities question might encourage ethnic minorities in Eritrea to seek independence, contradicting the EPLF's Eritrean nationalist goals (Plaut, 2016). While this shift in goals in 1976 led to tensions between the groups, with some claiming that relations halted for a short period (Young, 1996), cooperation soon resumed. However, the EPLF continued to pressure the TPLF to modify its stated goal. By the Second Fighter's Congress in 1979, the TPLF amended its views to define the Tigray question as an issue to be addressed within Ethiopia and abandoned calls for the formation of a greater Tigray (Trivelli, 1998). However, the issue remained a source of friction between the two groups as the TPLF never internalized their commitment to this view.

Cooperation between the two groups remained stable until about 1986. Part of this stability is likely a result of Operation Red Star, which started in 1981. The operation aimed at militarily crushing the Eritrean movements saw a drastic increase in the Derg's fighting capacity in the region and threatened both the EPLF and the TPLF, making the military

benefits of cooperation indispensable (Tareke, 2009). However, after successfully surviving the government offensive, the relationship between the groups again began to sour. However, this was not only due to the decreased benefits of cooperation. Cooperation would not break down until 1985, almost four years after the Red Star Offensive ended.[33] Further, the two groups experienced shifts in their goals in the period between 1982 and 1986.

The rifts between the two groups, which led to the cessation of cooperation, first came to a head in 1983. These differences stemmed partially from tactical decisions made during the 1981 Red Star Campaign. The EPLF adopted conventional warfare early in the conflict, while TPLF was committed to not holding territory. For example, the TPLF evacuated its main bases in Western Tigray on four separate occasions before 1989, under pressure from Derg forces (Young, 2006). This divergence in tactical approach was a significant point of contention between the two groups, partly because the EPLF utilized TPLF recruits in their costly conventional defense. However, according to Young (1996), these clashes were more about the perceived democratic and popular nature of the groups rather than solely about tactics and strategy. One TPLF fighter emphasized this observation, "We don't want to distance ourselves from the general population for whom we are fighting. We aren't an army but a liberation movement, and our people have to be convinced that we are operating on their behalf. The mutual trust and confidence that we now enjoy would be lost if we turned Tigray into a site to carry out large-scale heavy armament fighting" (Young, 1996). In contrast, the EPLF viewed their struggle as a war for independence, necessitating a conventional approach to secure territory for their independent nation-state.

While these differences strained the relationship between the two groups, they did not immediately break it. It was not until 1985 that the cooperation between the TPLF and EPLF came to a halt. This shift in the behavior of the two groups corresponds to shifts in the goals of the two groups. By 1984 a sector of the TPLF leadership was consolidating power within the group. This cadre of leaders would establish themselves under the brand of the Marxist-Leninist League of Tigray (MLLT) in June 1985.[34] The aim of the MLLT, which

[33] And, with it, the best hope for a Derg victory in the foreseeable future (Young, 2006).

[34] The MLLT is not a different group. Rather it served more as a leadership or "vanguard" group within the TPLF. Almost all of the MLLT central committees were also members of the TPLF's central committee and the fighters and supporters saw no distinction between them (Berhe, 2009).

served as a Marxist party within the group was to replace the broader ideological and political orientation of the TPLF up to then with a more tightly defined party logic (Gebregziabher, 2019). The MLLT was led by Meles Zenawi who rose to become the preeminent leader of the TPLF by 1989. Meles was particularly influenced by and admired the Albanian model of anti-Soviet socialist states which thought to maintain its self-reliance (Plaut, 2016).

This shift in stated goals clashed with the EPRP in two important ways. First, during the mid-1980s the EPLF attempted a rapprochement with the Soviets who at the time supported the Derg regime in Ethiopia. The EPLF's sympathy with the Soviets was in part due to their shared understanding of Marxism. They believed the USSR to be a genuine socialist state and a strategic ally of any oppressed peoples. This view was further propagated by fears of US imperialism in the region and its expectation that an independent Eritrea would fall under the Soviet-dominated Eastern Block post-conflict (Young, 1996). Further, Eritrea was not a member of the United Nations and therefore Soviet support (or at least acquiescence) as a permanent member of the Security Council could be important to secure its legitimacy as an independent state, a factor that became more important as EPLF's chances of victory seemed to be increasing significantly after their victory in the Red Star campaign. This problem was not as relevant for the TPLF as Ethiopia was already recognized as an independent state and was a member of the UN (Plaut, 2016).

In contrast, the TPLF held the view that the USSR, once a legitimate socialist state, had deviated from its principles and transformed into an imperialist power that oppressed both its own people and others abroad (Berhe, 2009). This perspective gained significance due to the USSR's extensive support for the Derg regime in the recent Ogden Conflict against Somalia and the ongoing civil war in Ethiopia. The TPLF argued that, alongside the Derg, the Soviet Union was the primary enemy of the revolution. Their conviction was so strong that they refrained from condemning the United States, unlike the EPLF, as they perceived the U.S. to have little influence in the region at the time (Young, 2006).[35]

While in some ways these arcane debates about communist lore and interpretation seem

[35]It is important to note that the TPLF's relatively amicable view of the U.S. should not be misconstrued as being pro-American or supportive of Western influence in the region. They simply saw no need to unnecessarily antagonize the U.S. However, during much of the civil war, the U.S. predominantly viewed the TPLF as a Marxist organization controlled by the EPLF (Young, 2006).

trivial, they were a major source of friction between the two groups. Scholars widely agree on the significant importance of this dimension in exacerbating the deteriorating relations between the two groups. (Young, 2006; Plaut, 2016; Berhe, 2009; Clapham, 1990; Tareke, 2009). Further, Young (1996) cites Meles Zenawi[36] to state in 1988 that the issue of the Soviet Union was the main division between the TPLF and the EPLF. In many ways, this debate is sensible as it gets to core issues about the future of Ethiopia and the region more broadly. Especially in the context of the Cold War choosing between the East and West, or in the case of the TPLF neutral, was of extreme consequence for the post-conflict status quo in the region and the role of each state in the broader international system.

Besides the growing issue of the Soviet Union caused by the MLLT's more explicitly anti-Soviet stance and the EPLF's growing desire to gain acceptance from the USSR, the old issue of national determination returned to relevance in the mid-1980s. Trivelli (1998) argues that the TPLF's argument about self-determination experienced another shift around 1985. The political discourse of the group began to blur the previously explicit distinctions between colonial and national issues which were of extreme importance for the relationship of the two groups. Specifically, the TPLF argued that a referendum was the only way to settle both issues. This issue was problematic for the EPLF as it questioned Eritrea's right to independence due to its status as a colony, and raised issues of ethnic self-determination within Eritrea. In particular, the TPLF challenged the "democratic" nature of the EPLF for not recognizing the right of self-determination for minorities within Eritrea (Tareke, 2009). The issue of self-determination never disappeared as a source of friction between the two groups as argued by Clapham (1990) given the ethnic and historical connection between Tigray and Eritrea the self-definition of Tigrayan identity could not be divorced from their relation with Eritrea and Ethiopia. However, the attempt at characterizing a Tigrayan identity propagated by the TPLF around 1985 was more problematic than in the past as it was orthogonal to the EPLF's reasons for Eritrean independence.

Self-determination within Eritrea was an issue for the EPLF as it attempted to mobilize irrespective of religion and ethnicity despite the territory of Eritrea being multi-ethnic and

[36]The head of the MLLT Central Committee and arguably the leader of the TPLF who would become the President (and Prime Minister) of Ethiopia.

composed of (at least) nine linguist groups who, according to the TPLF's new position had the right of self-determination including independence (Tareke, 2009; Trivelli, 1998). The EPLF spent considerable efforts in re-enforcing a broader Eritrean identity in their recruits, and to represent all ethnicities in the leadership. However, a majority of the Kunama and Afar people of Eritrea were indifferent about independence or outright hostile to it. Further, many highland Christians who were the backbone of the EPLF's recruitment still supported the Ethiopian regime and worked in the administration or served in local pro-government militias as late as 1982 (Plaut, 2016). This greater emphasis on national self-determination for all nations, even in Eritrea, by the TPLF was potentially harmful to the EPLF in two separate ways. It put in question the independence of Eritrea if not popularly supported and opened the possibility of the balkanization of Eritrea by its different ethnicities. For its part, the EPLF combated this shift by emphasizing the colonial nature of their right to independence and argued that the Ethiopian nationalities' right to self-determination, did not include independence as this right was dependent on the colonial experience, a stance which was problematic for the Tigrayan nationalist components of the TPLF (Plaut, 2016).

In June 1985, around the same time as the establishment of the MLLT, the TPLF and EPLF broke off their relationship. The end of this cooperation had immediate effects on both organizations. For the EPLF, the withdrawal of the TPLF contingents from the trenches in Eritrea was a blow to the EPLF as it now had to withstand the Derg's offensives without the manpower provided by the TPLF (Berhe, 2009). Following the termination of cooperation, the EPLF cut off the supply lines used by the TPLF that led to Sudan via Eritrea and stopped TPLF radio broadcasts from within their territory (Young, 1996). Cutting off the TPLF from their supply lines was possibly disastrous given that the region faced one of the worst famines in modern times. Tareke (2009) claims that due to the drought about two-thirds of the province was severely effect by drought between 1983 and 1985 leading to thirty-six thousand deaths, as well as eighty-nine thousand permanently displaced people who were resettled in southwest Ethiopia, as well as up to a million temporarily displaced placed people mostly to Sudan.[37] A larger disaster was prevented by the mobilizing of around

[37]These numbers are considerable, even when not considering that the population of Tigray at the time was about 3-4 million people.

10,000 peasants by the TPLF to construct a new road system that did not go through Eritrea. This impressive feat allowed food and supplies to reach Tigray again within weeks of the closure of the Eritrean route (Tareke, 2009; Plaut, 2016). Despite the souring relationship with the EPLF as a result of these actions, the two groups did not engage in conflict.

Cooperation between the two groups would not restart again until 1988. During the three-year hiatus, significant changes had taken place which would facilitate this rapprochement. First, the military situation had altered considerably in that period. Despite the lack of aid from the EPLF and the famine in Tigray between 1985 and 1987, the TPLF had refitted its forces and became a large, well-equipped, and efficient army (Tareke, 2009).[38] This increase is due partially to military success against the government as well as the successful implementation of their policies and relocation of their base to the region of Sheraro following the break with the EPLF which allowed them to become more self-sufficient and provided a more defensible zone to grow the organization. This self-sufficiency is relevant given that the drastic increase of food production in the region, coupled with the newly built road to Sudan helped the TPLF gain the "hearts and minds" of many in Tigray by reducing the burden imposed by the famine (Tareke, 2009). Another factor that changed the power distribution in the conflict was the peace deal reached between Somalia and Ethiopia over the Ogaden which freed up to twenty thousand soldiers for the Derg to redeploy to fight against the many rebel groups (Young, 1996). These conditions increased the benefits of cooperation for both groups, but also the TPLF to renegotiate with the EPLF from a stronger position. However, these were not the only factors facilitating a renewed alliance in 1988.

The goals of both groups saw significant change between 1985 and 1988. Certain changes stemmed from external factors, while others emerged from internal interactions within the groups. By 1988, the USSR was pulling back from the region. This shift was so significant that in 1988 the Derg regime started to back down from its extreme socialism. For example, it gave substantial concessions to private investments and began to shift to a "mixed-economy" (Zewde, 2002). This shift in global power politics as well as the decreased ideological allure

[38]The scale of this change in part shown by how in 1978 the front had three battalions (around three thousand soldiers) by 1988 the TPLF fielded an army of around fifty thousand regular fighters.

of socialism in the face of Soviet weakness also led to both the EPLF and TPLF to revisit their positions. In 1987 the EPLF held its second congress where Ramadan Muhammad Nur was sidelined and replaced by Isaias Afewerki as the General Secretary of the front while his close affiliate Sebhat Ephrem became the head of the army general staff. This shift in leadership resulted in the change of the EPLF's goals to embrace a more pragmatist ideology. The EPLF's National Democratic Program of 1977 was officially scrapped in 1989, effectively distancing it from Marxism-Lenninsm and therefore Soviet Block which was collapsing at the time (Tareke, 2009).

Likewise, the TPLF around this period began to revisit the Marxist-Leninist ideology it had exposed under the MLLT and embraced the more western-friendly Revolutionary Democracy economic and political program (Gebregziabher, 2019). In an interview in 1990 while on a visit to the United States, Meles Zenawi argues that "We are not a Marxist-Leninist movement. We do not apply Marxism-Leninism in Tigray... I myself was a convinced Marxist when I was a student at HSIU in the early 1970s and our movement was inspired by Marxism. But we have learned that dogmatic Marxism-Leninism is not applicable in the field. We do not believe that any foreign system can be imposed on a country. The only way people can be liberated is on their own terms and in accordance with their own traditions and their own situation...We believe in developing a practical approach to the problems we face. We are aware of what has been happening in the world" (Paul B. Henze Papers, box 76, folder 11). This statement does not imply that the TPLF had abandoned its Marxist ideology Berhe (2009). While interpretations of the Revolutionary Democracy system vary, Gebregziabher (2019) succinctly summarises it as an ideology based on Marxism that served to bridge it with market liberalism through market socialism following an ethnic-based approach to political and social rights. The main point is that like the EPLF, the TPLF was introducing some elements of liberal ideologies palatable to Western democracies. But more importantly, this distancing from their previous strict and overt Marxist framing essentially removed the issue of the role of the Soviet Union in the region that had been a primary area of division between the two fronts in 1985. No longer was the EPLF as keen to defend the Soviet Union, while for the TPLF the issue was not of primary importance as Soviet intervention in the region seemed less likely while its Democratic Revolutionary

ideology aimed to balance its Marxist roots with market liberal ideology.

The changes in goals experienced by both groups also led to a less conflicting view of the Nationality Question. The TPLF never abandoned its perspectives on the self-determination of nationalities, which included the right to secession. Meles Zenawi was even a primary force pushing for the inclusion of this right in the 1994 constitution (Aalen, 2006; Berhe, 2009). However, despite this unwavering position on the nationalities issue it seems that by 1988 while independence was theoretically still possible it was not desired given a new regime that respected the rights of the nationalities (Young, 2006). By 1988 under their more "pragmatic" approach, the TPLF seems to have settled against the idea of independence. The exact reasons for this shift are unclear but range from a belief that an independent Tigray would not be sustainable and could lead to further oppression of its people to opportunism from the TPLF's leadership in the face of being the main power brokers in a post-conflict Ethiopia (Berhe, 2009). Further, the group also began to place greater emphasis on cooperation with other groups, including non-ethnic based groups such as the Ethiopian People's Liberation Movement (EPLM) in 1987 (Young, 2006). In short, by 1988 the TPLF seemed to be more flexible concerning the issue of independence of nationalities in Eritrea as it seemed less relevant for its defense of their possible independence.

By 1988, the circumstances surrounding the conflict and the two groups had undergone significant changes compared to when they severed their alliance in 1985. The joint declaration on the goals of the alliance further highlights these changes, but also how the alliance itself was dependent on some level of compromise. In 1988, the EPLF and TPLF resumed their collaborative efforts based on five shared perspectives. Firstly, they aimed to overthrow the Derg regime. Secondly, they condemned the interference of superpowers in the region, particularly focusing on the United States and the Soviet Union. Thirdly, they acknowledged the Eritrean struggle for independence. Fourthly, they recognized the right to self-determination for the nationalities within Ethiopia. Lastly, they emphasized the necessity for both national and multinational organizations (organizations not based on ethnicity) to unite in the struggle (Young, 2006; Berhe, 2009). This agreement exemplified compromise from both groups. The EPLF, by criticizing both superpowers, deviated from its previously pro-Soviet inclination, while the TPLF compromised by condemning

the United States, which the EPLF had consistently denounced. Although the TPLF had previously argued against condemning the US, this no longer carried significant political consequences given the approaching end of the Cold War. Additionally, the statements regarding self-determination, although vague, demonstrated compromises made by the groups. The omission of mentioning the nationalities in Eritrea while recognizing their right to independence, along with the recognition of the rights of Ethiopian nationalities, showcased a delicate balance as the EPLF had viewed the recognition of Ethiopian nationalities with skepticism. However, this recognition was tempered by a stronger emphasis on collaboration with multinational forces, which the TPLF would have preferred to minimize (Young, 1996). These compromises proved effective as they facilitated cooperation between the two groups. The renewed alliance, coupled with the increased strength of both fronts, immediately impacted the war. Between 1989 and 1990, they achieved a string of impressive victories against the Derg regime, notably in the battles of Af Abet, Shawa, and Massawa, ultimately leading to the defeat of the Derg in 1991 (Tareke, 2009).

It is not my aim to argue that the changes in goals brought the groups together rather than changes in power dynamics or some other factor. Rather, these factors are indistinguishable and part of the same complex system of interactions. In this section, I aim to highlight the changes in the goals of the different actors involved in the conflict and that at the very least, they are related to the resumption of the alliance in 1988. Further, while the goals of the two groups seemed less in opposition in 1988, there were still substantial differences between them, and for cooperation to resume the two made concessions (at least temporarily) in their joint statements. This joint statement affected the perception of the goals of the groups and would become the basis for the peace deal in 1991 (Berhe, 2009).

2.3.2 The Formation of the EPRDF

In the previous section, I focused on the relationship between the EPLF and TPLF for two reasons. First, it was the most crucial alliance in the conflict and served as the center of gravity for all other cooperation decisions in the late stage of the war. Second, the changes in the relationship between these two groups highlight patterns in alliance decisions

during conflicts. However, the alliance between these groups was not the only example of cooperation in the conflict, and in the late stages of the war, it was one edge in a network of alliances called the Ethiopian People's Revolutionary Democratic Front (EPRDF). This was an alliance between a series of smaller groups dominated by the TPLF and EPLF. In this section, I briefly summarise how the EPRDF coalition formed, focusing on the alliance between the TPLF and EPDM.

While the origins of the EPDM are clear, the circumstance under which it developed is less so. One clear component of their emergence is that the EPDM is a splinter group of the EPRP which developed following its defeat by the TPLF in the 1970s. The group held its first congress in November 1983 (Clapham, 1991). However, there are different explanations for the development of the EPDM in the conflict. Ademe (2022) recounts the two main narratives. The first points at dissatisfaction within the EPRP with its dismissive narrative of the nationalities question that prevented a more pragmatic approach to engaging with the issue and other groups. The second claims that the TPLF infiltrated the EPRP to create the EPDM as a puppet multi-national movement. The real events are probably somewhere in the middle of these two narratives. It is possible and even likely that the TPLF had some role in encouraging the transition into the EPDM of the small remains of the EPRP. However, it is unlikely that the group was a creation of the TPLF.

For one, leaders of the EPDM, such as Tamrat Layne (former Prime Minister of Ethiopia), refute this narrative. Second Berhe (2009) argues that the TPLF leadership in 1983 was divided around the issue of cooperation with multi-ethnic groups and despite a decision being reached to engage with such movements in the second fighters congress in 1983, no concrete attempts were made to engage with such groups, including the EPDM.[39] Berhe (2009) argues that it was not until 1985-1986, with the prospects of fighting outside of Tigray, especially without the EPLF, that the TPLF made serious attempts to engage with the EPDM. This narrative matches with Trivelli (1998), who argue that it was in 1985 when the EPLF attempted to reach an agreement with the EPDM that the TPLF stepped in and

[39] At the time the EPDM considered itself as a multi-ethnic group, although after the conflict under the new ethno-federalist model of government imposed by the EPRDF coalition, it would transition into the Amhara National Democratic Movement (ANDM) and became an Amharic party as this ethnicity represented a majority of its membership Ademe (2022).

began to bring the EPDM under its tutelage.

By 1986, the EPDM was heavily cooperating with the TPLF and held some territory in the province of Wollo south of Tigray. While it was an independent group all its political and military actions were highly coordinated with the TPLF and carried out with extensive TPLF support. This deep cooperation has given rise to claims that the EPDM was only a TPLF puppet.[40] The goals of the EPDM at its onset are hard to distinguish, but by 1988 it is clear that the group was in line with TPLF in all of its core goals. Namely their understanding of Marxism, the approach to self-determination, and the views on the Soviet Union (Young, 1996; Berhe, 2009). The only two factors dividing the two groups were that the EPDM was at the time not an ethnic-based group and claimed to represent all Ethiopians and that the majority of the membership was of Amhara origin.

In 1989, two significant and interconnected events contributed to an increase in the level of cooperation and coordination between the EPDM and TPLF. The first event was the establishment of the EPRDF, which formalized a coalition comprising the TPLF, EPDM, and EPLF. As part of this process, two additional groups were"created", namely the Oromo People's Democratic Organization (OPDO) representing the Oromo people, and the Ethiopian Democratic Officers' Revolutionary Movement (EDORM) composed of Ethiopian army officers who had switched sides (Tareke, 2009).[41] Under the agreement between the TPLF and EPLF mentioned earlier, this coalition worked together to combat the Derg regime. The second event was the formation of the Ethiopian Marxist Leninist Force (EMLF) during the Second Congress of the EPDM. The EMLF served as a counterpart to the MLLT within the EPDM and played a role in ensuring the TPLF's influence and adherence to the MLLT's party line on key issues (Clapham, 1990; Berhe, 2009).

The creation of the EPRDF was the culmination of the cooperation between the TPLF,

[40]These claims are similar to perceptions of the TPLF as an EPLF puppet that persisted even into the 1980s, despite clear evidence that two groups were separate, albeit highly interconnected at both the individual and group level. However, until the EPRDF creation in 1988, such claims about the relation between the TPLF and EPLF seem tenuous, and even after 1988 it is still more useful to classify them as independent groups cooperating at the highest possible level with a hierarchical structure not dissimilar to those described in Lake (2011).

[41]Because these groups were relatively powerless and formed within the EPRDF, I will not delve into their cooperation decisions. However, the creation of separate groups within the coalition to accommodate different identities sheds light on the challenges faced by fully unified groups in accommodating diverse sets of goals.

EPLF, and their minor partners, namely the EPDM. Following their alliance, the coalition won a string of victories against the Derg regime demonstrating both domestically and internationally that the regime would lose eventually. By 1991 peace talks between the EPRDF and the Derg were being held in London alongside the other major stakeholder in the final days of the conflict, the Oromo Liberation Front (OLF) which quickly reached accommodations with the EPRDF late in 1990.[42] The war officially ended on May 28, 1991, when the EPDF forces entered the capital before the finalization of the peace agreement in London. However, the groups present at the conference would soon begin forming the transition government (Berhe, 2009).

2.4 SUMMARY

In this chapter, I have presented an overview of the Ethiopian Civil War (1974-1990), specifically on the developments in Tigray and the groups that operated in the region. In the first section, I provide a background to the pre-conflict situation in Tigray and describe the different clusters of individuals that the rebel groups would attempt to mobilize during the conflict. I then highlight the mobilization of the groups in the region with a focus on the TPLF and the role their goals played in the process. I then compare this with the other organizations operating in the region and their interactions with the individuals they aimed to mobilize. Lastly, I focus on the cooperation between the TPLF and the EPLF. I again highlight the role of different goals espoused by these groups in determining the status of their interactions. This cooperation eventually led to the creation of the EPRDF coalition with smaller junior partners, most notably the EPDM, a splinter group of the EPRP.

This analysis does not aim to test specific hypotheses or offer a comprehensive overview of the conflict. Instead, its purpose is to underscore the significance of goals in the formation and cooperation of groups. By doing so, it exemplifies the interconnectedness between these

[42]The OLF existed since 1973, but given that emerged in Southeastern Ethiopia, it falls outside the scope of this analysis. But in short, the OLF did not have a cooperative relationship with the TPLF, which resulted in the creation of the OPDO in an attempt by the TPLF to gain support from the Oromo people(Tareke, 2009). The OLF did, however, have an on-and-off cooperative relationship with the EPLF, which facilitated the cooperation with the EPDF in the closing stages of the conflict.

two aspects, which is a fundamental feature of the theory and models presented in this project. In subsequent chapters, I will revisit this case to emphasize essential components that bridge the Agent-Based Model with real-world events.

3.0 GOALS AND GROUP EMERGENCE

In this chapter, I theorize and model group formation to set up a framework for how individual preferences lead to group goals, and how these goals are key to group formation. To do so I will use a generative social science approach and construct an Agent-Based Model (ABM) of group formation. Before I construct the model I review the relevant literature on group formation and set up the theoretical foundation for the model. I then describe the ABM and a model of society construction and I test the implications of my theorized framework of group formation. Lastly, I connect the model and its results to group formation in the Tigray region during the Ethiopian Civil War.

More precisely, I show that models of group formation based purely on the private benefits offered by groups as a result of the power of the rebel group fail to explain observed implications about groups in civil wars, namely the existence of more than one rebel group. At the same time, I show that the inclusion of individual preferences is sufficient to explain the emergence and continuation of multiple contenders in a civil war. Further, it highlights how the underlying macro-level structure of a society influences observed patterns of group formation. Specifically, it shows that rebel groups tend to form around clusters of individual preferences. However, these clusters, which can be thought of as identities in society, are not perfect predictors, as the correlation between these clusters and their relative size influences which groups are likely to form. Further, the model provides one explanation of how groups with similar goals can form a conflict. When a society is composed of distinct yet similar clusters of individual preferences, which are too small to offer sufficient private benefits to motivate union, groups with similar ideal points will form.

Next, I theorize a model of social macro-structure based on social identity theory, where the preferences of individuals are structured in clusters such that these clusters inform both

an individual's preference point along a dimension and the relevance of that dimension. I then encode this model in the Agent-Based Model (ABM) framework described in the previous chapter. The ABM then shows how groups will form based on this macro-level structure by emerging based on clusters of individual-level preferences. This division of groups along preferences illustrates the mechanism through which groups fail to join together despite the incentives of larger groups. I then model a complex society and show how different patterns of group formation can emerge given a set of preferences in a multidimensional space. Specifically, it shows that rebel groups tend to form around clusters of individual preferences. However, these clusters are not perfect predictors, and the correlation between them and their relative size influences which groups are likely to form. Further, the model provides one explanation of how groups with similar goals can form during a conflict. When a society is composed of distinct yet similar clusters of individual preferences, which are too small to offer sufficient private benefits to motivate union, groups with similar ideal points will form. The emergence of different numbers of groups given a societal structure provides a first indication that preferences are sufficient to keep groups from joining together as one group, yet possibly not sufficient to prevent alliance formation.

Last, I analyze the ABM modeling framework I developed and its results in light of mobilization in Tigray during the Ethiopian Civil War, with a focus on the TPLF. This analysis highlights how key features of the ABM can be found in the mobilization of groups in the region. Particularly I focus on the role that goals played in individual level cooperation to form groups, thus linking macro-structures with micro-level decisions. However, I also note that these same goals were prone to change as a result of growing membership of the TPLF.

3.1 GROUP FORMATION IN CONFLICT

One approach to explain the formation of sides during a crisis begins by grouping individuals based on their position on support or opposition to the status quo. A prominent example of this framework is seen in selectorate theory as argued by Bueno De Mesquita et al. (2003). Earlier works such as Tilly (1985) also build from a similar set of assumptions.

In this framework, there is a competition between incumbent political elites and potential challengers to capture the government's power over the distribution of resources in a given society. These studies assume that a crisis will affect everyone in a given society equally. However, this is unlikely. Due to preference heterogeneity within populations, different individuals interpret crises differently. The same political opportunities that create a movement against the status quo also affect other complementary, competing, and hostile sectors of the population (Tarrow, 2011). Thus, it is important to relax the assumption that individuals either fall inside or outside of the selectorate. While this assumption artificially constrains the number of actors to two, relaxing it opens the possibility that multiple challengers can form as a result of different preferences amongst individuals. I argue that, under some distributions of these individual preferences, there are sets of goals that can generate sufficient support to challenge the status quo. The number and content of these policy portfolios depend on the underlying structures of the society.

Research on group formation often emphasizes the importance of coercion and access to private goods as motivation for joining rebel groups (Olson, 1965; Weinstein, 2005; Eck, 2014). While such factors are important, I argue that they are not sufficient to explain why groups facing the same source of grievance sometimes fail to come together and coordinate their position on key issues. If individuals joined groups to maximize the private goods, we would expect groups to form following Riker (1964)'s logic of minimal winning coalition. This is because they would prefer to join a group sufficiently large to win the conflict, yet small enough that private goods are distributed to the smallest number of people possible. The logical implication is that in any civil war there should not exist more than two groups in the conflict. These groups would be a challenger and the incumbent government. This logic maps closely to previous theories such as that of Bueno De Mesquita et al. (2003). However, this logic does not match observed patterns in civil wars. For example, Walter (2019) shows that between 1946 and 2013, 46% of civil wars involved more than 2 rebel groups and that the majority of these groups formed independently of one another.[1]

Despite it not being sufficient to create multiple challengers, the logic of minimum coalition does provide a useful model to understand the patterns of group formation in civil war.

[1]Only 12% of these groups formed as a result of splintering.

It is safe to assume that all participants wish to be sufficiently powerful to win the war, and maximize their private benefits. However, this alone cannot explain the observed patterns of group formation. Therefore, it is essential to account for other factors. I argue that individual preferences and group goals greatly shape group formation. Rebel groups are deeply involved in naming and constructing frameworks and narratives around grievances to construct their goals precisely because these goals are key to forming and maintaining the group. Even rebel groups who infamously relied on little support from local populations, such as the Revolutionary United Front (RUF) in the Sierra Leone Civil War, created narratives over equitable distribution of diamond revenues, better access to health care, education, and ethnic/religious equality and attempted to communicate these goals to followers.[2] This is because mobilization for a collective purpose requires that rebel groups create consensus between individuals with different demands and identities who they would like to incorporate into the group. This process means that rebel groups form around a defined set of policies that are agreed upon by the group's members to implement after a successful civil war.

To outline a framework of rebel group emergence, I assume that all individuals in a society have payoffs over all possible policy portfolios that can be offered by all possible challengers and the incumbent. These individuals rationally select among the alternative policy portfolios to maximize their payoffs. These payoffs are dependent on an individual's preferences, which have two key components. The first is the position of the individual on a specific policy. I assume that all policies can be mapped into a dimensional space, with a point signaling a specific policy. While most preferences can be mapped onto a one-dimensional space, others such as ethnicity and religion, cannot. These policies can be more easily mapped into a two-dimensional space, by presenting a vector with a magnitude and direction.[3]

The second component is how much each individual cares about each specific policy, this can be operationalized as the weight of each policy dimension when comparing proposed policy portfolios with the individual's preferred positions. Given a specific level of private incentives, the payoff for an individual is maximized when the status quo policy portfolio

[2]This information is drawn from Footpaths to Democracy: Toward a New Sierra Leone, the RUF's Manifesto.

[3]For more detail, see the section on multi-dimensional goals in the ABM Creation Section.

matches his preferred positions across all relevant policies. As the distance between the status quo and the preferred point of an individual increases, he/she becomes more aggrieved, decreasing the utility of being part of that society. The more important an individual places on a dimension, the more grievance is generated by a larger distance between the status quo and his preferred position.

In any polity, aggrieved individuals coordinate to challenge the government and create organizations to oppose the status quo imposed by the incumbent government. Individuals thus join groups to pool their resources towards an agreed purpose (Weinstein, 2005). Similarly, rebel groups attract followers to create a sufficiently strong movement that can use force to challenge the state. To begin the process of group formation, group leaders must first propose a portfolio of policies that explain the consequences of a successful rebellion. As such, possible members can decide to join or not, based on their ideal points and the group's proposed policies by calculating if the challenger will increase or decrease their grievances as well as taking into account any private benefits.

Goals allow groups to mobilize because they are excludable, jointly-produced goods – goods that individuals desire but cannot provide by themselves – also known as group goods (Hechter, 1988). Treating goals as group goods is not an entirely new concept. Studies such Chandra (2005), and Warren and Troy (2015) have treated related concepts such as ethnic identity as group goods. However, I argue that all goals, not only those that are related to identity, are excludable and jointly produced. They can be understood as jointly-produced goods because individuals cannot change the status quo nor overthrow the incumbent government alone. Rather, they must share resources to create a sufficiently strong challenge to decrease their grievances. Further, these goals are excludable because only individuals who are members of the group can influence how the group will change the configurations of policies in society. Membership in the group is necessary to be part of the agreed consensus of the group, while those who are not members do not engage in any decision-making processes that the group has. Thus, both the challenger and status quo goals, represented by their proposed policy portfolios, can be thought of as jointly produced goods around which groups in a civil war mobilize.

Precisely because goals are excludable, jointly-produced goods, they are shaped by the

preferences of the group members. As more individuals join the organization, the group's goal reflects the preferences of all of these individuals. Thus, because organizations are a reflection of their members, the set of policies pushed by rebel groups is susceptible to change as the group attracts more supporters or loses current members. Therefore, goals increase the payoff for some individuals through the possibility to decrease grievances brought upon by the current status quo. Yet, goals also serve to push individuals away from other individuals who are also discontent with the status quo. For example, imagine two individuals A and B who share the same source of grievance, the current status quo C. If the status quo C is between the preferred policies of A and B, their preferred set of policies are even more distant from each other than each set is from the status quo. As such, joining together against the current set of policies can be prohibitively costly, even if private goods can be used to increase the benefits of cooperating.

In studies that fall under the broad term of contentious politics, there is growing evidence that non-material rewards are key to motivating participation. For example, Wood and Jean (2003) finds evidence that the primary motivators of participation were mostly non-material and performative. These motivators include the value of participation, defiance of repression, and the pleasure of working to accomplish change. More recently McClendon (2014) finds that in-group esteem is a key force behind participation in protests. These non-material benefits do not negate in any way my claim that goals are used as club goods. Rather, they should be seen as relevant dimensions in which individuals have preferences, and working with other individuals who do not share these preferences is costly.

Thus far I theoretically argued that individuals form groups to pool their resources to move the status quo set of policies that creates individual grievances. In civil wars, this is done through violence. Because groups are formed to move the status quo, the preferences of the individuals and that of the group matter to the individual's decision to join or not a group. In this framework, I specifically argue that individuals care not only that they are inside the winning coalition but also about future policy outcomes. This leads us to two testable implications. The first is that a model of group formation based on the power of groups and the desire of individuals to be in a group which is the minimum winning coalition will always lead to the formation of two groups in a society facing a civil war, which can

be described as the challenger or rebel group; and the incumbent or the government. The second implication is that the addition of individual preferences which are made of a position and the importance of each policy dimension is crucial to group formation, such that it is sufficient to generate observed patterns in the number of groups that form.

3.2 AGENT-BASED MODEL OF GROUP FORMATION

I use a generative social science approach to explain the emergence of rebel groups with varied goals in a conflict. In this approach, researchers grow social structures in computer simulations to show that a set of micro-specifications suffices to generate the macro-phenomena of interest, in this case, group formation, and later cooperation (Epstein, 2006). Agent-Based Models (ABM) are the main analytical tool of this approach. They work by "situating an initial population of heterogeneous agents in a relevant special environment; then allowing them to interact according to simple local (user-specified) rules which generate the macroscopic regularity from the bottom-up" (15) (Epstein, 2006).

As a tool for studying complex dynamics, ABMs are uniquely suited to exploring the observational implications of my theory as it argues that groups emerge out of the complex interplay between competing government and potential rebel leaders for individual support, in a system defined by hierarchy and the constellations of individual preferences within a multi-dimensional policy space. Further, the theory suggests that groups emerge out of the interdependence of individual choices acting with bounded rationality to decided what group they support. Often interdependence between such agents prevents analytical solutions to models, thus computer simulations present the best alternative to solving models with the interdependence of agent choices (Laver and Sergenti, 2011). ABMs are particularly helpful as they allow my dissertation to explore the mechanisms that have been ignored in previous studies on group formation as a result of their complexity. Further, this added complexity may allow me to address some of the contradictions in the predictions about cooperation. Moreover, modeling group formation presents an important form of exploring group formation as it is often hard to observe directly. Thus, creating a modeling framework

that can reproduce observed patterns of group formation is an important step in explaining cooperation at the individual level and eventually group level in civil wars.

Thus, I construct an ABM of group formation where I make a set of assumptions and simplifications about real-world group formation in civil wars while clarifying and formalizing important theoretical principles highlighted so far. This allows me to study group formation as I have theorized while maintaining some important complexities of the process. More precisely, I can test the theoretical implications highlighted in this chapter.[4] While, the model itself is grounded on the literature described in the previous sections. The ABM framework I develop here is sufficiently flexible to instantiate models that include different micro-specifications about individuals and groups, as well as macro-structure that stretches across different theoretical perspectives.

I begin by populating the model with individual agents indexed by $(n_i \in N | i \in \mathbb{N}_0)$. Each agent represents a person agent that is a member of society and the total number of people in a society is given by the cardinality of the set of agents $|N|$ which is a parameter defined in the model. This model has a second type of agent, groups $(g_i \in G | i \in \mathbb{N}_0 > |N|)$. Group agents emerge as a property of the model through people agents interacting at each iteration $t \in \mathbb{N}_0$ where T denotes the number of iterations. If there are no groups in the model then $G_t = \{\}$. Each n agent has four attributes. The first attribute is the status S_{nt} of an agent. In a society, $S_{nt} = \{Individual, Member, Leader\}$. At the onset of the model, all agents are set to the $Individual$ status. This signifies that in the beginning, no individual agent n is part of a group g.[5] As the model progresses, the status S_{nt} of an agent can change as the agent either join a group g, such that $S_{nt} = Member$ or the agent forms a group g, becoming its leader, such that $S_{nt} = Leader$. This attribute is important to decide which behavioral rule an individual agent will follow.

Next, position P_n is a sequence such that $(p_d \in P_n | d \in \mathbb{N})$ the value in each d dimension is the preferred position of the agent for the dimension d. These dimensions d are the salient political and social identities found in society and the cardinality of $|P_n| = D$. Where D is the total number of dimensions and is a parameter in the model. For example, a society may

[4] I code the model described in this section using Python 3 and the Mesa package for Agent-Based Modeling (Masad and Kazil, 2015).

[5] This assumption can be relaxed and pre-existing groups may be coded into the model.

be divided along an economic dimension, a religious dimension, an urban-rural dimension, a democratic-authoritarian dimension, or any combination of these dimensions, amongst others. I assume that $-0.5 \leq P_{n_d} \leq 0.5$ where in each dimension agents can take any position between -0.5 and 0.5. This assumption implies that the dimensions can be laid out in a continuum where -0.5 and 0.5 represent the most extreme positions and the maximum absolute distance between two different agents is 1. For dimensions d such as authoritarian, ethnic, and religious preferences that cannot be mapped in a continuum, an accompanying angle $\theta \in \{0, 180\}$ is given to position P_{n_d}, and additional constraint $0 < P_{n_d} < 0.5$ is added. The calculation of distance is different for these cases but the same properties as one-dimensional preferences hold.[6]

The next attribute is the weight W_n which is also a sequence such that $(w_d \in W_n | d \in \mathbb{N})$. It represents the importance of position P_{n_d} for agent n. This attribute is related to my argument that the preferences of individuals are made of positions along relevant dimensions and the importance of each dimension. Here I assume that $0 \leq W_{n_d} \leq 1$ such that agent n places the highest possible weight on dimension d when $W_{n_d} = 1$. As discussed previously, the preference of an individual is his weighted position on a dimension. Thus, individual preferences are represented by $P_n * W_n$. Because of the constraints imposed both in W_n and P_n, the maximum absolute weighted distance between the preference of two different agents is still 1 for any d dimension.

The last attribute is C_n, the payoff an agent n receives from not belonging to any group such that $S_{nt} = Individual$. This value represents the opportunity cost of joining any group in the conflict and $-1 \leq C_n \leq 1$. Positive C_n values represent individuals in society who have a high opportunity cost for joining groups, while negative values represent individuals who will join groups even if the group does not provide any benefits. This attribute contains a lot of information about individuals. For example, large values of C_n could indicate individuals who have sources of income that would be lost by joining a group. On the other hand, it could indicate an individual for whom joining a group is extremely dangerous. Negative values can indicate individuals with pre-existing sources of income, or individuals in situations

[6] I do not use any two-dimensional preferences in this article because there is no difference in results and it simplifies the model, but such dimensions can be easily added. The Appendix Section on Multi-dimensional goals provides further clarification.

where non-participation in a group could be dangerous. Low values could also be found in individuals who are prone to being part of a group for psychological reasons. (Kalyvas and Kocher, 2007)

Like individual agents, group agents g also have four attributes. The first is $L_{gt} = \{n\}$ which is a set containing one agent $n \in N_{gt}$ where $S_{nt} = Leader$. This attribute signals which agent is the leader of the group. The next attribute N_{gt} is of all agents that are part of the group g such that $(n_i \in N_{gt} | n_i \in N)$. For all agents in $(n_i \in N_{gt} \notin L_{gt})$ their status $S_{nt} = Member$. The size of a group is given by the cardinality of the set agents in a group $|N_{gt}|$. For a group $g \in G_t$ them $|N_{gt}| \geq 2$. Group agents also have positions and weights that define their goals. The positions of a group at time period t are defined by the sequence P_{gt} such that $(p_d \in P_{gt} | d \in \mathbb{N})$. The elements in P_{gt} are the average position P_n of all agents in N_{gt} in a given dimension. Further due to the constraints placed on P_n, all $-0.5 \leq P_{gt_d} \leq 0.5$. Thus:

$$P_{gt} = \frac{\sum_{i \in N_{gt}} P_i}{|N_{gt}|}$$

Groups also have weights on each dimension given by the sequence W_{gt} such that $(w_d \in W_{gt} | d \in \mathbb{N})$. The elements in W_{gt} are the average position W_n of all agents in N_{gt} in a given dimension. Again, due to the constraints placed on W_n, all $0 \leq W_{gt_d} \leq 1$. Thus:

$$W_{gt} = \frac{\sum_{i \in N_{gt}} W_i}{|N_{gt}|}$$

These positions and weights represent the group's goals and are the average positions and weights of all the individual agents in the group. This encodes in the model the argument that groups are made of individuals who join to cooperate to change the status quo to a position that is agreed upon by the members of the group. As such, in the model agents can affect the position and weight of groups they are in pulling it towards their preferences. Here I assume that leaders and members have an equal say on the group's goal. This assumption can however be relaxed by weighting the averages such that $n \in L_{gt}$ has more weight in deciding the value of the elements in P_{gt} and W_{gt}.

Now I turn to the behavior of the agents in the model. These behaviors are the set of choices that an agent makes at each iteration, or t period, of the model. Once the society

is initialized, at every period t every agent $n_i \in N$ is paired at random with another agent n_j also drawn at random from the total population of agents in set N. To simplify $n_j = j$ and to the initial agent who is doing the behavioral actions as agent $n_i = i$. This pairing-off process is an analog to recruitment for a group where agent j serves as a recruiter for group g where $j \in N_{gt}$. As described above, the set of behaviors an agent has is dependent on its status $S_n t$. However, before I describe the behavior of each of these types I will describe important functions which are key to the behavior of all agents.

The first function is $B(N_{gt}, N)$, which represents the private benefits an individual agent receives from being a part of a group. As previously argued, the logic of minimum winning coalition is a good assumption to begin modeling group formation.[7] As such, I encode this logic into the payoff of being part of a group in the following function:

$$B(N_{gt}, N) \begin{cases} 0 & |N_{gt}| = 0 \\ 0 & |N_{gt}| \geq |N| \\ 1 & |N_{gt}| = \frac{|N|}{2} + 1 \\ \frac{1}{\frac{|N|}{2}+1} * |N_{gt}| & |N_{gt}| < \frac{|N|}{2} + 1 \\ \frac{-1}{N-(\frac{|N|}{2}+1)} * |N_{gt}| - \frac{-1}{|N|-(\frac{|N|}{2}+1)} * |N| & \frac{|N|}{2} + 1 < |N_{gt}| < |N| \end{cases}$$

The function shown above is a linear step-wise function that is maximized at 1 when the group size, $|N_{gt}|$, is equal to $\frac{N}{2} + 1$, where $|N|$ is the total number of agents in the model. This payoff decreases until it is 0 when the size of the group N_{gt} is equal to the total population of agents $n \in N$. Thus, $B(N_{gt}, N) \in \{0, 1\}$. The function B encodes the logic of minimum winning coalition in civil wars, assuming that if half plus one of the population supports a group it is sufficiently large to outright win the conflict and secure any private goods. Another underlying assumption of this model is that the group size is directly related to the number of private goods it can offer. Further, in this model, I assume that all agents have perfect information on the size of the total population $|N|$ and on the size $|N_{gt}$ of all groups.

[7] The logic of minimal winning coalition described in Riker (1964) has explanatory power across different areas of study. For example, Christia (2012) uses this logic to explain alliances between rebel groups.

The other key function is $R(N_{gt}, N, D, P_n, W_n, P_{gt}, W_{gt})$. All agents $n \in N$ base their decisions to join a group on the payoff of the function R, which represents the utility of an agent for being part of a group. The function is:

$$R(N_{gt}, N, D, P_n, W_n, P_{gt}, W_{gt}) = B(N_{gt}, N) - \frac{\sum_{d=1}^{D} |P_{gt_d} * W_{gt_d} - P_{n_d} * W_{n_d}|}{D}$$

In other words, the utility an agent receives for being part of a group is given by the payoff $B(N_{gt}, N)$ received from the group g minus the average absolute value of the weighted distance between the preferences of the group and the agent. Because of the constraints placed on the weights and positions of both people and group agents, the value is $0 \leq \frac{\sum_{d=1}^{D} |P_{gt_d} * W_{gt_d} - P_{n_d} * W_{n_d}|}{D} \leq 1$ and $0 \leq B \leq 1$. Thus, $-1 \leq R(N_{gt}, N, D, P_n, W_n, P_{gt}, W_{gt}) \leq 1$. This utility encodes the main argument of this section that as the preferences of an individual diverge from those of a group, the utility this individual gains from cooperating to change the status quo decreases.

I now describe the behaviors of agents $n \in N$, beginning with the behavior of an agent whose status $S_{it} = Individual$. After agent i is paired with agent j, agent i can either stay as is and not join any groups or join agent j's group $g_z = z$. If $S_{jt} = Individual$, then for the duration of the interaction, j forms a group z where $L_{zt} = j$ and $N_{gt} = j$, if by the end of the interaction $|N_{gt}| \leq 2$ then the group disappears such that $z \notin G_t$. Focusing on i's decision, if $R(N_{gt}, N, D, P_i, W_i, P_{zt}, W_{zt}) > C_i$ then agent i wishes to join j's group z. However, joining a group requires that both sides agree. Here, the choice is up to group z's leader. Thus, i joins group z if $R(N_{zt}+1, N, D, P_{L_{zt}}, W_{L_{zt}}, (P_{zt}|N_{gt} \cup \{i\}), (W_{zt}|N_{gt} \cup \{i\})) > R(N_{zt}, N, D, P_{L_{zt}}, W_{L_{zt}}, P_{zt}, W_{zt})$.[8] In other words, if group z's leader receives a larger utility from having agent i in the group than without him, agent o joins the group.[9] Note that in this evaluation, the Leader of a group z evaluates the absolute distance between himself and his group and compares it to that of the group if the agent i joined the group, while agent i compares his preference to that of a group z as it currently stands. This implies two assumptions. The first is that the agent x only considers the group's preferences and not

[8] If $S_jt = Individual$ such that j is not part of any group then the comparison is $R(N_{zt} + 1, N, D, P_{L_{zt}}, W_{L_{zt}}, (P_{zt}|N_{zt} \cup \{i\}), (W_{zt}|N_{zt} \cup \{i\})) > C_j$

[9] Or a new group z that is formed, with j as the leader.

how his preferences will affect the group. The second is that the group leader does consider how agent x may influence the group's preferences.

Next, I turn to agents with status $S_{it} = Member$ where $(i \in N_{wt} | i \notin L_{wt})$ meaning the agent is part of a group w but is not its leader. Agent i has a choice of either staying in his current group, joining the group of agent j (group z), or leaving both groups and returning to be an individual. In a situation where $R(N_{wt}, N, D, P_i, W_i, P_{wt}, W_{wt}) > C_i$ and $R(N_{wt}, N, D, P_i, W_i, P_{wt}, W_{wt}) > R(N_{zt} + 1, N, D, P_i, W_i, P_{zt}, W_{zt})$, the agent i stays in the current group w. However, if $C_i > R(N_{wt}, N, D, P_i, W_i, P_{wt}, W_{wt})$ and $C_i > R(N_{zt} + 1, N, D, P_i, W_i, P_{zt}, W_{zt})$ then the payoff of having status $S_i t = Individual$ is larger than what either group offers, such that agent n leaves both groups. If $R(N_{zt}+1, N, D, P_i, W_i, P_{zt}, W_i) > R(N_{wt}, N, D, P_i, W_i, P_{wt}, W_{wt})$ and $R(N_{zt} + 1, N, D, P_i, W_i, P_{zt}, W_{zt}) > C_i$ agent i attempts to joins group z as the utility of doing so is higher than of staying in its current group j or having $S_i t = Individual$. Before i joins group z, the leader of the group, $n \in L_{zt}$ must accept i in the group z. Again, $n \in L_{zt}$ accepts i if $R(N_{zt} + 1, N, D, P_{L_{zt}}, W_{L_{zt}}, (P_{zt} | N_{gt} \cup \{i\}), (W_{zt} | N_{gt} \cup \{i\})) > R(N_{zt}, N, D, P_{L_{zt}}, W_{L_{zt}}, P_{zt}, W_{zt})$.[10] These rules are similar to those for agents with $S_{it} = Individual$ and have the same set of implications. However, I further note that here I make a simplifying assumption that there are no additional costs associated with leaving a specific group. I make this simplifying assumption for ease of interpretation. The results will most likely not vary substantially when relaxing this assumption unless the parameter is extremely large.[11]

The final set of behavior is when $S_{it} = Leader$, such that agent i is the leader of a group w and $i \in L_{wt}$. This scenario mirrors a merger as all other agents $n \in N_{wt} \notin L_{wt}$ will also decide to follow agent i in joining a new group or leave both groups behind and return to status $S_{nt} = Individual$. Thus, before i makes a decision $n \in N_{wt} \notin L_{wt}$ are randomly drawn to indicate their support to join agent j's group z. The decision of these agents takes the same form as when $S_{nt} = Member$, except that instead of accounting for group z growing by

[10] Again, if $S_j t = Individual$ such that j is not part of any group then the the group z is temporarily created and $n \in L_{zt}$ compares $R(N_{zt} + 1, N, D, P_{L_{zt}}, W_{L_{zt}}, (P_{zt} | N_{zt} \cup \{i\}), (W_{zt} | N_{zt} \cup \{i\})) > C_j$. If this fails, the group z stops existing.

[11] While case evidence points to a cost to leaving groups, it also suggests that oftentimes this cost is not significant, and many groups allow members to part ways. This assumption can however be relaxed in the computational program to run the model and may warrant future investigation.

1 agent, they account for group z growing by $F+1$ agents where F is a set of all agents in $n \in N_{wt} \notin L_{wt}$ who have already signaled support to join group z. This process stimulates the leader of the group canvassing the group's membership about how they feel about merging with another group. Once all members of group w have signaled their preference, agent i makes a decision to join group z with the followers in set F, or stay in group w as it is. If $R((N_{zt} \cup F+1), N, D, P_i, W_i, P_{zt}, W_{zt}) > R(N_{wt}, N, D, P_i, W_i, P_{wt}, W_{wt})$ then agent i wishes to joining group z and joins the set F.[12] Again, the leader of the group z must accept the merger. This happens if $R((N_{zt} \cup F), N, D, P_{L_{zt}}, W_{L_{zt}}, (P_{zt}|N_{zt} \cup \{F\}), (W_{zt}|N_{zt} \cup \{F\})) > R(N_{zt}, N, D, P_i, W_i, P_{zt}, W_{zt})$.[13] If the group i joins group z, then $n \in N_{wt} \notin F$ leave both groups and return to status $S_{nt} = Individual$.

There are some assumptions in the ABM described above that are important to highlight. The first is that there are no groups at the model onset. In other words, all agents in the model have $S_x = \{Individual\}$ at $t = 0$. This assumption makes it such that the state is treated exactly like a rebel actor in the model. In the framework as defined, the state is simply the largest group in the model. While useful for computational efficiency and simplicity, this assumption is not realistic. A more considerate implementation of a state agent is likely to influence specific model outcomes, yet it is unlikely to affect the primary takeaways of the model discussed in the following sections.

I further assume that all agents in the model have perfect information about the population size of agents, the size of all groups, and the values of P_d and W_d of agents and groups. Also, note that all non-group agents have stable preferences (values of P_d and W_d). Group goals (values of P_d and W_d for group-level agents) are prone to change as agents join and leave groups. However, for group goals, I assume that all members of the group (all agents of status *Member* and the agent of status *Leader*) have equal importance in deciding the group's goals. Last, when deciding to join a group, the agent only considers the group goals and not how his preferences will affect them. But, the group leaders do consider how new members may influence group goals. I make this set of assumptions in the model to simplify

[12] Notice that when $S_{it} = Leader$ there is no option to leave the group such that no comparison is made with C_i.

[13] Although it is unlikely that this scenario happens if agent $S_j t = Individual$, than the temporary group z is created and the comparison C_i. Again if the merger fails group z is disbanded.

the model and its outcomes. However, it is important to note that relaxing any or some set of these assumptions may change model outcomes in some ways and thus must be explored in future work.

The last and most consequential assumption is that individuals join groups in an attempt to create minimal winning coalitions. The principle of minimum winning coalition has been used to explain the formation of political coalitions in a parliamentary setting and under some specific electoral rules. Further, it has been shown to be a useful approach to exploring group-level cooperation in civil wars by Christia (2012). However, this logic contrasts with works on group formation at a societal level under more broad and often peaceful scenarios which highlights a preference for the formation of groups of moderate size that represent a numerical minority of the total observable population (Brewer and Weber, 1994; Ellemers and Van Rijswijk, 1997). Optimal distinctiveness theory argues that this preference is a biological and cultural heuristic to maximize successful group cooperation, which is effective in smaller groups while maintaining sufficient size to maintain cooperation (Olson, 1965; Brewer, 2004). For example, previous ABMs of social group formation such as Smaldino et al. (2012) have set optimal groups to be 33% of the total population. Even though my model works at the society level like Smaldino et al. (2012), rather than at an electoral or parliamentary level, I argue that the logic of minimum winning coalitions is particularly useful for group formation in civil wars. Given the large and extended threat of violence and all else equal, groups with the support of 50%+1 of the population are the only group sufficiently strong to militarily defeat any other coalition that could form in the conflict.

Although the agent-based modeling framework I propose focuses on and is theoretically grounded in the process of rebel group formation, it shares many similarities with spatial models of electoral competition (Downs, 1957; Aldrich, 1983; Besley and Coate, 1997; Snyder Jr and Ting, 2002; Glazer, 2010; Laver and Sergenti, 2011). Like these models, actors in the ABM have an ideal package of policy positions that are key to their behavior. Further, when moving to a multidimensional space, these models often include weights on different dimensions (Glazer, 2010). The actors in my ABM also shares some parallels with the "citizen-candidate" approach used by Besley and Coate (1997), where each actor is both key in choosing the leaders of successful groups via their choice of which group to join and

thus which leader to support. But all actors are also capable of becoming the leader of a group if it is capable of attracting followers. Thus, many of the principles of the model are well-founded in spatial modeling.

However, the ABM I present in this section expands on these principles by allowing them to play in an agent-based framework which expands the number of relevant actors and the heterogeneity in the preferences of these actors. Laver and Sergenti (2011) does provide one example of an ABM of political party formation. Besides the already mentioned similarities with other models of party formation, the main similarity between the ABM proposed here and the ABM in Laver and Sergenti (2011) is the recursive nature of the interaction between agents and groups. In the aggregator version of their ABM, voters continually review party support and switch parties to increase their expected electoral success, and parties change policy positions to the preferred position of their supporters. Similarly, in this ABM, individuals continuously review their support to rebel groups while groups adapt the goals to their membership.

However, the distinctions between the two ABMs result from the different aims of the models and the nature of the conflict. This ABM seeks to explain how many groups will form and what characteristics these groups will have. As such, the groups in the ABM of group formation in civil wars are an emergent feature of the model that depends on the interactions of individuals period by period, and these actors must account for the conflict. In contrast, Laver and Sergenti (2011) seeks to understand the effect of different vote-seeking strategies, and agents do not account in any way for violence.

In the ABM I present, agents decide to support a group based on their policy preference as in the Laver and Sergenti (2011) model, but also on the private incentives offered by different groups. The inclusion of private incentives is crucial to the process of group formation during conflicts. These incentives capture the ability of groups to buy support through payments (in goods, money, safety, etc.) or through the threat of violence, as rebel groups and governments often do. More importantly, in the model, each group's strength defines both the private incentives it can offer and its probability of victory. I model this feature through the logic of a minimal winning coalition driving the behavior of all agents.

In civil conflicts, groups form such that they can defeat any other group militarily; this

is because group formation under the threat of violence makes it imperative to create sufficiently large groups to defeat militarily any other group that could emerge. Given the personal risks of fighting in the conflict, individuals must also consider the group's strength in their expected utility of participating, while accounting for how the group can distribute private incentives to offset the risks caused by violence. The benefits the group can offer to any given member are at the highest value when the group has $50\% + 1$ of the support in the country, as the tradeoff between the likelihood of victory and private benefits is maximized. These dynamics link group-level expectations of victory with individual needs through the logic of minimal winning coalition. Electoral rules such as single-member plurality, where only one party can win, approximate these incentives for group formation through minimal winning coalitions as used in the model. However, the principle of minimal winning coalitions would fail to capture the underlying mechanics under many other sets of institutions. Further, in peacetime, parties can form to raise awareness, push specific issues, or represent specific minorities, and individual support for a group is not necessarily tied to their participation in the group itself. Thus, not all organizations necessarily aim to form minimal winning coalitions in the electorate.

Thus, while in the endogenous parties version of the model the parties are also an emergent property of the model, their emergence and elimination are constrained by electoral cycles. This assumption is consistent with observations about elections where the process of party formation is a direct consequence of the electoral rules and institutions (Downs, 1957). However, during conflicts, groups are constantly growing and shrinking as a result of their successes or failures in mobilization. Thus, the model simulates this grassroots, continuous mobilization in a way that diverges from the electorally based mobilization in Laver and Sergenti (2011). These different features are also demonstrated by how groups form and disband in the two models. The emergence of parties in the Laver and Sergenti (2011) model is a probabilistic feature of dissatisfaction of an individual with existing parties where any individual can form a new party even if the agent has no supporters at the current moment and party death is not intrinsically tied to vote share. Thus, under some circumstances, parties can emerge or continue to exist without support. This modeling choice is consistent with party formation in peacetime as parties can exist regardless of their level of support as

there is no (or at least comparatively little) threat of violence, meaning barriers to group creation are low. However, in civil wars, groups can only exist once a leader has gathered some level of support through which they can act as a group in the conflict. But, if the leader loses all his members, a group no longer exists as individuals are not expected to survice fighting by themselves.

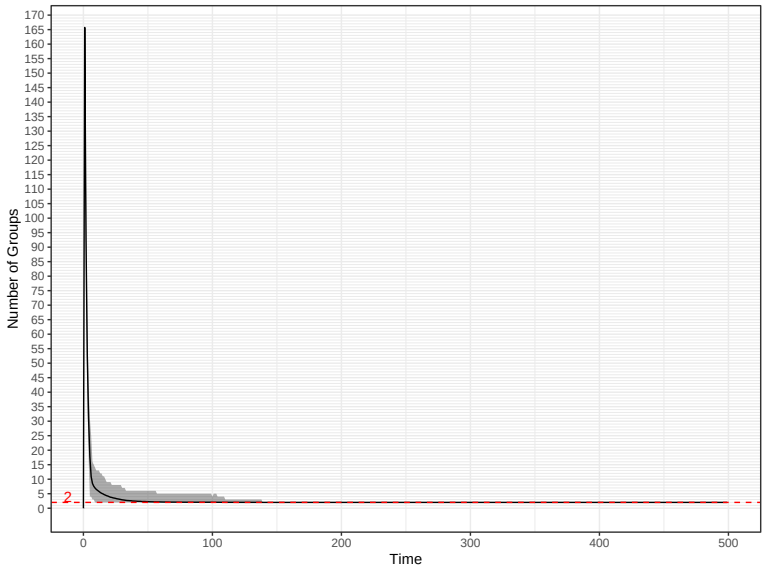
3.3 MINIMAL WINNING COALITIONS, GOALS, AND GROUP FORMATION

Using the Agent-Based Model described in the previous section, I can begin to show the link between goals and cooperation in civil wars. As is, the model allows me to test two implications of my theory. First, my theory predicts that a model of group formation that follows the logic of minimum winning coalitions is insufficient to reproduce observable patterns of civil wars, namely the existence of more than one rebel group. Second, I expect that the inclusion of individual preferences as defined by P position and W weight on the $D \geq 1$ dimension is sufficient to produce more than one rebel group. Demonstrating the sufficiency of a micro-specification, such as individual preferences, in creating macro-phenomena of interest, such as rebel group formation, is not sufficient to explain this phenomenon. However, being able to generate the phenomena is a necessary condition to do so. (Epstein, 2006). This does not imply that my model is the correct process of group formation, but rather that it is a possible candidate to model and thus explain this phenomenon. As such, the two implications of my theory modeled through the ABM are a starting point in understanding group formation and through it, cooperation in civil wars.

To demonstrate that minimal winning coalition logic cannot reproduce observable patterns of group formation in civil wars I run the Agent-Based Model of Group Formation but I make individual preferences irrelevant. This means that the driving logic of each agent is to maximize their utility of joining a group through function B, which encodes the logic of minimal winning coalition. This is achieved by setting the P and W parameters to be equal for all $n \in N$ agents across all dimensions. This implies that the absolute distance between

any two agents in the mode is equal to 0. Thus, I set $P_n = 0$ and $W_n = 0$ and $D = 1$ for all $|N| = 1000$ agents in the model. Another parameter that must be in the model is C_n, which is the opportunity cost for each agent. I set this value to be drawn from $C_n \sim N(0.3, 0.5)$ for each agent in each model run. This encodes the idea that this cost varies between individuals in society, but in general, individuals are more likely to have some opportunity cost associated with joining a group. I then run my model 100 separate times for $T = 500$ iterations each.

Figure 2: Number of Groups, No Individual Preferences

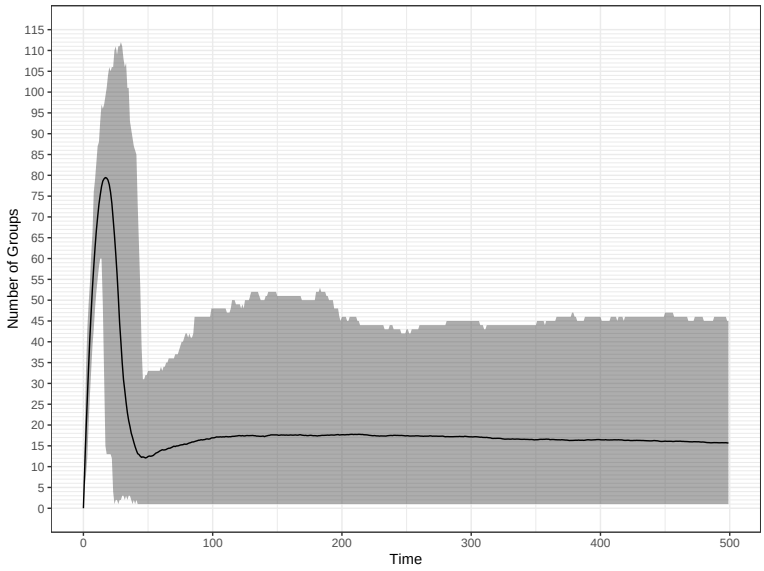


Graph 2 shows the average number of groups in existence at each t iteration for all the 100 model runs. The upper and lower bounds represent the minimum and the maximum number of groups observed in all of the runs. The graph shows a sharp increase in the number of groups formed. However, this is followed by a sharp decrease in the number of groups. This process is a result of larger, and therefore more powerful, groups beating out the competition by providing larger utilities to the followers of other groups, or their leaders. Given the expectations of minimum winning coalition logic; the number of groups unsurprisingly reaches an equilibrium at 2 for all 100 model runs. This outcome matches my theoretical expectation that if group power is the only factor influencing individual choices on joining groups in society, any society should have only two groups, a challenger and the incum-

bent. This tracks with models such as those in Bueno De Mesquita et al. (2003). However, this does not match with real-world observations of multi-sided civil wars. This observation shows that models of group formation that do not account for other information besides the strength of the parties involves are not a candidate explanation for group formation as such models always imply that only one challenger can exist.

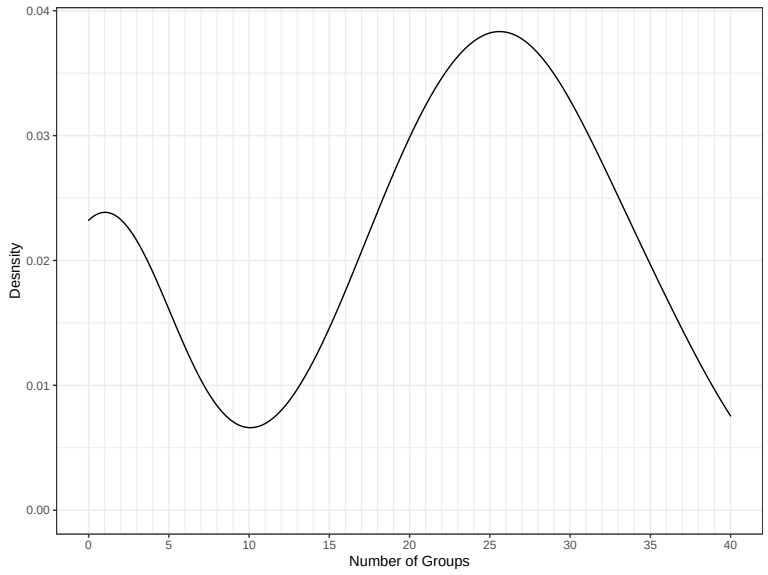
Next, I add individual preferences as a relevant factor in calculating the utility of being part of a group as described by the ABM. For each $|N| = 1000$ agent in the model, $P_{n_d} \sim N(0, 0.5)$ where $P_{n_d} \in (-0.5, 0.5)$ for dimensions $D = 1$. Likewise, for each agent, $W_{n_d} \sim N(0.3, 0.5)$ where $W_{n_d} \in (0, 1)$ for dimensions $D = 1$. Again I set the average opportunity cost $C_n \sim N(0.3, 0.5)$ for each agent.[14] Note, that I do not make any assumptions about the number of relevant dimensions that are needed to create multiple groups. The number of dimensions does influence the number of groups. However, all that is required for multiple groups to emerge is that individuals have preferences (positions and weights) that exist in some continuum. I now run the model 100 times for $T = 500$ steps. This model is thus equal in all aspects to the previous setup, except that the preference values are now allowed to vary across individuals given the defined distributions.

Figure 3: Number of Groups, With Individual Preferences



[14] At each model run all these values are re-sampled to generate the society.

Figure 4: Density of Number of Groups, With Individual Preferences



Graph 3 shows the average number of groups in existence at each t iteration for all the 100 model runs. The upper and lower bounds represent the minimum and the maximum number of groups observed in all of the runs. Like in the model where $P_n = 0$ and $W_n = 0$ for all agents, there is a sharp increase in the number of groups, which is followed by a decrease in these groups as smaller groups are incorporated into larger ones. However, this decrease is not as sharp, and more importantly, the model does not always converge on two groups. Rather, the model shows that given these specifications and the randomly sampled components of the model, it converges into an average of about 19.47 groups.[15] The model runs with the lowest number of groups 1 and the largest is 37.[16] Graph 4 shows the distribution of the number of groups at the end of the model run. These patterns show that the inclusion of individual preferences even in a one-dimensional, non-binary policy space can lead to multiple groups such that these individual preferences are a sufficient condition to explain the observations of multi-sided civil wars. The distribution of the number of groups created in these runs does not match real-world expectations of the number of groups across

[15]Not all model runs reach an equilibrium in the number of groups, however, they reach a quasi-equilibrium where the number undulates.

[16]Running the model for longer periods $t = 1000$, $t = 2000$, does not always lead to convergence into 2 groups.

cases of civil war. This is because the micro-specifications of the model (the preferences of individual agents) are not necessarily realistic. However, what this model specification can show is that adding these preferences is *sufficient* to create more than two sides in the conflict. In later chapters, I build on this model to develop model specifications that can make more accurate predictions of the expected number of groups in particular conflicts.

A parameter that is worth some further investigation is the opportunity cost parameter C_n. This parameter contains a lot of information about individuals. For simplicity, I marginalize over these complexities. And while they are unlikely to influence the outcomes of this analysis, the framework I present can unpack this parameter further. However, the distribution of C_n for each agent in a model has an important effect on group formation. To analyze the effect of this parameter on the model I first replicate the model run where individual preferences are irrelevant.

I analyze the results wherein each set of model runs I set the value of C_n to be equal for all agents where $C_n = C \in -1, -0.75, -0.5, -0.25, 0, 0.25, 0.5, 0.75, 1$. I run the model for each value of C 100 times. Varying C does influence the number of groups formed. When $C_m \geq 0.25$, for all agents in the model no groups form in the model. This makes sense since no payoff from a group is ever sufficient to generate a value higher than C. But, setting C to its lowest value of $C = -1$ still results in no more than 2 groups forming. Interestingly, when C approaches 0, the model generates group sizes according to the minimum winning coalition logic, where one group forms with $50\% + 1$ and the other with $50\% - 1$. In this case, all individuals are members of groups. Next, I reproduce the model where individual preferences matter but vary the value of C. The results mirror that of the previous model, except that sometimes when the $C \leq 0$, more than two groups form. This indicates that low opportunity costs for joining groups are key to the formation of rebel groups. This tracks with a series of research connecting civil war onset with low state capacity, poor economic performance (Fearon and Laitin, 2003) and high grievances (Collier and Hoeffler, 2004) all of which likely lower individual costs of fighting in the conflict. However, these results also indicate that these factors should be inconsistent predictors of the number of groups in a conflict unless the structure of individual preferences is taken into account.

3.4 SOCIAL IDENTITY THEORY IN THE CONTEXT OF GROUP FORMATION

Social identities are pivotal to linking macro-level societal structures and micro-level behavior and preferences (Hogg, Terry and White, 1995). The main argument of social identity theory is that the social category that an individual belongs to (or believes he/she belongs to) describes and prescribes that individual's attributes (Tajfel et al., 1979; Hogg, Terry and White, 1995). In other words, one's identity is deeply correlated with how one thinks, feels, and behaves (Burke and Reitzes, 1991). Another important model that derives from social identity theory is the self-categorization theory. Fiske and Taylor (1991) argue that not only are one's preferences tied to their identity but also that these identities can be represented in terms of prototypes. Prototypes are the most typical member of a category, which can usefully be modeled as the average member of the category.[17] The prototype model represents individuals of a shared identity as a "fuzzy set" of attributes that captures the features of an identity group membership. These attributes have no defined or systematic boundary but rather are associated with the attributes of the prototype (Fiske and Taylor, 1991). Following the insights of social identity theory, I argue that the preference of individuals in a society can be modeled by a set of prototypical individuals which creates clusters of policy preferences along the relevant dimensions.

In this framework, these clusters represent goals around which rebel groups can form. Because individuals belonging to these clusters of preferences share similar preferences, rebel groups can form around these clusters by offering the prototypical preferences of the group as the group goals. Given the mechanisms explained by the ABM, this minimizes the effects of having a different preference than the group goal for individual agents, thus maximizing the benefits offered by group membership. This pushes some groups away from each other, as forming one group decreases the payoffs for each group's members. As groups join together, the group's goal would change to reflect the average preference of its members. If groups composed around different clusters of preferences attempt to join, the goal of this joint group

[17] The prototype does not need to represent an actual individual in a society and often no instance perfectly matches the prototype (Hogg, Terry and White, 1995).

would not reflect either of the clusters. The payoffs of belonging to a larger group would thus be less than those of a smaller group where the group goals reflect the preferences of the members. Prior research provides some support for this behavior. Ugarriza and Craig (2013) demonstrate that ideology is significant to individual members of Colombian rebel groups as a motivation to fight and that it plays an important role in maintaining group cohesion. Further, Oppenheim et al. (2015) shows that deviation from a group's ideology can lead to desertion amongst ideologically motivated fighters.

3.4.1 Simple Society

For example, imagine a highly simplified society divided along 2 dimensions where all $n \in N$ individuals are randomly assigned a position for each dimension such that $P_{n_1} = \{-0.5, 0.5\}$ and $P_{n|2} = \{-0.5, 0.5\}$ (the extremes of each dimension). Further, imagine a simplification such that all n agents care equally to the highest extent possible about both dimensions such that $W_{n_1} = 1$ and $W_{n_2} = 1$ for all $n \in N$ agents. In this society, there are 4 clusters, defined by the 4 prototypes (0.5, 0.5), (0.5, -0.5), (-0.5, 0.5), and (-0.5, -0.5). I run the ABM under this societal structure where $|N| = 1000$ agent in the model and again I set the opportunity cost for each agent to be drawn from $C_n \sim N(0.3, 0.5)$. I then run the model as specified above 100 times. Under the social structure presented above, 4 groups always form as shown in Graph 5. Each of these groups contains about 1/8th of the total number of agents in the model, and about half of the agents never join a group. These agents fail to join any group because no group is ever large enough to offer a better payoff than the high opportunity cost of these individual agents. The 4 groups that always form have their goals based on each of the 4 prototypes present in this society as expected. Graph 6 shows the two-dimensional policy space of this society and the position of each group for all 100 iterations of the model.[18]

[18]There is a small jitter added to the points to prevent overlapping points over the goals (0.5, 0.5), (0.5, -0.5), (-0.5, 0.5), and (-0.5, -0.5).

Figure 5: Number of Groups, Simple Society Example

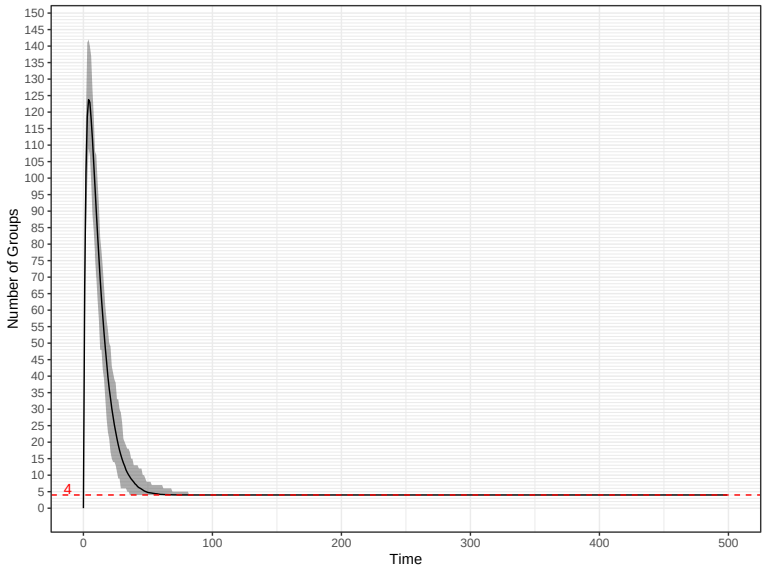
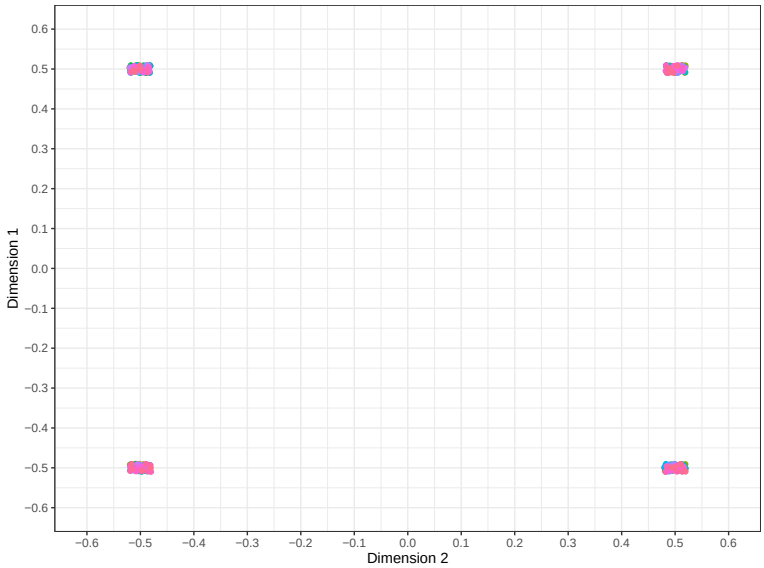


Figure 6: Position of Groups, Simple Society Example



These patterns of group formation show that in the ABM groups will form around clusters of individual preferences, and these preferences are the main mechanism preventing groups from joining into larger and thus more powerful groups. These observations are drawn from

the data showing that even accounting for the randomness of each model run, the model produces groups that mirror the clusters of individual preferences in both numbers and their stated goals. Overall, these results indicate that the social structure of individual preferences is key to understanding the process of rebel group formation as I have modeled it. These patterns are very compatible with observational studies of the number of rebel groups that arise in a conflict. For example, Walter (2019) shows that the number of identifiable ethnic and religious groups and the size of the disgruntled population are the strongest predictors of the number of rebel groups. Likewise, in my model, the number of groups is driven by the number of preference clusters which I have argued mirror salient identities in society and the opportunity cost of individual agents for joining a group. I do note, however, that the clusters of preferences in my model do not necessarily need to represent ethnoreligious identity.

3.4.2 Modeling a Society and Implications

While the simplified society presented above provides some insights into the model of group formation, social identity theory highlights that these prototypes are "fuzzy sets" with no defined or systematic boundary on the values of attributes indicating belonging (Fiske and Taylor, 1991). Thus, the cluster in real societies is often not as strict as offered by the simplified society described above. Rather, these clusters can be characterized by a prototype individual who gives the mean position along the relevant policy dimensions for those individuals that belong to the cluster. The clusters are like fuzzy sets of the preferred position along a dimension, where those individuals associated with a prototype tend to have a similar position as the prototype but there is not a strict boundary to mark membership in the cluster. This insight can be encoded when creating the agents for the ABM to run on.

Thus, when modeling complex societies to study through the Agent-Based framework I have presented so far, I use the following model. A society is composed of $n \in N$ agents which can belong to ($o_i \in O \in \mathbb{N}$) prototypes. Each o_i is a set of agents n of that prototype. The number of agents that belong to each o_i prototype can also be set by the researcher such that $|o_i| = N_o \in \mathbb{N} \leq |N|$. Each o_i prototype can be defined as a multivariate normal

distribution, $\mathcal{N}(\mu_o, \Sigma_o)$, where μ_o is a segment of D length indicating the mean position for each dimension of the prototype. Next, Σ_o is the variance-covariance matrix of size DxD where the diagonal of Σ_o represents the variance on each dimension and the off diagonals are the covariance between positions on each dimension. Since $P_n \in \{-0.5, 0.5\}$ these distributions are truncated by those positions.[19]

In the ABM, the preferences of individuals include weights that describe how important each dimension is to each individual. Like positions, the weights on each dimension of individuals belonging to the same cluster are related. As such, they can be modeled as multivariate normal distributions $\mathcal{N}(\nu_o, \Pi_o)$, where μ_o is a segment of D length indicating the mean weight for each dimension of the prototype, and Σ_o is the variance-covariance matrix of size DxD where the diagonal of Σ_o represents the variance of the weight on each dimension. Also, since, $W_n \in \{0, 1\}$ these distributions are truncated by those positions. I further argue that the weights of the prototypes inform the range of positions individuals of that prototype are likely to have. The more important a specific dimension is to a cluster's prototype, the more important it is that individuals in that cluster uphold the mean position on that cluster. This assumption encapsulates the idea that as a policy dimension becomes more important to a cluster, the policy space that still captures the cluster of similar individuals shrinks. For each prototype o this structure can be modeled as $\Sigma_o[d, d] = \frac{0.001}{\nu_{o_d}}$. In other words, the variance of a prototype's position in a dimension is equal to 0.001 divided by the mean of the weight of that same dimension. This means that as the weight of a dimension for a prototype increases, the variance of the position decreases. Thus the clusters of individuals produced by the prototype are tighter in that dimension.

Following this model, I will create a more complex society and analyze how this added complexity influences the model's behavior. In this society of $|N| = 1000$ agents, there are $D = 3$ salient policy dimensions and $N_o = 4$ such that there are 4 prototypes of individuals. This example of a complex society is defined in Table 1 and Graphs 7 and 8 show the actual distributions of weights, position, and the opportunity costs of all agents in this society.[20]

[19] When creating these distributions, I use the *TruncatedNormal* package in R using the rejection sampling method.

[20] In this society I assume that the positions of individuals in each dimension are independent of each other.

These graphs show how the identity prototypes create clusters in the preferred position of individuals along the relevant policy dimensions. They further illustrate the relationship between the clusters and the weights around the dimensions. For example, individuals who associate with prototype 3 generally have low weights on dimension 2. Thus, dimension 2 is not a strong signal of belonging to this cluster such that the spread of the cluster in the positions for this dimension is very large, spanning about half of the policy space. On the other hand, individuals of prototype 2 generally have a high weight in dimension 2 and thus the cluster is very tight for the position of this prototype in dimension 2.

Table 1: Complex Society Example

$N_{o_1} = 300$	$N_{o_2} = 300$	$N_{o_3} = 200$	$N_{o_4} = 200$
$W_{n \in o_1} \sim \mathcal{N}\left(\nu_{o_1}, \Pi_{o_1}\right)$	$W_{n \in o_2} \sim \mathcal{N}\left(\nu_{o_2}, \Pi_{o_2}\right)$	$W_{n \in o_3} \sim \mathcal{N}\left(\nu_{o_3}, \Pi_{o_3}\right)$	$W_{n \in o_4} \sim \mathcal{N}\left(\nu_{o_4}, \Pi_{o_4}\right)$
$\nu_{o_1} = \begin{bmatrix} 0.6 & 0.4 & 0.9 \end{bmatrix}$	$\nu_{o_2} = \begin{bmatrix} 0.1 & 0.9 & 0.9 \end{bmatrix}$	$\nu_{o_3} = \begin{bmatrix} 0.5 & 0.1 & 0.8 \end{bmatrix}$	$\nu_{o_4} = \begin{bmatrix} 0.9 & 0.8 & 0.1 \end{bmatrix}$
$\Pi_{o_1} = \begin{bmatrix} 0.001 & 0 & 0 \\ 0 & 0.001 & 0 \\ 0 & 0 & 0.001 \end{bmatrix}$	$\Pi_{o_2} = \begin{bmatrix} 0.001 & 0 & 0 \\ 0 & 0.001 & 0 \\ 0 & 0 & 0.001 \end{bmatrix}$	$\Pi_{o_3} = \begin{bmatrix} 0.001 & 0 & 0 \\ 0 & 0.001 & 0 \\ 0 & 0 & 0.001 \end{bmatrix}$	$\Pi_{o_4} = \begin{bmatrix} 0.001 & 0 & 0 \\ 0 & 0.001 & 0 \\ 0 & 0 & 0.001 \end{bmatrix}$
$Pn \in o_1 \sim \mathcal{N}\left(\mu_{o_1}, \Sigma_{o_1}\right)$	$P_{n \in o_2} \sim \mathcal{N}\left(\mu_{o_2}, \Sigma_{o_2}\right)$	$P_{n \in o_3} \sim \mathcal{N}\left(\mu_{o_3}, \Sigma_{o_3}\right)$	$P_{n \in o_4} \sim \mathcal{N}\left(\mu_{o_4}, \Sigma_{o_4}\right)$
$\mu_{o_1} = \begin{bmatrix} -0.5 & 0.4 & -0.2 \end{bmatrix}$	$\mu_{o_2} = \begin{bmatrix} -0.1 & -0.3 & 0.5 \end{bmatrix}$	$\mu_{o_3} = \begin{bmatrix} -0.3 & -0.1 & 0.5 \end{bmatrix}$	$\mu_{o_4} = \begin{bmatrix} 05 & 0.3 & -0.4 \end{bmatrix}$
$\Sigma_{o_1} = \begin{bmatrix} \frac{0.001}{0.6} & 0 & 0 \\ 0 & \frac{0.001}{0.4} & 0 \\ 0 & 0 & \frac{0.001}{0.9} \end{bmatrix}$	$\Sigma_{o_2} = \begin{bmatrix} \frac{0.001}{0.1} & 0 & 0 \\ 0 & \frac{0.001}{0.9} & 0 \\ 0 & 0 & \frac{0.001}{0.9} \end{bmatrix}$	$\Sigma_{o_3} = \begin{bmatrix} \frac{0.001}{0.5} & 0 & 0 \\ 0 & \frac{0.001}{0.1} & 0 \\ 0 & 0 & \frac{0.001}{0.8} \end{bmatrix}$	$\Sigma_{o_4} = \begin{bmatrix} \frac{0.001}{0.9} & 0 & 0 \\ 0 & \frac{0.001}{0.8} & 0 \\ 0 & 0 & \frac{0.001}{0.1} \end{bmatrix}$
$C_{n \in o_1} \sim N(-0.1, 0.2)$	$C_{n \in o_2} \sim N(0.1, 0.2)$	$C_{n \in o_3} \sim N(0, 0.2,)$	$C_{n \in o_4} \sim N(-0.1, 0.2)$

While there are still four prototypes, this society is much more complex than in the first example. Not only have I increased the dimensionality by one, but, as shown in the graphs, there are regions of overlap between clusters and dimensions that are not necessarily relevant for all prototypes. By building the society based on self-categorization theory (Fiske and Taylor, 1991), I have provided a theoretical basis to further structure the model.[21] I run the

[21] This is still a simplistic model of a society which can have many more dimensions and identities than shown here. The model is capable of recreating this complexity, however, I do not believe it necessary to demonstrate patterns of behavior in the model.

model 100 times on the complex society described above.

Figure 7: Complex Society Example

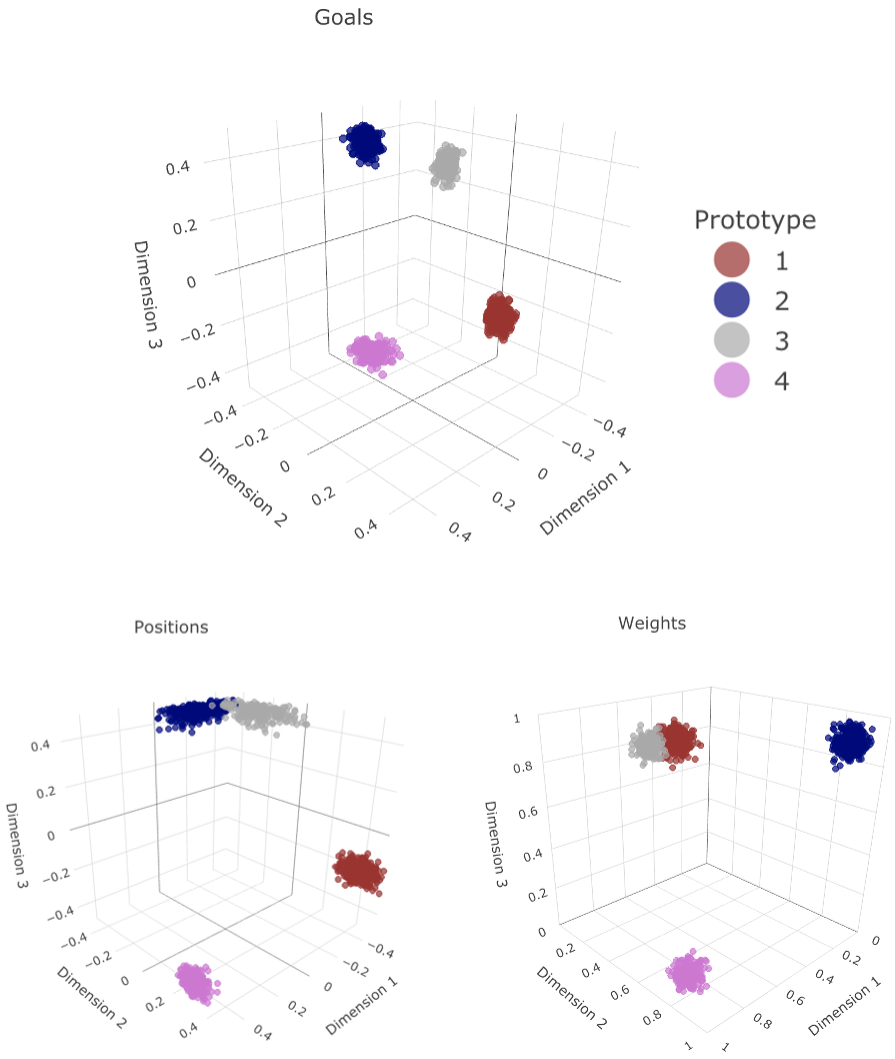
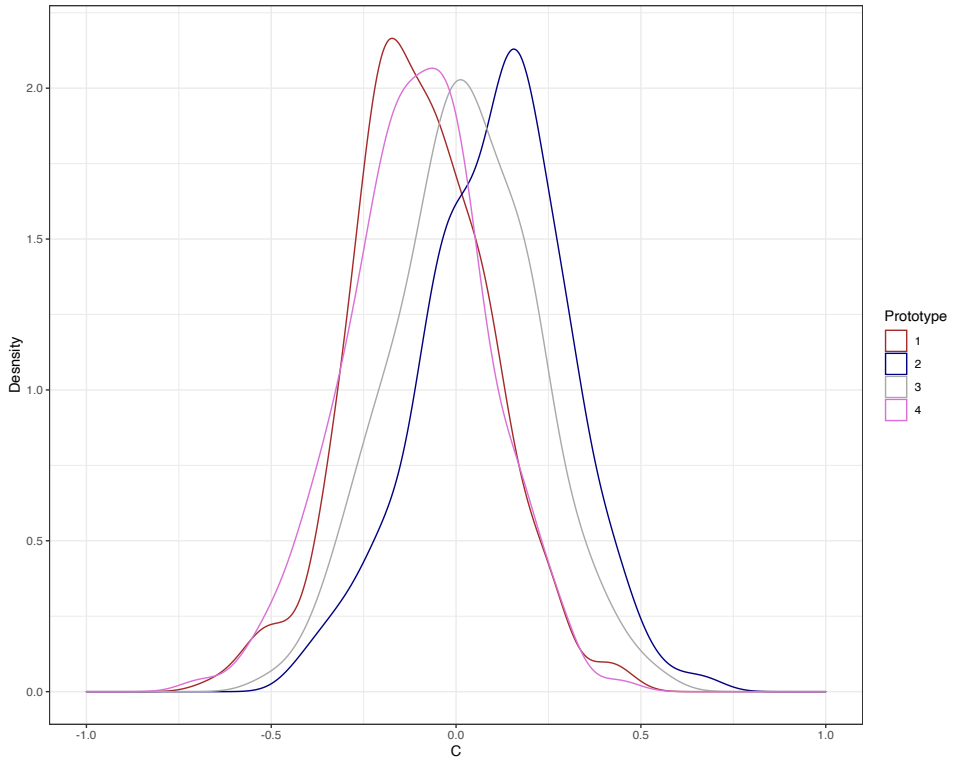


Figure 8: Agent Opportunity Cost in Complex Society Example



The results of these 100 model run further support the observations that, under the theorized model of group formation, groups will tend to form around the clusters of salient individual preferences in a given society. I first turn to Figure 9 shows the average number of groups that form at each T iteration with the bounds being the maximum and the minimum number of groups formed. As with all previous runs of the model, it shows an increase in the number of groups in the early periods of the model followed by a sharp decrease which eventually reaches a quasi-equilibrium. Under the complex society described above, the model predicts an average of 2.96 groups forming. Figure 10 shows the bar graph of the number of groups at the last time period of the model for the 100 model runs. The figure shows this society most often will lead to three or 4 groups forming. However, there are interesting patterns where in some model runs there are 1, 5 groups, and rarely 2 groups form. This variation is a result of the random components of the model. More specifically the order in which agents will interact with one another. Unpacking the random components

can provide a fruitful area for future research, for example adding agent interaction across geographical and network space can help explain some of the variations in runs of models with the same micro-specification.

Figure 9: Number of Groups, Complex Society Example

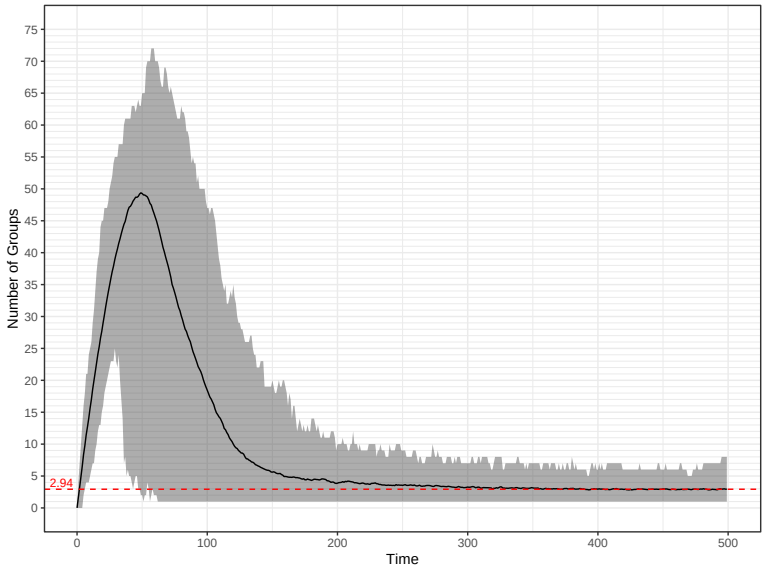
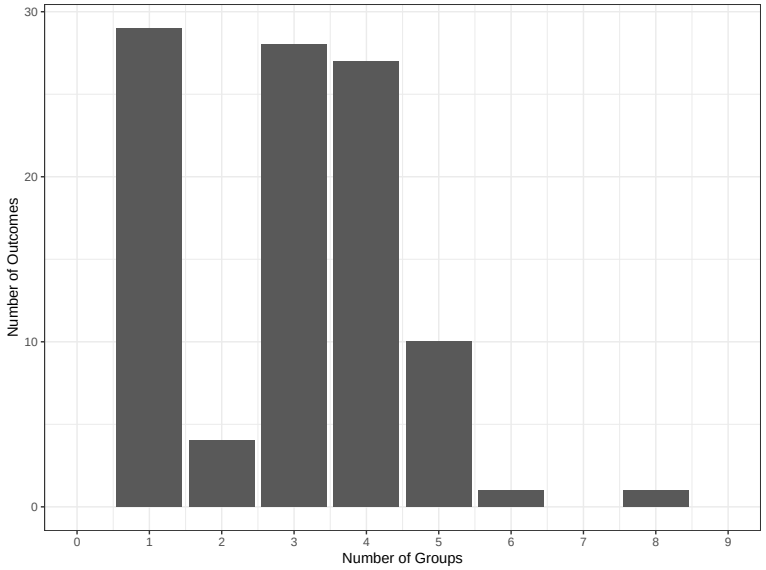


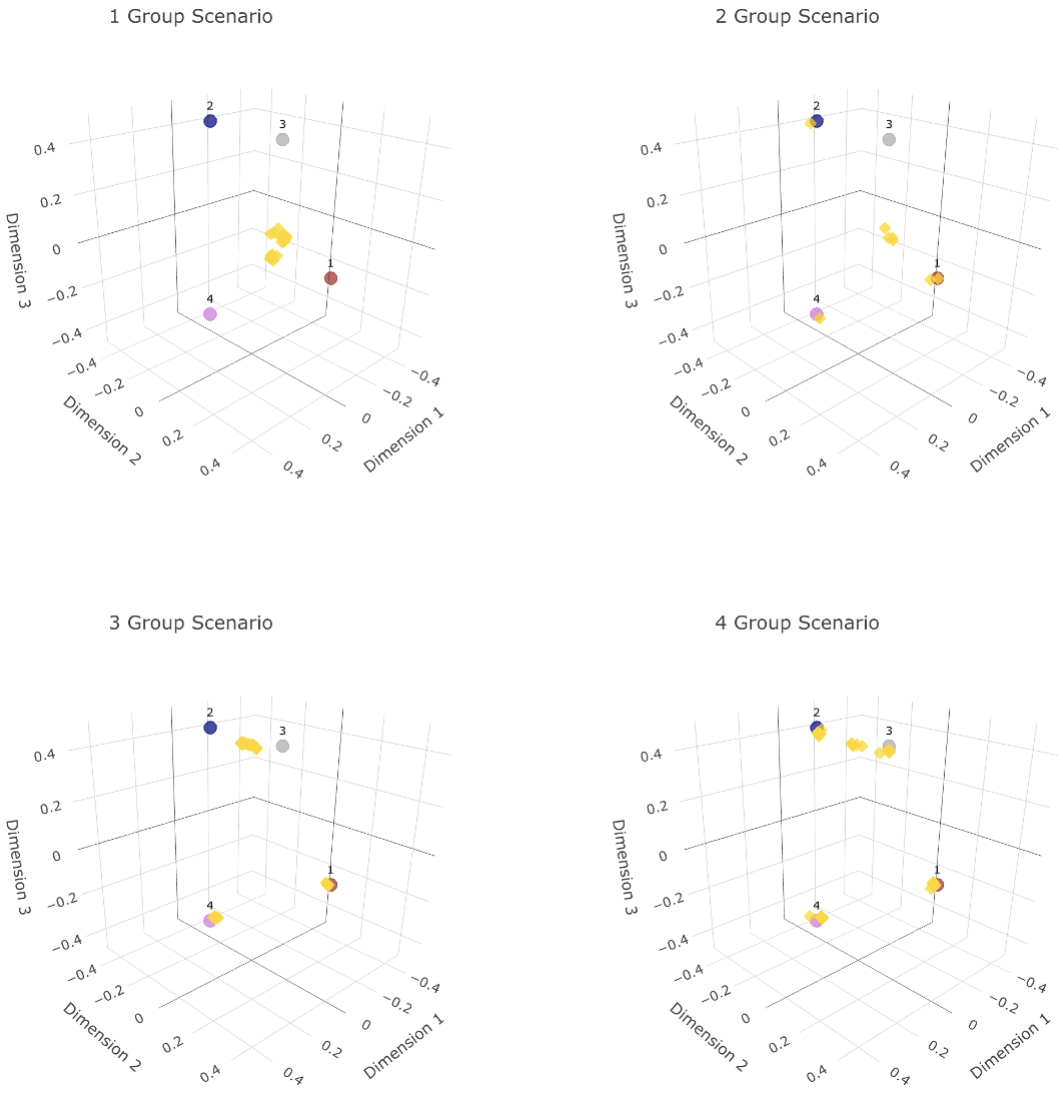
Figure 10: Density of Groups, Complex Society Example



To better understand what groups form under the complex society, Figure 11 shows the positions of the groups formed in the 100 model runs. As in the simple society example, the figure shows that the group goals will follow along with the clusters of preferences in the society. This is demonstrated in Figure 11, under the three and four group scenarios, especially for groups that form around prototypes 1 and 4.

However, there are some interesting deviations. First, there is a cluster of groups that forms not around prototypes 2 and 3 but rather at the intersection between them. This suggests that a group can form that incorporates members of both prototypes. Demonstrating that even though the ABM tends toward groups forming based on the prototypes in a society, it is still capable of generating groups containing more than one prototype. Another implication of this output is that even when separate groups do form between prototypes 2 and 3 these groups are very similar in preferences which may indicate the possibility that they can ally.

Figure 11: Group Goals in Complex Society Example



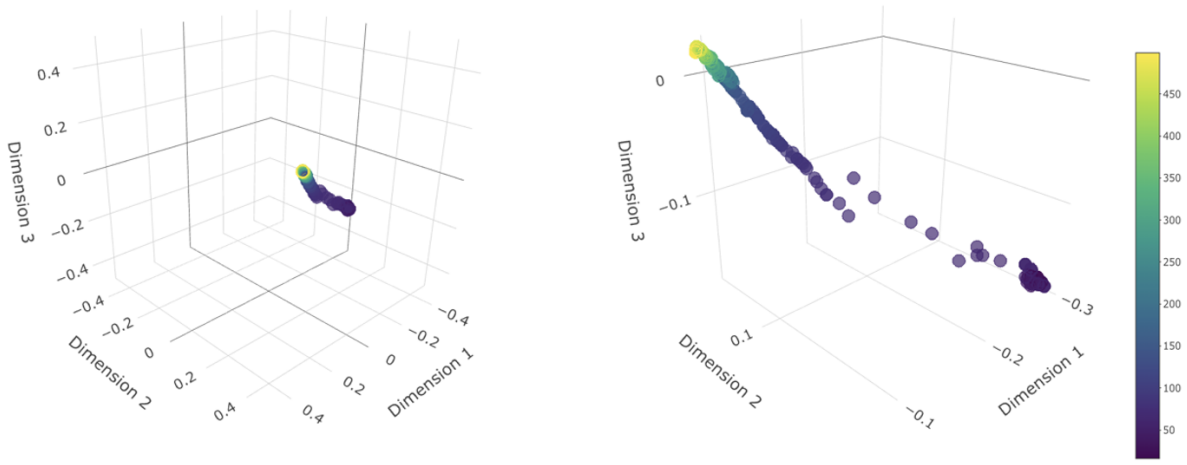
Notes: The colored dots represent the mean prototype goal for the respective prototype number to the top of the value. The yellow triangles represent the observed goals of groups formed in all the runs that resulted in a given group formation scenario.

The second deviation is the cluster of groups that form in the center of the 3-dimensional space. This cluster is composed of groups that form in model runs where only one group emerges out of the model. While this outcome is not as common as two or more groups

forming, it is not uncommon. This clustering of group goals in the center of the policy space when one group forms suggests that this complex society can reach an equilibrium where there are no rebel groups. This happens when a group is capable of attracting individuals from all prototypes with a low opportunity cost for joining a group. One group can present a goal that is sufficiently close to all these individual agents as well as the large private goods of being part of a sufficiently large group. Further, because no group is sufficiently large due to high individual opportunity costs they do not consider the negative effects of larger groups according to minimal coalition logic. These factors allow only one group to form. One implication of this pattern is the importance that individual-level opportunity costs have in influencing the likelihood of civil wars as suggested by previous studies.

Overall, the output of the ABM under the complex society example illustrates similar and divergent patterns from those of the simplified society. The results provide one answer to the puzzle of multiple groups forming with similar preferences, as it is capable of generating groups that share similar preferences. Even under a more complex structure where the preferences of individuals are clustered, yet not homogeneous, the model shows that groups tend to form with goals that aim to minimize the differences in the preference of their members. Thus, it is rare for the groups to have agents with distant preferences as this minimizes the utility of group leaders and members. However, sufficiently large (powerful) groups can offset this through private benefits.

Figure 12: One Group Scenario: Group Position Over Time Example



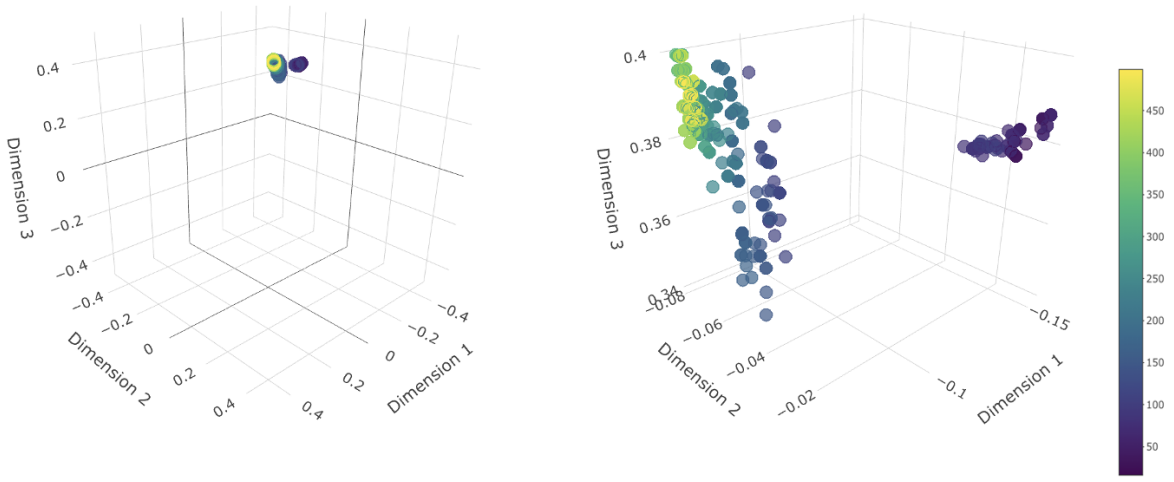
Notes: The image in the right zooms into the cluster depicted in the image in the left.The gradient in the right of the image maps the color of the group's goal position to the corresponding iteration of the model, which is equivalent to a time period.

Using the data generated by the model, it is also possible to examine how the goals of groups change over time by tracking the position across each iteration. In Figure 12, I plot an example of the goal of a group over time for the scenario where only one group exists by the end of the model run. The plots in Figure 12 demonstrate how the group begins the model with a goal matching the average position of the identity prototype 1. However, as the group grows over time, the goal of this group begins a slow and smooth migration towards the center of the policy space as it incorporates the preferences of individuals outside of the prototype of the initial membership.

Next, Figure 13 plots another example of goal change over time. Specifically, the plot shows the goal change of the group that forms between identity prototypes 2 and 3 in the three-group formation scenario. Unlike in the previous example, the goals of this group do not change linearly and smoothly. Rather, the group begins with its goals near the average position of prototype three and slowly moves towards prototype 2. However, at some point

around iteration 200, the goals of the group make a sudden jump towards prototype 2, indicating that the group took in a large number of members of that prototype in a very short period likely as a result of a merger with a group formed around prototype 2.

Figure 13: Three Group Scenario: Group Position Over Time Example



Notes:The image in the right zooms into the cluster depicted in the image in the left. The gradient in the right of the image maps the color of the group's goal position to the corresponding iteration of the model, which is equivalent to a time period.

Figures 12 and 13 demonstrate the process of goal change in groups across time. In general, they demonstrate the logic encoded in the ABM where the goals of groups change due to changing membership. Both figures depict the goals of groups changing in the direction of the preferences of their new members, but not transforming into those preferences. In Figure 12, the group incorporates large numbers of agents from all prototypes, the goals of the group change towards the middle of the policy space as it is roughly the average of the preferences of all four prototypes. However, in Figure 13, where the group's original membership, which comes from prototype 3, is joined by new members predominantly of prototype 2, the goals move towards the preferences of that prototype. Further, the plots demonstrate that these goal changes are proportional to the preferences and number of

members. The group in Figure 13 changes its goals only by a small space as the agents of prototype 2 have goals that are not on average distant from those of its original membership. However, this change mostly comes in one drastic jump as it incorporates a number of those members in a short period. A similar but less drastic process is observed in Figure 12. In this case, the group's goals change less smoothly around iterations 100-150, but in general, the goal change in this example is smooth as the group incorporates new members throughout the model. Yet, in contrast to the example in Figure 13, the absolute change in goals in this example is significantly more drastic as the group incorporates more agents, and agents with more distant goals.

3.5 GOALS AND TPLF MOBILIZATION

In the first chapter, I tracked the rise of the TPLF and highlight the process through which they formed their organization. In particular, I show how the group's goals were both used to attract the support of and influenced by the Tigrayan peasants that became the backbone of the organization. Further, the case study revealed that despite the appeal of the group's goals, other organizations were able to mobilize other sectors of Tigrayan society against the Derg, notably the Tigrayan Liberation Front (TLF), the Ethiopian Democratic Union (EDU), the Ethiopian People's Revolutionary Party (EPRP), and the Eritrean People's Liberation Front (EPLF). Overall the mobilization of Tigray and Tigrayan society during the Ethiopian Civil War highlights features of the Agent-Based Model I present in this chapter.

First, the case demonstrates that group goals emerge out of the preferences of their members and that these goals are prone to change as the group expands. These patterns match individual agent behavior in the ABM where the group's goals are the property of its membership, thus linking macro-structures with micro-level decisions. Further, the goals that emerge with the group are played a crucial role in gathering support from other individuals. The case shows how different individuals supported one group or another depending on their preferences in relevant political dimensions. Thus, each group formed around separate

prototypical individuals, yet attracted membership from the same sets of clusters. However, the case also emphasizes how not all individuals necessarily have an equal influence on the group goals. For example, the creation of the MLLT within the TPLF shows how a comparatively small number of members can dictate important components of a group's goals. However, even in this case, the capacity of the leadership to dictate goals is constrained by the group's membership. For example, the more nationalistic MLLT gained power as their Tigrayan-nationalist agenda was also popular with many of its peasant base of support.

Second, the case shows that while large groups can overcome divergence in goals in their membership, substantial differences still push individuals apart, leading to the emergence of different groups. The relationship between the EDU, EPRP, and the TPLF is an example of this dynamic. These groups formed around very distinct sectors of Tigrayan society and yet attracted members from similar sectors. As the EDU and EPRP lost power due to military defeats and the TPLF grew its influence, many members of the EDU defected to the TPLF while the EPRP would later be re-organized into Ethiopian People's Democratic Movement (EPDM) as a junior partner of the TPLF.[22] As the TPLF grew and the power of the other groups declined, it was better able to accommodate new members who had previously chosen to support the other groups, some of which held preferences that did not perfectly align with the TPLF. However, it is telling that not all members of those groups joined the TPLF. Rather, they chose to remain with their much-weakened group in the case of the EDU, while others abandoned the conflict, or reformed a new and much weaker organization in the case of those the EPRP. This demonstrates that even strong groups are limited in their appeal, given that sufficient differences between a group's goal and the preferences of individuals exist.

Lastly, the mobilization of Tigray and Tigrayan society demonstrates the flaws in looking only at ethnic groups as predictors of group formation. Here I have shown how distinct groups such as the EPRP, EDU, EPLF, and the TPLF formed through recruiting members of the same ethnic group. Thus, despite a cursory look at the war leading to descriptions of the conflict as an ethnic-nationalist conflict, this dimension alone cannot explain the patterns

[22]While the EDU endured until the end of the conflict as a minor group formed around its original feudal base.

of group formation observed in the conflict. The broader preferences observed in pre-1974 Ethiopia present a complete explanation. Individuals had preferences about issues such as land redistribution, the nationalities question, the issue of Eritrean independence, and plans for a future Ethiopia all of which influenced which groups emerged in the conflict. However, it is also clear these goal dimensions were influenced by and correlated with ethnicity in complex ways determined by the social structure of pre-conflict Ethiopia.

3.6 SUMMARY

In this chapter, I have argued that individuals have preferences across all relevant policy spaces in society. These preferences are composed of positions and weights on each dimension, indicating how much that individual cares about the policy. When individuals in society are aggrieved, they form groups for collective action against the status quo set of policies. Because individuals join groups to move the status quo towards their preferences, groups can use their stated goals as excludable, jointly-produced goods to increase the benefits of some individuals to join the group, while pushing others away. In summary, different groups with different goals can emerge given a different distribution of individual preferences.

To demonstrate the importance of these preferences in group formation, I constructed an Agent-Based Model that shows that a model based only on group size cannot reproduce observed patterns of group formation in Civil Wars. However, the addition of individual preferences can be sufficient to create multi-party conflicts. As such, the proposed model provides a possible explanation for how rebel groups emerge in civil wars. I then theorize and model how societies are structured such that clusters of individual preferences exist around which groups can form. In summary, I construct a model of macro-level social structure based on social identity theory and connect identities to individual decisions by treating discrete identities as defining a set of clustered preferences of the identity group members in a multi-dimensional policy space. Thus the preferences of individuals are structured in clusters such that these clusters inform both an individual's preference point along a dimension and the relevance of that dimension.

Next, I show that through a simple two-dimensional society, the Agent-Based Model created groups of agents based on a cluster of preferences. I then encode social identity theory into a model to create social macro-structures and use this model to create a more complex society of agents to run in the Agent-Based Model. This run of the ABM shows that the framework generates rebel groups that share similar goals in the conflict. As such, the model can explain one of the initial puzzles about the role of goals in group formation. Why do groups with similar goals emerge in a given civil conflict? The model shows how some social structures can create groups with similar preferences when there are distinct, yet similar clusters in the example society. Under some structural conditions and unexplained randomness, groups can form around similar clusters, yet not be sufficiently large to make it profitable for members of a similar group to overcome the small difference in preferences. Further, the ABM can depict the process through which these goals develop as a result of the changing membership of the groups.

This provides the first step in explaining how the goals of different parties in the conflict influence group behavior in terms of cooperation and alliance-making by connecting pre-existing macro-structures to micro-level decisions and showing how the complex system in which these decisions take place influences the macro-level phenomena of group emergence. I then use the case of the TPLF in the Ethiopian Civil War to highlight the role of goals in group formation. Particularly, I highlight how the distribution of preferences across different sectors of Tigrayan society shaped the process of mobilization in a way that is congruent with the modeling framework and the model outcomes.

4.0 GOALS AND ALLIANCES

In this chapter, I explain cooperation in civil wars at the group level. In previous chapters, I demonstrated how failing to account for individual preferences and group goals in individual-level cooperation decisions leads to models of group formation that cannot explain multiparty conflicts, a necessary condition for alliances between rebel groups. Given the importance of individual preferences and group goals for rebel group formation, how do they influence alliance decisions? To explain the role of these factors in alliances during civil wars, I carry forward the implications of the theory of group formation presented in Chapter 2 to the decisions of groups to cooperate.

First, I define alliances and review the literature on cooperation between rebel groups, focusing on how power and preferences influence these decisions. However, I highlight how research has often assumed the exogeneity between rebel formation and alliance decisions. I then explain how accounting for the role of individual preferences and rebel goals alters alliance decisions. I then build on the Agent-Based Modeling framework I presented in Chapter 2 to include alliance decisions between groups, which links power considerations and group goals. This framework allows me to illustrate the endogeneity between group formation and alliance decisions, as the process of group formation (and fracturing) can affect and be affected by alliance behaviors. Lastly, I show how failing to account for group goals and power can lead to incorrect inferences about these factors. Yet when individual-level preferences are accounted for, goals became a driving factor behind group alliances in civil wars.

4.1 ALLIANCES IN CIVIL WARS

Alliances or pacts of military cooperation between actors are consequential for their survival and behaviors. For example, more formalized and involved alliances are associated with a higher likelihood of victory in conflicts (Fearon, 1998; Morrow, 2017), deterrence of possible enemies (Leeds, 2003), and, under some conditions, a higher likelihood of conflict (Smith, 1995; Benson and Smith, 2021). Similarly, alliances—especially between non-state actors such as rebel groups—have similar effects on groups engaged in civil wars. Research has linked cooperation between rebel groups with increased violence (Cunningham, 2006), lengthier conflicts, and a higher likelihood of rebel victory (Akcinaroglu, 2012; Phillips, 2014). Therefore, it is necessary to understand why and how these alliances function in civil wars to understand relevant conflict processes.

Broadly, alliances are a form of cooperation that entails the adjustment of behavior to the actual or anticipated preferences of others through a process of coordination (Oye, 1986; Keohane, 2005). In the study of international relations, alliances are formal agreements among independent states to cooperate militarily while retaining their sovereignty and identities as independent states (Leeds, 2003). In the context of civil wars, Christia (2012) defines alliances between rebel groups as formal or informal relationships of security cooperation that involve commitment and exchange of benefits for both sides in preparation for post-conflict power distributions. These works highlight three critical features of alliances in civil wars: (1) there is an increase in the security of the actors involved; (2) the cooperating actors retain their internal decision-making power; and (3) there is some level of coordination in the preferences of the actors involved in the alliance.

A related but distinct phenomenon that is important to differentiate from alliances is group mergers. Mergers are a one-time integration of some or all newly merged group members into the existing structure of another group. Two features distinguish such actions from alliances. First, as argued by Leeds (2003), when actors ally they retain their sovereignty—in this context, a group's internal decision-making power— and identity as an organization. In mergers, one or both organizations have their membership fully or partially incorporated.[1]

[1]Splinter groups that result from mergers is categorized more usefully as a new group.

Second, when groups ally there is no active integration between the group. Instead, they are continually negotiating across group structures. Thus, mergers do not have ongoing coordination costs that are separable from the maintenance of order and discipline within the organization.[2]

In the context of civil wars, previous research has operationalized the conceptual definition of alliances discussed above civil wars to include a broad set of behaviors that include training recruits, engaging in tactical support, sharing information, receiving military support, receiving material, carrying out coordinated military operations, and establishing formal alliances between rebel groups (Akcinaroglu, 2012; Bapat and Bond, 2012; Popovic, 2018). Following previous literature, I categorize this broad set of behaviors as alliances between rebel groups. These behaviors operationalized as alliances entail different levels of engagement between actors. Although, the different levels of cooperation in these behaviors lead to a range of potential costs and benefits (Leeds, 2003; Morrow, 2017). I argue that these behaviors represent the same phenomenon as they all meet the three criteria delineated above. Therefore it is possible to analyze them under the same framework.

4.1.1 Rebel Group Alliances in Civil Wars

Given the conceptual and operational definition of alliances in civil wars, I explore how and when these rebel groups cooperate in civil wars. Specifically, I highlight how previous research has explored the effects of power and ideologies in alliance decisions in conflict. While both approaches provide useful models of alliances in civil wars, by failing to account for the endogeneity between group formation and alliances, these works do not present both features in a coherent framework to understand how and when these factors are relevant. In Chapter 2, I demonstrated that the emergence of groups and the maintenance of their internal cohesion depends on both power and preferences (at the group and individual levels). As such, it is necessary to carry through the theoretical framework of group formation to

[2]For an example of a merger refer to Chapter 4, which describes the merger of the TLF and the TPLF in the Ethiopian Civil War (1974-1991). In this case, the TLF merged into the TPLF and its organization. This case shows how the TLF membership was (almost) fully integrated into the TPLF. Those who did not join the TPLF were either killed or abandoned the group. While it would have been possible for TLF members who did not join the TPLF to form a splinter movement, this did not happen in this case.

inter-group alliances. Doing so highlights the importance of preferences while accounting for power considerations at the group alliance level, which can better demonstrate the complex mechanisms through which these factors matter for alliances.

Existing research on alliances between rebel groups has highlighted how credible commitment problems prevent cooperation between rebel groups. Scholars propose several mechanisms to overcome these issues. For example, Bapat and Bond (2012) present a game-theoretical model to demonstrate that powerful rebel groups are more likely to form alliances as they can credibly resist government attempts to stop cooperation. They further highlight how shared external sponsors facilitate alliances between groups, by serving as an enforcement mechanism when groups are not sufficiently strong to resist government interventions. Popovic (2018) further highlights this influence of foreign support in inter-rebel alliances and finds that shared sponsors make alliance formation more likely. Blair et al. (2022) provides yet another mechanism and argues that shared ideologies can help groups overcome credible commitment by providing community monitoring, authority structures, trust, and transnational networks. However, an issue with this approach to alliances in civil wars is the underlying assumption that because of the tangible benefits it provides, all groups who can credibly commit to an alliance will form one.

In contrast, other research has approached alliances in civil wars by explaining the costs and benefits of alliances. Christia (2012) argues that alliance formation is a tactical move motivated by concerns with victory and maximizing wartime return in anticipation of post-war power-sharing. In this framework, groups concern themselves with their survival and the relative power of warring factions. This logic builds from minimal winning coalition theory (Riker, 1964) to argue that groups want to be in a coalition that is powerful enough to win yet small enough to ensure maximum political payoffs. Christia (2012) analyzes how battlefield performances change the distribution of power between groups and, subsequently, change the costs and benefits of alliances. This process occurs as groups try to maximize their post-conflict positions, explaining why some groups may not want to cooperate even if they could overcome credible commitment problems.

Christia (2012) explicitly argues against the role of ideology and identities in explaining alliance decisions. She contends that these factors are a post-hoc explanation for choices

resulting from power considerations. Yet, other works highlight the role of ideology and identity in alliance decisions. For example, Blair et al. (2022) argues that these factors help overcome credible commitment problems. Further, Balcells, Chen and Pischedda (2022) demonstrates that both ideological and ethnic similarity increases the likelihood of cooperation, yet the effect of ideological similarity is larger than those of shared ethnicity. They further suggest one reason for the effects of ethnic and ideological similarity is that similar groups can better maintain internal cohesion after forming cooperative relationships. However, their theory does not provide specific mechanisms to explain why and how alliances may cause internal cohesion issues. Similarly, Gade et al. (2019) highlights the role that homophily plays in shaping networks of alliances; however, the mechanism through which homophily works, in this case, is ambiguous, especially when considering the role of power dynamics and its interaction with similarities between groups.

These works show that both preferences and power considerations influence the decisions of rebel groups to form alliances. However, they also assume the existence of rebel organizations. This assumption is problematic because for any alliance to exist between rebel groups there first needs to be multiple rebel organizations, and if the similarity in goals is to play a role in choices about who to ally with, then there must be groups with sufficiently similar goals. Thus, by marginalizing the individual level and focusing only on the group level, these works fail to coherently explain how and when differences over goals will cause internal cohesion issues.

4.1.2 Individual Preferences, Group Goals, and Alliances

In the previous chapters, I showed that group formation is motivated by the complex interactions of preferences and power dynamics and that failure to consider the role of group and individual-level preferences fail to produce multi-party conflicts. Yet accounting for these dynamics allows for multi-sided conflicts, where distinct groups can emerge with shared goals. Thus, these factors set up the stage where groups in a civil war, possibly with similar preferences, can form alliances. In this section, I argue that accounting for the processes of group formation is essential for a cohesive framework of alliance decisions in civil wars, by

not only explaining which groups exist in a conflict but also their goals. Crucially, because alliances influence both the material capacity of groups and the goals of groups –or at least the perception of the goals of a group– organizations must account for these factors when making alliance decisions.

This framework begins by addressing the main features of alliances in civil wars. Alliances benefit a group by increasing its fighting capacity. Thus also decreasing the probability of an unwanted post-conflict status quo (Akcinaroglu, 2012; Balcells, Chen and Pischedda, 2022). However, these benefits entail additional costs. For groups fighting in a civil war, one of the substantial costs is the adjustment of behaviors to the preferences of their allies. These changes are crucial to maintaining their alliances (Oye, 1985; Keohane, 2005; Johnson, 2015). Cooperation between actors in civil wars necessitates a minimal agreement on what the groups wish to achieve. As such, groups must fit their behavior to match these agreements (Leeds and Savun, 2007; Gartzke and Weisiger, 2013). These shifts inform the group membership and other actors about how to perceive the group goals.[3] Further, alliances also empower a group alliance partner to accomplish their goals in the future, which may or may not be shared by the group and its members. Thus, whom the leadership of a group is willing to cooperate with communicates information about a group's goals to both their membership and other actors in the conflict (Morrow, 1991).

Cooperation between two groups leads to other actors in the conflict updating their beliefs about the goals of both these groups. Therefore alliance decisions in civil war offer groups competing incentives. Alliances increase the material capacity of an actor, yet alter the perception of their goals. Given the role of both of these factors in creating and maintaining the rebel organizations, the impact of the alliance on both factors is a significant concern for groups in making alliance decisions. The cost of changes in the perception of a group's goals within its membership —often characterized as agenda dilution in the international relation literature on alliances (Johnson, 2015)—has been suggested by previous research as a cost to cooperation between rebel groups (Balcells, Chen and Pischedda, 2022). The first stage of the ABM framework demonstrates this critical link. As the distance between

[3]For example, to maintain their partnerships with Eritrean groups, the TPLF stopped supporting anti-Eritrean independence rhetoric during parts of the Ethiopian Civil War.

individual preferences and group goals increases, the smaller the benefits of membership in that group become. This decrease in benefits can lead individuals to abandon the group to either join another group or stay out of the fighting. Further evidence of this mechanism is shown by Oppenheim et al. (2015), who demonstrates that deviation from the ideological precepts of rebel groups in Colombia resulted in side-switching and demobilization amongst its members, especially amongst more ideologically driven fighters.

Fundamental goal incompatibilities—or disagreements about the direction of the country or region, post-civil war—influence alliance decisions in part because they threaten one of the principal mechanisms through which groups maintain the individual-level cooperation that led to the group forming. More precisely, if the number of dissatisfied members who would leave the group if an alliance formed is sufficiently large, then the cooperation becomes counterproductive. This is because the group loses a portion of its membership, resulting in a reduction in capacity that offsets any potential gains from the alliance. On the other hand, when rebel groups have similar goals, the changes in perceived goals due to cooperation are minimal, making dissatisfaction within the membership less likely. Therefore the costs associated with cooperation are smaller, making alliances between groups with similar goals more likely. Although Christia (2012) argues against the role of identity and goals in alliance formation, she acknowledges that fractionalization within groups is a form of power change that influences the decision-making process for cooperation. Thus, by carrying through the implications of group formation to the group level, this framework connects goals and alliance decisions in a manner that is cohesive with both preference-centric and power-centric approaches to understanding alliances in civil wars.

The framework so far explains which groups are likely to form alliances. However, it does not explain how these groups overcome credible commitment issues, a central concern in the existing literature. Blair et al. (2022) have argued that shared identity and ideological factors help overcome credible commitment issues by providing community monitoring, authority structures, trust, and transnational networks. While all these factors likely play a role, the theoretical framework I outline provides insight into the trust mechanism by specifying the link between goals and trust. I argue that the mechanics of group formation create internal pressures for groups with similar goals to trust one another.

When considering groups involved in civil wars, the concept of trust can be viewed in terms of encapsulated trust, as defined by Hardin (2002). In this context, trust exists when it is in one actor's best interest to account for the other's interests. When rebel actors share similar goals, it is in their best interest to take the other's interest into account for two reasons. First, when two actors cooperate and share similar goals, their utility from cooperation is higher due to a decrease in agenda dilution. Hardin (1997) argues that cooperative relationships that generate more benefits create incentives for both actors to maintain the relationship. This holds so long as the benefits of cooperation are higher than the benefits of defecting. Second, because neither actor is likely to defect, this creates credible expectations of future cooperation between the two groups. These expectations signal future gains from the cooperative relationship, which allow groups to overcome credible commitment issues (Hardin, 2002).

Given the role of both group goals and power in maintaining group cohesion described in previous chapters, when groups in civil wars form alliances with other groups with shared goals, the individual benefits for the group members increase. As a result, it is advantageous for these members to encourage their group to maintain a cooperative relationship. If the alliance is dissolved, some members may leave the group due to a reduction in the group's fighting capacity, while others may become dissatisfied due to changes in the group's perceived goals. These internal pressures create a situation where groups have a vested interest in maintaining their alliance relationships and thus develop trust between them.

Thus far, I have explored cooperation in civil wars at the group level, building upon the theoretical foundation established in previous chapters. I have also defined alliances and reviewed the literature on cooperation between rebel groups, with a focus on the role of power and preferences in shaping these decisions. By highlighting the limitations of existing models that fail to consider individual preferences and group goals in understanding multiparty conflicts, I investigate how these factors influence the decision-making process of groups to form alliances. Lastly, I discussed how distant goals between groups lead to incentives against forming cooperative relationships, while similarity in goals incentivizes alliances and creates encapsulated trust via internal pressures allowing groups to overcome commitment problems. I will next incorporate group-level cooperation in the existing agent-

based modeling framework and analyze the influence of different factors in this modeling framework.

4.2 AGENT-BASED MODEL OF GROUP ALLIANCES

In this section, I build on the ABM framework presented and utilized in Chapter 2 to explore patterns of alliances in civil wars. The modeling framework already examines how individuals join together to form groups. I now describe the framework's second level, where groups form alliances with other groups. By incorporating the individual and group levels into the framework, I aim to simulate and understand the dynamics of the preference- and power-centric approaches to alliances argued by existing research (Christia, 2012; Balcells, Chen and Pischedda, 2022). Specifically, this framework conceptualizes alliances as an agreement between two groups that define the goals that would be implemented if the two groups win the conflict.[4] This conceptualization aligns with the definition of alliances in the context of civil wars, as discussed in the previous section (Leeds, 2003; Keohane, 2005; Balcells, Chen and Pischedda, 2022; Blair et al., 2022).

Thus, a third type of agent is added to the model. These are the alliance agents ($q_i \in Q_t | i \in \mathbb{N}_0$). Alliance agents emerge as a property of the model through the interactions of group agents at each iteration t. If in a given iteration t there are no alliances, then $Q_t = \{\}$. Alliances are dyadic relationships that can be thought of as bi-directional edges between two groups. Thus, each alliance agent is a set containing two groups that share an alliance, such that $q_i = \{g_z, g_w\}$. However, large alliance networks may still form in this framework through the dyadic choices of groups. For example, if groups z and w are allies, and a third group k is also allied to z and then allies with w, all three groups will form an alliance triad, which represents a multi-party alliance. In this framework of alliances, q_{zw} and q_{zk} do not directly influence the decision of groups w and k to ally. However, alliances can have an indirect effect through the shift in the perception group's goals of z and k towards group w's perceived goals.

[4]Recall that *goals* are operationalized as positions across dimensions and weights on each position.

Alliance agents have three attributes. The first attribute A_{qt} where $(0 > A_{qt} > 1)$ represents the level of cooperation that two alliance partners have at a given time period t. In this formulation, 0 is no cooperation and 1 is a merger and is thus excluded from the alliance range. Concretely, A_{qt} can be thought of as how much cooperation two groups have, with higher values meaning that groups contributed more resources and intelligence and share more command structures. This means that groups are sharing more of their resources and fighting capacity with other groups for their joint goals. This parameter moderates both the benefits of alliances and how much the alliance-negotiated agreements will affect a group's perceived goal. The general idea is that the higher the level of cooperation A_{qt}, the more power an alliance agreement provides to each group (Akcinaroglu, 2012). However, the more cooperation two alliance partners have, the higher the impact of the alliance on shaping the perception of a group's goal (Leeds and Savun, 2007; Gartzke and Weisiger, 2013). The attribute A_{qt} is drawn for each alliance decision from a truncated normal distribution, where the mean and standard deviation are set by the researcher such that $A_{qt} \sim N(\mu, \sigma)$, where μ and σ are model parameters. In reality, the level of cooperation is usually decided by the two groups choosing to ally to maximize the benefit of cooperation and minimize costs. However, randomizing the parameters allows for simplification of the process while capturing some of the essences of the bargaining process. This approach to the A_{qt} parameters allows flexibility for researchers as it creates variation in the types of alliances that form in a given run while allowing researchers to explore how changes in alliances influence outcomes.

The second attribute alliances have are alliance negotiated position P_{qt} which represents the sequence of positions for D dimensions that the two groups which compose an alliance q have agreed upon. Like the position attributes for people and group agents, $-0.5 \leq P_{qt} \leq 0.5$. This parameter represents the positions across the relevant dimensions that the alliance would implement if it won the conflict. The elements of the set are the average P_{gt} of both groups weighted by their size $|N_{gt}|$. This implies that larger groups have a better negotiating position when deciding alliance goals, such that the positions and weights are closer to the group's internally negotiated goals (P_{gt} and W_{gt}). Thus, for an alliance $q = z, w$:

$$P_{qt} = \frac{P_{zt} * \frac{|N_{zt}|}{|N_{zt}|+|N_{wt}|} + P_{wt} * \frac{|N_{wt}|}{|N_{zt}|+|N_{wt}|}}{\frac{|N_{zt}|}{|N_{zt}|+|N_{wt}|} + \frac{|N_{wt}|}{|N_{zt}|+|N_{wt}|}}$$

The next attribute is the alliance negotiated weights W_{qt} which is the sequence of weights for D dimensions that the two groups which compose an alliance q have agreed upon. Given the constraints of the group and people agents weights, $0 \leq W_{qt} \leq 1$. Following P_{qt}, The elements of W_{qt} are the average W_{gt} of both groups are weighted by their size $|N_g t|$. Thus, for an alliance $q = z, w$:

$$W_{qt} = \frac{W_{zt} * \frac{|N_{zt}|}{|N_{zt}|+|N_{wt}|} + W_{wt} * \frac{|N_{wt}|}{|N_{zt}|+|N_{wt}|}}{\frac{|N_{zt}|}{|N_{zt}|+|N_{wt}|} + \frac{|N_{wt}|}{|N_{zt}|+|N_{wt}|}}$$

This ABM builds on the modeling framework of group formation, and people agents $n \in N$ behave as previously described in Chapter 2. However, there is one change to people agents' behavior in this model. Agents do not only account for the group's internally-negotiated goals when deciding to join or leave groups.[5] Instead, they also account for how the group's alliance partners affect their perception of these goals through the alliance goals. I refer to these as the perceived group goals. Likewise, individuals account for the group's aggregate power, which is the size of the group plus the added power given by all the alliances a group has.[6]

Given this set of behaviors, group agents now have four new attributes. The first is Q_{gt} which is the set of all alliances $q \in Q_t$ group g is part of. If in a given iteration t a group has no alliances, then $Q_{gt} = \{\}$. Next, like the internally-negotiated group goals, the perceived group goals are operationalized as positions and which are sequences of D dimensions. To differentiate between the two types of goals, I refer to the sequences of perceived group positions and weights as $\hat{P}_{gt}$ and $\hat{W}_{gt}$. Further, given the bounds of positions and weights for people agents, all elements of the perceived position sequence are $-0.5 \leq \hat{P}_{gt_d} \leq 0.5$ and the associated weights $0 \leq \hat{W}_{gt_d} \leq 1$. A group's perceived goal can be formalized as the weighted average between the group's internally-negotiated goals and the average of all the alliance

[5]The group's internally-negotiated goals are the group's goals as chosen by its membership.

[6]For example, the TPLF's alliance with the EPLF caused many to perceive them to be more in line with Eritrean independence by both other groups and individuals, despite the opinion of many in the TPLF that Eritrea should still be part of federal Ethiopia.

agreements the group has made. These factors are further weighted by the parameter A_{qt}. Thus, $\hat{P}_{gd}$ and $\hat{W}_{gd}$ can be operationalized as:

$$\hat{P}_{gt} = \frac{P_{gt} + \frac{\sum_{i \in Q_{gt}} P_i}{|Q_g t|}}{1 + \frac{\sum_{i \in Q_{gt}} A_i}{|Q_g t|}}$$

$$\hat{W}_{gt} = \frac{P_{gt} + \frac{\sum_{i \in Q_{gt}} W_i}{|Q_g t|}}{1 + \frac{\sum_{i \in Q_{gt}} A_i}{|Q_g t|}}$$

The last new attribute is M_{gt} which represents the overall power of the group, which accounts for its portfolio of alliances $q \in Q_{gt}$. The attribute M_{gt} uses the size of the group $|N_g t|$ plus an "artificial" increase in the size of the group due to its alliances. This attribute is calculated as:

$$M_{gt} = |N_{gt}| + \sum_{i \in Q_{gt}} (|N_{ijt}| * \frac{\frac{A_i}{2}}{|Q_{ijt}|})$$

Where ijt is the subscript for the alliance partner of a group g in alliance $q_i \in Q_{gt}$. In this formula, $\sum_{i \in Q_{gt}} (|N_{ijt}| * \frac{\frac{A_i}{2}}{|Q_{ijt}|})$ is the extra power gained from all alliances it has at a time period t. If a group has no alliances, then this value is 0. Thus, a group g receives a benefit for each alliance q that depends on the size of the alliance partner j weighted by the level of cooperation of alliance q divided by 2 and the number of other alliances group j has. By dividing the parameter A in half, the model represents the logistics and coordination costs, as well as the group's needs for the maintenance of its security and structure. The value is then further divided by $|Q_g|$ such that a group cannot offer the same support, fighters, and resources to two groups simultaneously. Rather, the group j divides its total cooperation resources amongst all its alliance partners. The value of M_{gt} replaces $|N_g t|$ in function B such that it now is:

$$B(M_{gt}, N) \begin{cases} 0 & M_{gt} = 0 \\ 0 & M_{gt} \geq |N| \\ 1 & M_{gt} = \frac{|N|}{2} + 1 \\ \frac{1}{\frac{|N|}{2}+1} * M_{gt} & M_{gt} < \frac{|N|}{2} + 1 \\ \frac{-1}{N-(\frac{|N|}{2}+1)} * M_{gt} - \frac{-1}{|N|-(\frac{|N|}{2}+1)} * |N| & \frac{|N|}{2} + 1 < M_{gt} < |N| \end{cases}$$

Given these changes to the model, the payoff of being part of a group, given by function R now takes the form of :

$$R(M_{gt}, N, D, P_n, W_n, \hat{P}_{gt}, \hat{W}_{gt}) = B(M_{gt}, N) - \frac{\sum_{d=1}^{D} |\hat{P}_{gt_d} * \hat{W}_{gt_d} - P_{n_d} * W_{n_d}|}{D}$$

After all people agents have completed their set of behaviors at $t = 0$ as described in Chapter 2, but with the new formulation of the function R, the group phase of the model begins. At this point, each group $g_z = z$ is paired off with another group $g_w = w$. Group w is randomly drawn from the set of groups G_t that exist at time t. Groups z and w will then decide whether or not they will form an alliance $q = \{z, w\}$. If the groups are already allied such that $q = \{z, w\} \in Q_t$, then they are given a chance to renegotiate their alliance where a new $A_{qt} = \hat{A}_{qt}$ is randomly selected and compared with the previous alliance A_{qt}, or for the two groups to break off their alliance. If the two groups are not already allied, and they agree to form an alliance than this creates an alliance agent $q = \{z, w\}$.

The decision to ally begins with z and w deciding on the alliance agreement which specifies the sequence of positions P_{qt} and weights W_{qt} for all dimensions D that the alliance would implement if they jointly won the conflict. Next, the leaders of each group $L_z t$ and $L_w t$ canvas the support of their group's members to the alliance. This canvassing mirrors the leader merger decision from Chapter 2 where all other agents $n \in N_{wt} \notin L_{wt}$ will indicate the decision to ally with group w, except the same now takes place within group z.[7] If an

[7]In the merger decision the leader of the other group does not account for how the membership feels towards the decision because the decision is to simply recruit new members, this decision has been modeled as a leader-only decision for other recruitment behavior. However, the ABM framework is sufficiently flexible to allow for experiments with this assumption to understand its implications.

agent $n \in N_{wt}$ does not support the cooperation then it joins the temporary set F_w and if the alliance forms, all $n \in F_w$ leave group w behind and returns to status $S_{nt} = Individual$.

Thus, before $L_w t$ makes a decision $n \in N_{wt} \notin L_{wt}$ are randomly drawn to indicate their support for alliance q. These agents support the formation of alliance q if their payoff from R is higher with the new alliance than with the group as it stands such that $R((M_w t|Q_{wt} \cup \{q\} - F_w), N, D, P_n, W_n, (\hat{P}_{gt}|Q_{wt} \cup \{q\}), (\hat{W}_{wt}|Q_{wt} \cup \{q\})) > R((M_{wt}, N, D, P_n, W_n, \hat{P}_{wt}, \hat{W}_{wt})$. If they do not support the decision then they join the set F_w.

After all agents $n \in N_{wt}|S_n = Member$ and $n \in N_{zt}|S_n = Member$ have chosen whether or not to support the alliance, the leader of the groups decides if the group will accept or decline the alliance. The leader compares its payoff from being the leader of a group w (or z) as it stands, with the payoff of a group w if the alliance q is formed. Like the other agents in the group, the leader's decision is based on function R such that the leader of group w will accept the alliance if $R((M_w t|Q_{wt} \cup \{q\} - F_w), N, D, P_{L_{zt}}, W_{L_{zt}}, (\hat{P}_{gt}|Q_{wt} \cup \{q\}), (\hat{W}_{wt}|Q_{wt} \cup \{q\})) > R((M_{wt}, N, D, P_{L_{zt}}, W_{L_{zt}}, \hat{P}_{wt}, \hat{W}_{wt})$. If the condition holds for both leaders, then the group $q = w, z$ will form, and all agents in F_w and F_z and leave the group to become $S_{nt} = Individual$. If one leader rejects the offer then no alliance is formed and the groups stay as they are with no agent $n \in F_w$ and $n \in F_z$ leave their respective groups.

When alliance q already exists, the same pattern as described above holds. However, $n \in N_{wt} \notin L_{wt}$ compare the group's current payoff with $R((M_w t|\hat{A}_{qt} - F_w), N, D, P_n, W_n, (\hat{P}_{gt}|\hat{A}_{qt}), (\hat{W}_{wt}|\hat{A}_{qt}))$, where $\hat{A}_{qt}$ is the new level of cooperation. While the leaders compare the groups current payoff with $R((M_w t|\hat{A}_{qt} - F_w), N, D, P_n, W_n, (\hat{P}_{gt}|\hat{A}_{qt}), (\hat{W}_{wt}|\hat{A}_{qt}))$. If both groups are better off under $\hat{A}_{qt}$ cooperation level then the attribute $A_{qt} = \hat{A}_{qt}$ for the alliance. After this renegotiation, the two groups also undergo a decision to break off the alliance where $n \in N_{wt} \notin L_{wt}$ compare their group (after the renegotiation) is better off without the alliance q through $R((M_{wt}, N, D, P_n, W_n, \hat{P}_{wt}, \hat{W}_{wt}) > R((M_w t|Q_{wt} \setminus \{q\} - F_w), N, D, P_n, W_n, (\hat{P}_{gt}|Q_{wt} \setminus \{q\}), (\hat{W}_{wt}|Q_{wt} \setminus \{q\}))$. Those agents that do not support breaking the alliance join set F_w. The leader of group w then compares $R((M_{wt}, N, D, P_{L_{zt}}, W_{L_{zt}}, \hat{P}_{wt}, \hat{W}_{wt}) > R((M_w t|Q_{wt} \setminus \{q\} - F_w), N, D, P_{L_{zt}}, W_{L_{zt}}, (\hat{P}_{gt}|\ Q_{wt} \setminus \{q\}), (\hat{W}_{wt}|Q_{wt} \setminus \{q\}))$. If the condition holds for either group, the alliance breaks off such that $q \notin Q_t$ and all agents in F_w and F_z leave their groups.

Further, after a group g undergoes the decision process described above, each previously

existing alliance partner that the group g has now has an opportunity to choose to break off the alliance by repeating the same process described above, but given the new values for M_{gt}, position $\hat{P}_{gt}$, and weight $\hat{W}_{gt}$.

The framework described above has some assumptions that are worth further highlighting. First, each group leader and the followers know the level of support for the alliance in his/her group given by the number of followers who support it. However, they do not know the level of support in the other group. As stated, the group leaders each assume that their possible alliance partner will stay united if an alliance forms. This implies that they calculate the benefits and alliance agreement as if their possible alliance partner were to stay united after the group's alliance.[8] Second, each group does not know how their allies will react to a new alliance before the alliance is made. This assumption is one representation of the uncertainty groups have about how other actors will react to their actions.[9]

The last assumption that is perhaps the most consequential is that I have modeled alliances as a positive sum interaction. Formally, this means that for two members of an alliance $q = \{z, w\}$, $(M_{zt}|Q_{zt} = \{q\}) > (M_{zt}|Q_{zt} = \{\})$ and $(M_{wt}|Q_{wt} = \{q\}) > (M_{wt}|Q_{wt} = \{\})$, further, $(M_{zt}|Q_{zt} = \{q\}) + (M_{wt}|Q_{wt} = \{q\}) > (M_zt|Q_{zt} = \{\}) + (M_{wt}|Q_{wt} = \{\})$. However, do note that given the constraints of A_{qt} and the formula for M_{gt}, $|N_{zt} \cup N_{wt}| > (M_{zt}|Q_{zt} = \{q\})$, and $|N_{zt} \cup N_{wt}| > (M_{wt}|Q_{wt} = \{q\})$. Thus, a merger of the two groups would be more powerful than either of the groups with the alliance q but less powerful than if the total power of the two groups given the alliance were to be added. This positive-sum interpretation of alliances is common in both the rebel group alliance literature (Akcinaroglu, 2012; Phillips, 2014), and the more broad alliances and cooperation literature (Axelrod, 1997; Morrow, 1991; Keohane, 2005; Cranmer, Desmarais and Kirkland, 2012). The way this works in this model is not that there is more power (or soldiers) being created by an alliance, but rather that a group can use some of their alliance partner's power temporarily. Imagine two groups with 10 soldiers each, that agree to share 2 soldiers with each other. What the alliance allows for is a situation where both groups can fight with 12 soldiers as long as they

[8]The framework presented can analyze this assumption in future work by drawing predicted attrition rates given alliances for each decision. However, the effects of this on the model are unlikely to significantly influence the analysis presented in the next sections.

[9]However, other representations can be modeled within the framework and may be worth future consideration.

do not fight at the same time.[10] While this simplifying assumption is coded into the ABM, the framework it provides allows for research to also explore other forms of power aggregation through alliances that are not positive sum through experimenting with the formula for $M_g t$.

4.3 ALLIANCE FORMATION ANALYSIS

Having described the second stage of the ABM framework, I now demonstrate how individual-level preferences influence group formation and, in turn, cooperation between groups. ABMs are generative models that explain a data-generating process. Thus, using computational experiments it is possible to compare the implications of these different processes and how these implications match observed data in the actual world. Further, given full knowledge of the data-generating process of the framework, it is possible to use the derived data to explore the strengths and weaknesses of observational data. As such, in this section, I first demonstrate how including the alliance formation stage in this modeling framework impacts model outcomes. Through this analysis, I aim to show that the mechanisms of group formation and maintenance affect alliance behavior, but alliance behavior also alters the number of groups we expect to see in conflicts. This displays the importance of specifying both types of behaviors in one cohesive framework. Next, I use a series of logit models to explore how these models can explore observable data. Further, I compare the results produced by analyzing the modeling framework with the findings of existing studies about alliance formation in civil wars. More specifically, I demonstrate how logit models on data generated from the ABM lead to coefficients in the same direction as previous studies on rebel group alliances across a series of model specifications. However, failure to correctly account for all variables, especially goals, results in misestimating effect sizes. These analyses demonstrate the connection between individual-level preferences and alliance decisions as articulated by the ABM, and that this connection is critical to generate data consistent with observed patterns of alliances between rebel groups.

[10] This is not a strong assumption to make as it only assumes groups do not need access to all their capacity at all times.

To analyze the patterns of cooperation suggested by the ABM framework, I first describe how to generate data using the model such that it approximates actual data of alliances in civil wars. I first create 170 random societies in which the ABM will run. This number of societies is roughly similar to the number of civil wars between 1946-2010 in the UCDP data.[11] To create each society, the first step is to select the number of N_o identity groups or prototypes present in each society. This value is drawn randomly from a truncated normal distribution with a mean of 5 and a standard deviation of 3. The distribution is left truncated to ensure that each society has at least two identity groups. This distribution is similar to the distribution of identity groups in the Fearon and Laitin (2003) measure of the number of identity groups in terms of mean and variance.[12]

Next, I define each prototype o_i following the steps in Chapter 3.1. For each o_i in a given society, I randomly assign a point in three-dimensional space such that the coordinates of the point indicate the average position of that prototype for the corresponding dimension, $\mu_{o_{i_d}}$.[13] Given the that $-0.5 \leq P_{n_d} \leq 0.5$, the space from which $\mu_{o_{i_d}}$ is drawn is bound by these values. I assume that there are only three relevant dimensions in all societies. This assumption is helpful as it reduces the complexity of the models and aids in the visualization of the data. But the number of dimensions is unlikely to affect the data generating process.[14] Each prototype is then assigned a ν_{o_i}, a segment of length three that contains the average weight for the prototype o_i for given dimensions d. Given that $0 \leq W_{n_d} \leq 1$, the space from which $\nu_{o_{i_d}}$ is drawn is bound by these values. Each $\nu_{o_{i_d}}$ is drawn from a truncated normal distribution with a mean of 0.5 and a standard deviation of 0.5.

Next, each prototype is randomly assigned a distribution from which the agents $n \in o_i$ will draw their opportunity cost of joining a group C_n. The distribution is composed of an average value $\mu_{C_{o_i}}$ drawn from a truncated normal distribution with a mean of 0.3, a standard deviation of 0.25, and truncated at -1 and 1. The distribution also has a variance $\nu_{C_{o_i}}$ drawn from a truncated normal distribution with a mean of 0.1 and a standard deviation of 0.25. Thus, each agent $n \in o_i$ will have a $C_{n \in o_1} \sim N(\mu_{C_{o_i}}, \nu_{C_{o_i}})$.

[11] I round the number of conflicts in UCDP in that period (169) to the nearest ten value.

[12] The distribution of this variable is shown in Appendix Figure 34.

[13] For a detailed explanation of the process behind the random assignment, please see the Appendix section Random Society Creation.

[14] However, it is possible to analyze the effect of the number of dimensions in future work.

For each o_i, I randomly assign a N_o, or the number of agents of that prototype. This value is drawn from a normal distribution with a mean of 250 and a standard deviation of 100. Given these values, I generate a N_o number of n agents for each o_i prototype in the 170 societies. Each n agent is generated following the model of society creation described in Chapter 3.1. In short, each agent n is given an opportunity cost, a set of positions, and a weight for each dimension based on the average values of their identity group. Following the process described creates 170 societies with a different number of agents and distribution of the goals and weights in a three-dimensional space.

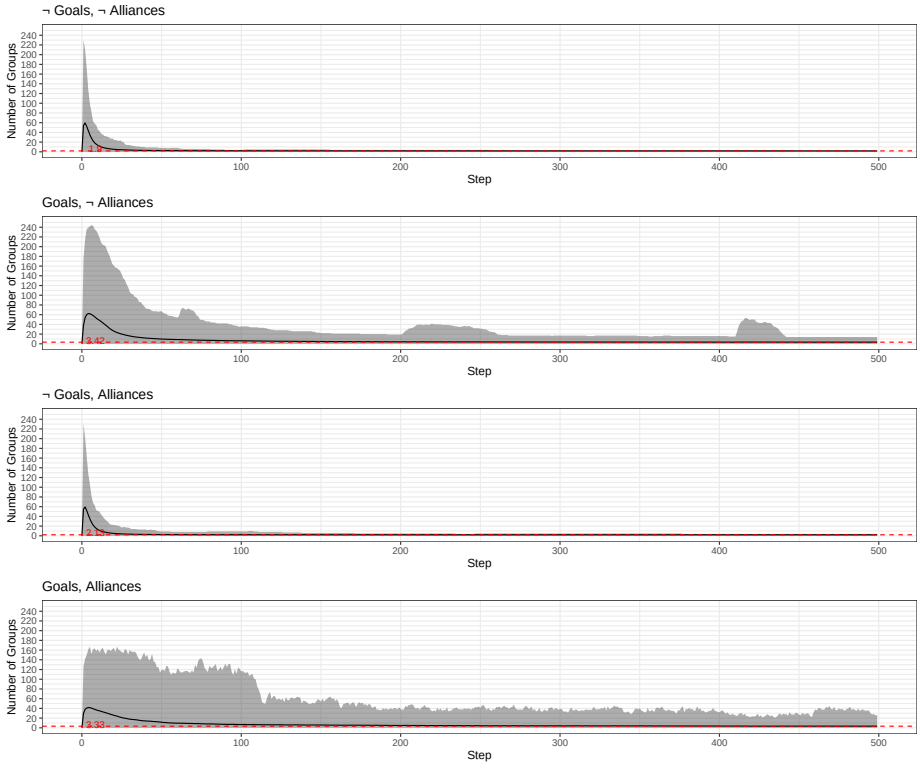
4.3.1 Effects of Goals and Alliances on ABM Outcomes

In this section, I analyze the role that individual goals and cooperation have on the outcomes of the agent-based model. I begin by exploring how accounting for these two factors lead to different outcomes in terms of the number of groups that form in a conflict, I then compare how these outcomes match with actual world data on the number of armed groups in conflicts. Particularly, I demonstrate that accounting for goals is necessary to actualize patterns of group formation observed in real data. Further, accounting for the interdependence of cooperation at the individual level to form groups and at the group level to form alliances leads to patterns that better approximate actual world data on armed groups. Lastly, I trace the process of alliance-making in an example run of the ABM to visualize the role of goals and group strength in alliance-making in the ABM framework as well as the emerging patterns of alliances.

To investigate the role of individual goals and group alliances in shaping cooperation among rebel groups, I conducted a series of simulations based on four model specifications. For the first two specifications, I set the weights for all individuals on all dimensions to be 0, effectively eliminating the influence of goals on individual and group positions. In one of these model specifications, the group cooperation stage was turned off, precluding the formation of alliances. In the other model, groups could form alliances. In the other two specifications, the weights for individual preferences were determined by the society data creation process, allowing goals to factor into individual and group decision-making. Again, for one of these,

the group cooperation stage was turned off, while in the other it was not. Thus, I created four model specifications: 1) ¬Goals, ¬Alliances, 2) Goals, ¬Alliances, 3) ¬Goals, Alliances, and 4) Goals, Alliances. Each specification was run twice for 500 iterations across each of the 170 generated societies, resulting in a total of 340 model runs for each specification.

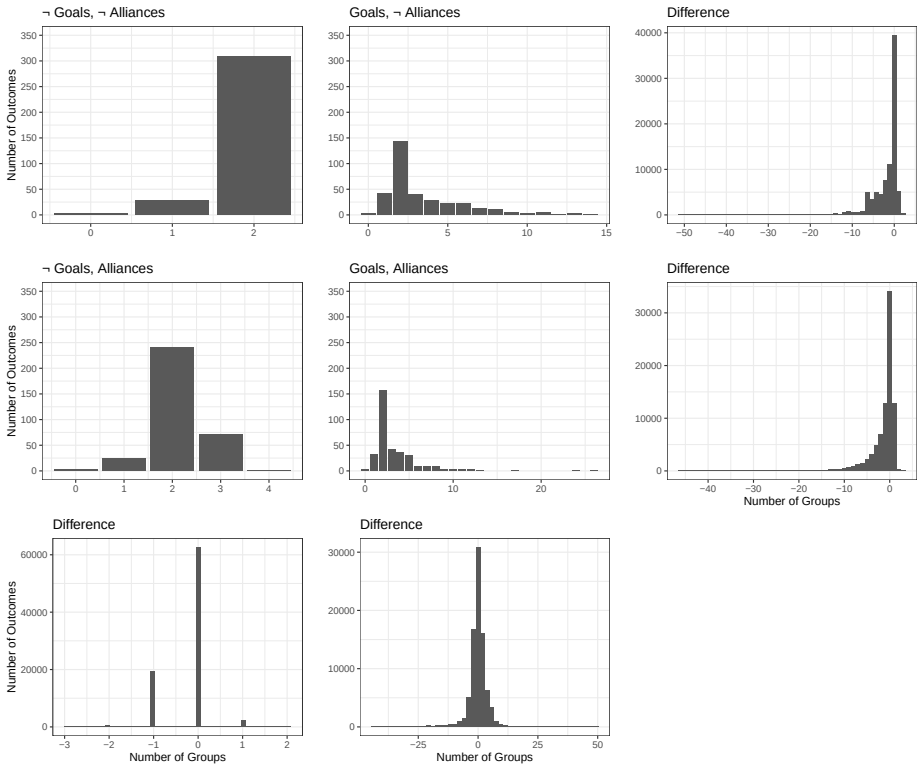
Figure 14: Comparison of Number of Groups



The number of groups for each model specification across 500 iterations is plotted in Figure 14. The solid line represents the average number of groups while the shaded gray area illustrates the range of maximum and minimum number of groups for each step. The figure shows a significant increase in the number of groups in all specifications followed by a plateau. However, in the models where there is no influence of individual goals, the number of groups reaches a stable equilibrium, whereas in the models where goals are relevant, there is no equilibrium, and the number of groups fluctuates around a quasi-equilibrium. These results are consistent with the previous analysis on a single society, with the exception that the "¬Goals ¬Alliances" now models exhibit three possible equilibria, namely no group

formation, the formation of one group, or the two-group equilibrium found in the previous examples. Importantly, the results also demonstrate different patterns of group formation across the model specifications. Notably, the model that incorporates both goals and alliances exhibits more variance in the number of groups and is less stable than the other models.

Figure 15: Comparison of Distribution of Groups at Last Iteration

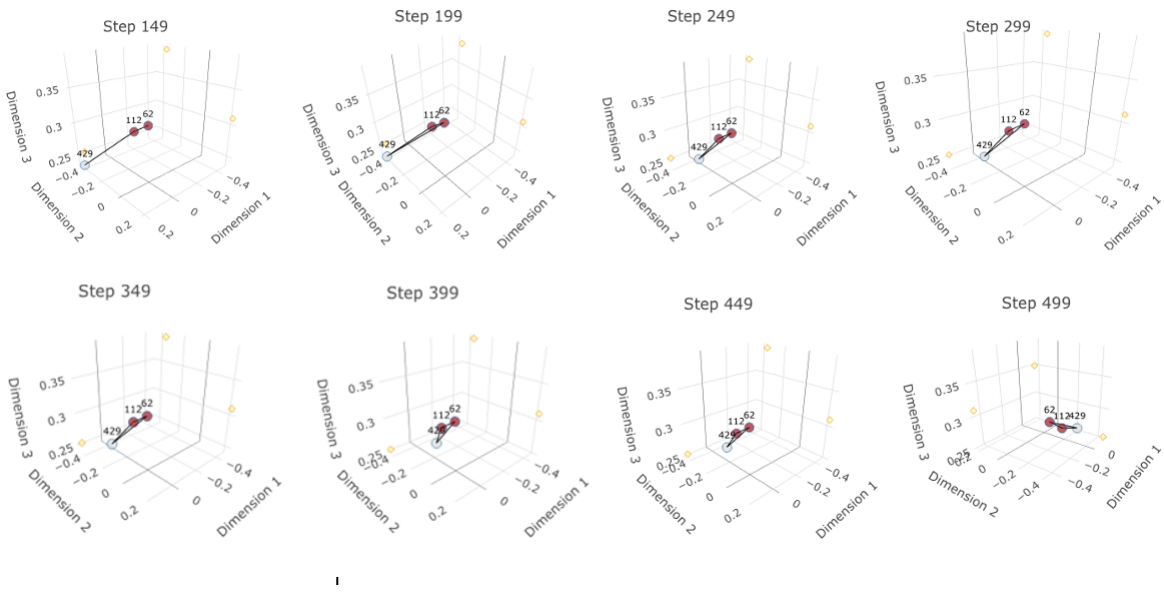


To better visualize the differences between the outcomes of the four mode specifications, Figure 15 plots the distribution of the number of groups in the last iteration of the model and the difference in the distributions between the comparable specifications. The two absolute difference graphs on the right-hand side display the difference between the models that fail to account for goals and those that do. Given the left skew in the distribution, both graphs demonstrate that failing to account for goals on average leads to fewer groups forming.

Further, the two bottom graphs in the figure demonstrate how the addition of the alliance stage changes the distribution of the number of groups likely to be seen in the data regardless of the role of goals in the specification. The bottom center graph in the figure

plots the absolute difference between the "Goals ¬Alliances" and the "Goals, Alliances". The distribution of the differences is centered on 0 and has a bell-shaped curve, but there is a light skew to the left, indicating that the "Goals, Alliances" has a slightly larger average number of groups. A similar pattern is observed between the "¬Goals, ¬Alliances" and "¬Goals, Alliances" model specifications. The differences between the two specifications are relatively minor but impactful. In particular, the existence of more than two groups in the latter model specification seems to allow for the possibility of a multi-party civil war accounting only for minimal winning coalition logic. Therefore, it is crucial to examine the patterns of alliances in the three social structures, especially the no-goal social structure.

Figure 16: Goals, ¬Alliances 3 Groups Example

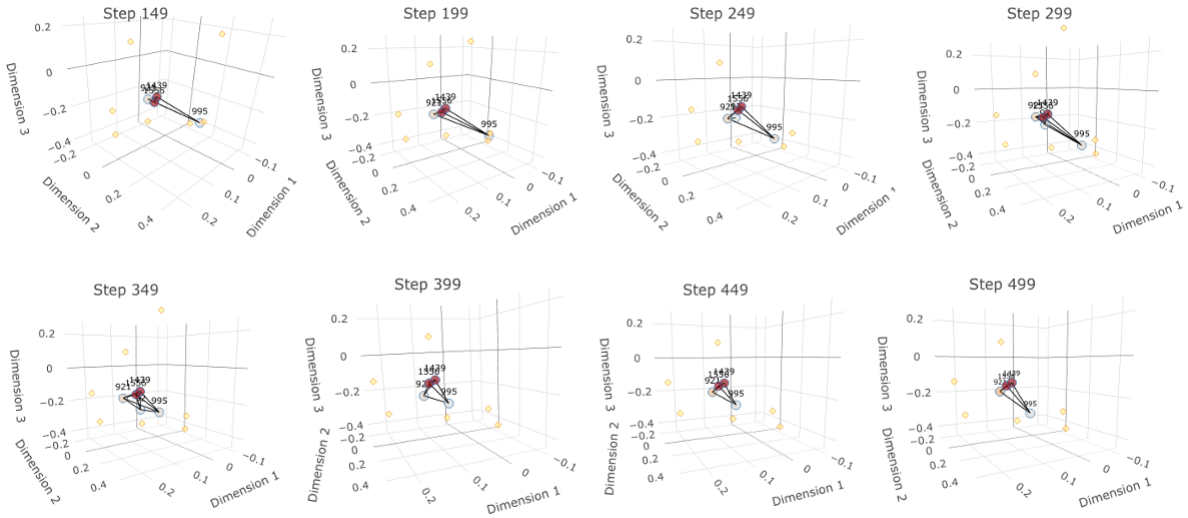


Notes: Each dot represents a group in the model run, while the number is the ID of the group. The light yellow diamond shapes are the average position of the prototypes in this model run. Darker reds for the dot indicate that the size of the group is larger, while the black lines indicate an alliance relationship.

Figures 16 and 17 show two examples of the group and alliance formation process in the ABM framework for the "¬Goals, Alliances" model specification where there are more than two groups. Figure 16 depicts an example of a model run where three groups form. In this

example, the groups quickly create a set of alliances such that all groups are allied with one another. In essence, this means that there are no rebel groups as everyone is cooperating. All other examples of the three-group run of this specification follow a similar pattern. Likewise, the model with a four-group outcome in the last step depicted in i17 leads to a fully connected network of alliance between the four groups by the 200th iteration. These figures show that while adding alliances does lead to more than two groups forming without accounting for goals, the outcomes still do not match with observation in the actual world as there is no possibility of civil war as all groups are allied with the government. Another notable observation is that as the number of steps increases, the positions of all the groups migrate to the center of the space as the groups recruit from all prototypes and the alliances also bring the groups together. Overall, this indicates the importance of accounting for goals in the models.

Figure 17: Goals, ¬Alliances 4 Groups Example



Notes: Each dot represents a group in the model run, while the number is the ID of the group. The light yellow diamond shapes are the average position of the prototypes in this model run. Darker reds for the dot indicate that the size of the group is larger, while the black lines indicate an alliance relationship.

Next, I compare the data generated by each model specification to actual world data from the Armed Group Dataset (AGD) (Malone, 2022). The AGD was chosen because it includes small groups that fall below the standard threshold of violence, thereby reducing concerns about selection bias. In addition, weak groups are prevalent in the ABM-generated data, where groups composed of only a few agents often form in the model. Although these groups may not last long in the ABM, they still count as armed groups. Therefore, the AGD provides a more natural comparison with the data generated by the ABM.

To make the data sets comparable, I removed all observations from the AGD data containing zero armed actors, as these cases represent no conflict. This resulted in a dataset of 3051 group-year observations. For data sets generated by the ABM, I subtracted one group from the total count of groups at each iteration, as one group in the model represents the government and which is not included in the AGD. I further excluded all observations from the first 100 iterations in all runs of the ABM. The number of groups in these steps is inflated due to the assumption of no initial groups in the ABM and therefore is unlikely to match observational data on armed groups.[15] To ensure comparability, I also excluded all cases of no groups in the ABM model runs. Finally, I create 10,000 randomly selected data sets of 3051 observations from each model specification. This randomized selection ensures that all datasets have the same number of observations as the AGD to facilitate comparison.

Table 2: Moments of Distributions of Groups

Model	Mean	Variance	Skewness	Kurtosis	EMD
Armed Groups Data	4.07	33.85	5.85	52.06	0
Goals, Alliances	3.80	29.93	4.06	28.65	0.63
Goals, ¬Alliances	3.40	13.03	2.65	14.72	0.69
¬Goals, Alliances	1.26	0.26	2.39	12.83	2.81
¬Goals, ¬Alliances	1.04	0.05	6.31	48.01	3.02

Table 2 shows the average of the first four moments of the distribution of the number of rebel groups in across all samples of data each model. The table shows that the data generated by the "Goals, Alliances" more closely approximates the actual data in the

[15]This inflation is demonstrated in Figure 14.These first 100 iterations are interpretable as a pre-conflict period where groups are not yet committing violence.

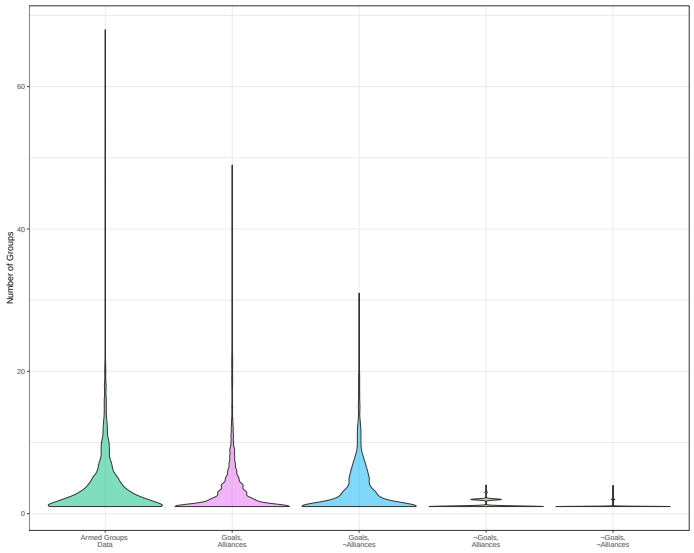
Armed Groups Data as it has the closest values for three out of four moments. The only moment where the "Goals, Alliances" is not the most similar is the kurtosis where the "¬Goals,¬Alliances" is closer in value. However, this model is the most different in all other moments and therefore is the most different dataset from the AGD. Further, the "Goals, Alliances" has the second most similar kurtosis. Further, the table shows the average Earth Mover Distance (EMD) across all sample for each model compared to the real world data from the Armed Groups Data.[16] The EMD is a measure of the minimal cost that must be paid to transform one distribution into the other, in short, it can be used as a quantitative dissimilarity between two distributions (Rubner, Tomasi and Guibas, 2000). In this context, the similarity of the sample generated from the four models to the real data. The smaller the value the less costly it is to transform the distribution of the number of groups generated from that model to that from real data. As the table shows, the data from the "Goals, Alliances" is the least costly to transform to real data, followed closely by the '¬Goals,¬Alliances" model. Both these models have much smaller EMD values compared to the two models where goals are not accounted for. Overall, the "Goals, Alliances" version of the ABM can closely approximate real data in the number of expected groups and produces data that best matches the real world. Therefore the full model is a better candidate to explain the data generating process of group formation than the other three models.

Figure 18 plots the distribution in the number of groups observed for one example of the 10,000 samples for each data set. The plot visualizes the results from Table 2 that the "Goals, Alliances" data is the most similar of the models to the observed AGD data. While the "Goals, Alliances" model does not perfectly match the actual world data from the AGD, it closely approximates it, suggesting it is the best out of the four sets of models.[17] While not perfect, the ABM framework provides a strong foundation to study the data-generating process behind group formation.

[16]The EMD is calculated using the emdist package in R Urbanek, Rubner and Urbanek (2015).

[17]Further calibration of the model parameters is likely to lead to a better approximation of the data in the AGD.

Figure 18: Comparison of Distribution of Number of Groups

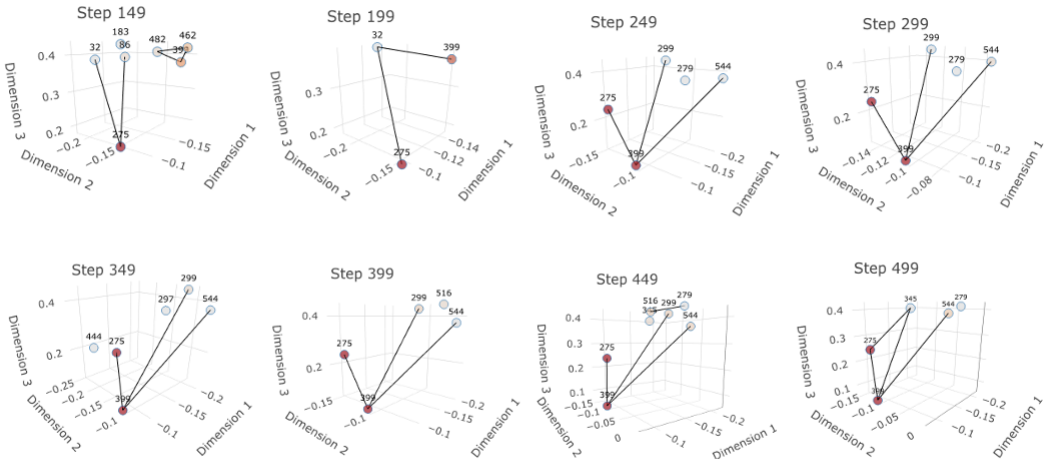


To visualize the role of goals and groups and the patterns that emerge in the data generated by the ABM, I randomly selected two model runs from the "Goals, Alliance" model that had more than two groups at the last step and plotted their alliance formation patterns. These plots provide insight into the consistency of the ABM-generated patterns with those observed in the real world. One example of such visualization is shown in Figure 19.[18] This model run demonstrates two interesting patterns. First, as seen in the 150th step of the model, the ABM can create triads of alliances, which are occasionally observed in the world. For example, in the early years of the Ethiopian Civil War, the TPLF, EPRP, and EPLF had cooperative relationships with one another. Second, the model shows that powerful groups (those in dark red) can create alliances with other groups with more distant goals. However, this is not always the case, especially when groups have more distant positions in the policy space, as seen in steps 249-499. The other groups are occasionally capable of forming alliances, but this seems to occur only with groups that have similar positions. For example, in step 449, two groups in conflict with larger groups ally. In contrast, in step 349,

[18]Additional visualizations of the two examples are presented in the Appendix section labeled "More Visualization of Example Networks," which includes the position of each society's prototypes to visualize the differences in positions between groups and the relationship between the groups and the prototypes.

the two groups in conflict with larger groups are unable to ally. Although one powerful group (which may be thought of as the government) can create a network of alliances with other groups that sometimes leads to a situation where there is no civil war, the lack of alliance formation between all groups could still result in non-state conflicts as defined by the UCDP dataset.

Figure 19: Goals, Alliances Example 1

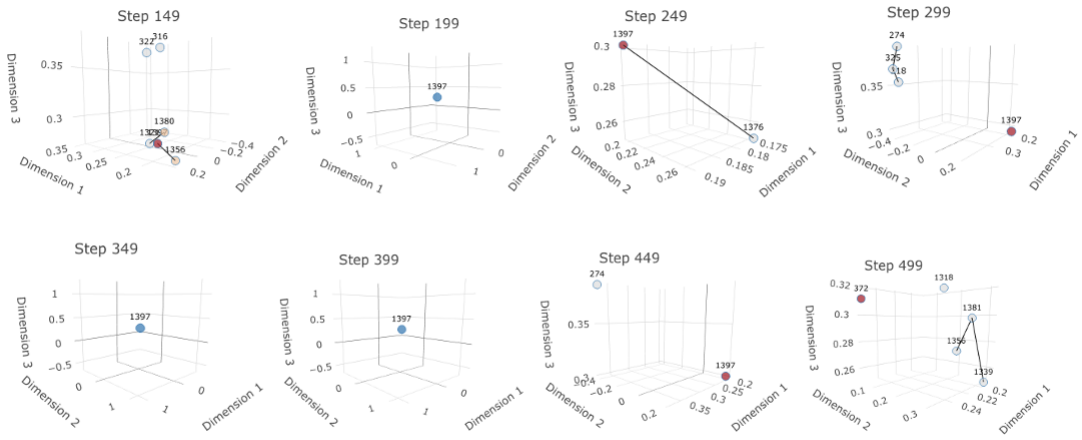


Notes: Each dot represents a group in the model run, while the number is the ID of the group. Darker reds for the dot indicate that the size of the group is larger, while the black lines indicate an alliance relationship.

The second example run of the model is depicted in Figure 20. This visualization also highlights important patterns in the generated data. In step 149, there are six groups, with four larger groups forming two coalitions of alliances in the lower corner of the plot. However, the two smaller groups in the top corner did not ally despite their similar positions in the policy space. This illustrates how slight differences in goals can hinder rebel group alliances, whereas larger groups can overcome these differences. Moreover, in steps 199, 349, and 399, one of the larger groups in the bottom corner of step 149 can eliminate all other groups. Nonetheless, in steps 299 and 449, other groups emerge with distant positions from

this group. In step 299, these small groups form some cooperative relations but quickly dissolve, while in 449, only one challenger exists. By the final iteration, the initial group that monopolized power in some steps splits into multiple groups, some of which can form alliances when they have more similar positions in the policy space.

Figure 20: Goals, Alliances Example 2



Notes: Each dot represents a group in the model run, while the number is the ID of the group. Darker reds for the dot indicate that the size of the group is larger, while the black lines indicate an alliance relationship. Blue dots indicate large groups when there is no other group.

In this section, I have shown how the patterns of data generated by the ABM can approximate actual world data on rebel group emergence. Further, the model best approximates this data when it accounts for both the role of goals in cooperative decisions at the individual level, and groups are capable of forming alliances, also accounting for goals. The patterns of cooperative ties between these groups also provide insight into the role goals and group strength in the data-generating process of the ABM and are capable of creating patterns that are observed in the real world.

4.3.2 Logistic Models of Alliance Formation

In the previous section, I provide evidence of the importance of accounting for goals and alliances in the process of group formation. I now explore how group-level factors influence alliance decisions in the ABM framework. To do so, I use a series of logistic models on the data generated by the ABM framework and compare these models with existing models of alliance formation. These models use a series of independent variables related to power and goals to explain a binary variable indicating alliance or failure to ally as the dependent variable. This analysis provides a level of validation of the ABM by demonstrating the similarities with existing models and shows that these types of models can capture underlying relationships between variables despite the complex nature of cooperation in conflicts. In essence, this means the ABM provides one valid explanation for the data-generating process. However, this analysis can also highlight the limitations and possible pitfalls of using these regression models. Further, the ABM framework allows for computational experiments to analyze how alternative hypotheses about the role of different factors lead to alliances between rebel groups. Most important to this work is how different levels of the importance of goals for individuals affect the models of alliance formation. By demonstrating the effects of not accounting for individual preferences on model outcomes, this computational experiment demonstrates that these factors play an important role in cooperative behavior in conflict.

The first step in this study is to generate data approximating real-world alliance data using the ABM framework. To accomplish this, I use the 170 societies previously created and run the ABM for a total of t iterations on each society, where $\frac{t}{100}$ represents the length of the conflict in years such that each year is analogous to 100 iterations.[19] The value of t is randomly drawn from a normal distribution with a mean of 2 and a standard deviation of 3. However, the distribution is truncated at 2 to ensure that each model runs for a minimum of 200 iterations, with the first 100 iterations discarded due to their high volatility (as depicted in Figure 14). Further, societies that failed to create at least three groups after 10 runs of the model are dropped from the analysis because one group represents the government model runs with two groups leaving only one challenger, thus eliminating the possibility of

[19]This means that each iteration is roughly equivalent to half a week.

rebel group alliances. As a result, 18 societies were excluded from the analysis, leaving data on 152 societies. This number is still considerably higher than the 51 countries analyzed in Blair et al. (2022).

At each iteration of the model, data is collected on every group that forms within each generated society, which is then converted into dyads of alliance interactions between the groups.[20] For each group in the dyad, I capture each group's size M, overall size $\hat{M}$, goal distance, which I operationalize as the average distance between the weighted positions of the two groups, and the alliance level A proposed for the interaction. This data is collected immediately before an alliance decision so that the alliance decision does not influence the values. For each dyad, I create a binary variable called Alliance Success which captures whether the interaction resulted in successful cooperation. This variable matches the binary alliance variable most research on rebel group alliances attempts to explain. Furthermore, to make the model more closely resemble actual world data, which is typically measured yearly, I group the data every 100 iterations and retain the last successful alliance between two groups in a dyad within that 100 iteration period. If there is no alliance in a given dyad, then the last failed interaction is kept. Lastly, I assume that the largest group at the 100th iteration represents the government, and we exclude all dyads involving the government from the data. This leads to a data set consisting of 60,165 dyad-year observations. The size of the data set is significantly larger than the actual world data on rebel alliances due to the larger number of conflicts in the generated data, and the inclusion of more small groups that often are not recorded in the data sets.[21]

One of the goals of this analysis is to compare the analysis of the generated data from ABM, with previous research on alliances in civil wars. Thus, I recreate two measures that rely on group power. The first is a Weak Link variable used by Bapat and Bond (2012). The idea behind this variable is that it captures the ability of the weakest group in a dyad to resist being co-opted by the government (or other groups) into breaking the alliance. The first variable is the power or $\hat{M}$ of the weakest group in the dyad, while the second variable, based on the expectation proposed by Christia (2012) and used in Popovic (2018),

[20] Here, "interaction" refers to attempted alliances or the maintenance of existing alliances during the given period.

[21] For example Blair et al. (2022) has a data-set of 2496 dyad years for 51 conflicts.

argues that rebel groups are more likely to cooperate with groups of similar strength. Thus, following Popovic (2018), I create a Ratio variable that measures the balance of power within a dyad as a range of values from 0 which signals one side is much more powerful, and 1 which signals a balance between the two groups. The variable is created by dividing the $\hat{M}$ of the less powerful group by the $\hat{M}$ of the more powerful group. To facilitate the interpretation of the results of all regressions, I follow the recommendations in Gelman (2008) and standardize the variables by dividing by two times the stand deviation so the resulting coefficients are directly comparable to untransformed binary predictors.

Table 3 summarizes the results of previous research on the three key variables, Weak Link, Strength Ratio, and Goals. The table includes the variables and the direction of the significant coefficients. I excluded the results of Christia (2012) from the table since they did not explicitly test the proposed model. Nonetheless, Popovic (2018) tested the model proposed by Christia (2012).

Table 3: Other Studies Summary of Results

	Bapat and Bond (2012)	Popovic (2018)	Balcells, Chen and Pischedda (2022)	Blair et al. (2022)
Goals	NA	NA	-	-
Weak Link	+	ϕ	NA	NA
Ratio	NA	+	NA	+

Notes: NA signifies a variable was not tested, while ϕ means no significant statistical relation was found.

I now create four logistic model specifications where the dependent variable is Alliance Success. In all four model specifications, I control for the existing alliances of each group in the dyad and the different social structures by adding a society-fixed effect. In the first specification, I further add the Weak link variable. This specification is similar to that of Bapat and Bond (2012) and the weak link model in Popovic (2018). The second specification has the control variables and the Ratio variable. This specification matches the relative strength model specification in Popovic (2018), which tests the arguments of Christia (2012). The third specification has the control variables and the Goal Distance variable. This specifica-

tion is similar to models in Balcells, Chen and Pischedda (2022), which do not account for any power dynamics. I further note that the models in this paper do not directly account for goal distance, but rather account for shared goals along specific dimensions or identities. While they are not the same measures, the Goal Distance measure is more refined and still encapsulates the same theoretical factor as the measures used in previous studies. Lastly, the final model specification accounts for the control variables and the Goal Distance, Weak Link, and Ratio Variables. This model is similar to that of Blair et al. (2022), who present a model that accounts for both power ratio and ideological difference measures.[22]

I run 2000 bootstrap samples of each of the logistic regression model specifications. I bootstrap the regression models for this analysis for three reasons: 1) I do not need to make any assumptions about the distribution of the population of coefficients for each variable, 2) it allows me to analyze how variable the model parameters are as a result of different samples, and 3) it facilitates comparison of coefficient sizes as I can more easily conduct statistical tests to compare the means and distribution of the coefficients. Table 4 shows the summary statistics of the coefficients obtained from bootstrapped samples of the four models.

Table 4 presents the summary statistics of four models analyzing the variables of Weak Link and Ratio suggested by Christia (2012) and Popovic (2018), as well as the variable for Goals of groups. Both Models 1 and 4 reveal a positive coefficient for Weak Link, indicating that stronger groups are more likely to form alliances in the data generated by the ABM, with a 95% confidence interval that excludes 0. This supports the finding of Bapat and Bond (2012) on alliance formation in actual world data. Similarly, Models 2 and 4 show that as the Ratio variable increases, indicating a smaller discrepancy in power between two groups, the likelihood of their alliance increases, consistent with existing research. Lastly, Models 3 and 4 indicate that as groups' goals become more divergent, the probability of their alliance formation decreases, in line with both the theoretical construction of the ABM and empirical evidence from Balcells, Chen and Pischedda (2022) and Blair et al. (2022). These results demonstrate that the ABM can replicate alliance formation patterns in civil wars found in

[22] Blair et al. (2022) does not however account for the strength of the weakest link in the dyad. Further, their ratio measure relies on the number of attacks committed rather than the size of the group, however, the two measures are operationalizations of the same theoretical factor.

Table 4: Generalized Logistic Models Bootstrap Results

Model 1

	Estimate	2.5 %	97.5 %
Weak Link	2.084	1.827	2.327
Group Alliance Count	−1.198	−1.249	−1.137
Other Alliance Count	−0.032	−0.090	0.031
Society Fixed Effects	YES		

Model 2

	Estimate	2.5 %	97.5 %
Ratio	1.103	1.051	1.153
Group Alliance Count	−0.970	−1.019	−0.912
Other Alliance Count	0.217	0.147	0.290
Society Fixed Effects	YES		

Model 3

	Estimate	2.5 %	97.5 %
Goal Distance	−0.980	−1.030	−0.927
Group Alliance Count	−1.242	−1.290	−1.183
Other Alliance Count	0.010	−0.056	0.080
Society Fixed Effects	YES		

Model 4

	Estimate	2.5 %	97.5 %
Goal Distance	−1.013	−1.065	−0.957
Weak Link	3.499	3.074	3.861
Ratio	1.363	1.292	1.422
Group Alliance Count	−1.253	−1.305	−1.193
Other Alliance Count	−0.073	−0.158	0.026
Society Fixed Effects	YES		

previous research and validate the model. Furthermore, they indicate that such models can capture complex relationships between variables underlying cooperation in conflicts.

In addition to comparing the results of the ABM-generated data with actual world data, these models allow us to use our knowledge of the data-generating process behind the ABM data to explore how different model specifications influence the estimates of each variable. The ABM is specified such that both Goal Distance and power dynamics are relevant factors in the alliance decisions of groups. As such, the complete model that accounts for all three variables better represents the cooperation dynamics in the ABM. Table 5 illustrates the superiority of the complete model by presenting each model's AIC, BIC, and AUC specifications. It is evident that Model 4 outperforms all other model representations significantly. Consequently, the estimates produced by this model are more accurate, given the known data-generating process. Figure 21 visually depicts this contrast by plotting the distribution of the bootstrapped coefficient estimates for each model for the three main variables.

Table 5: Model Fit Statistics

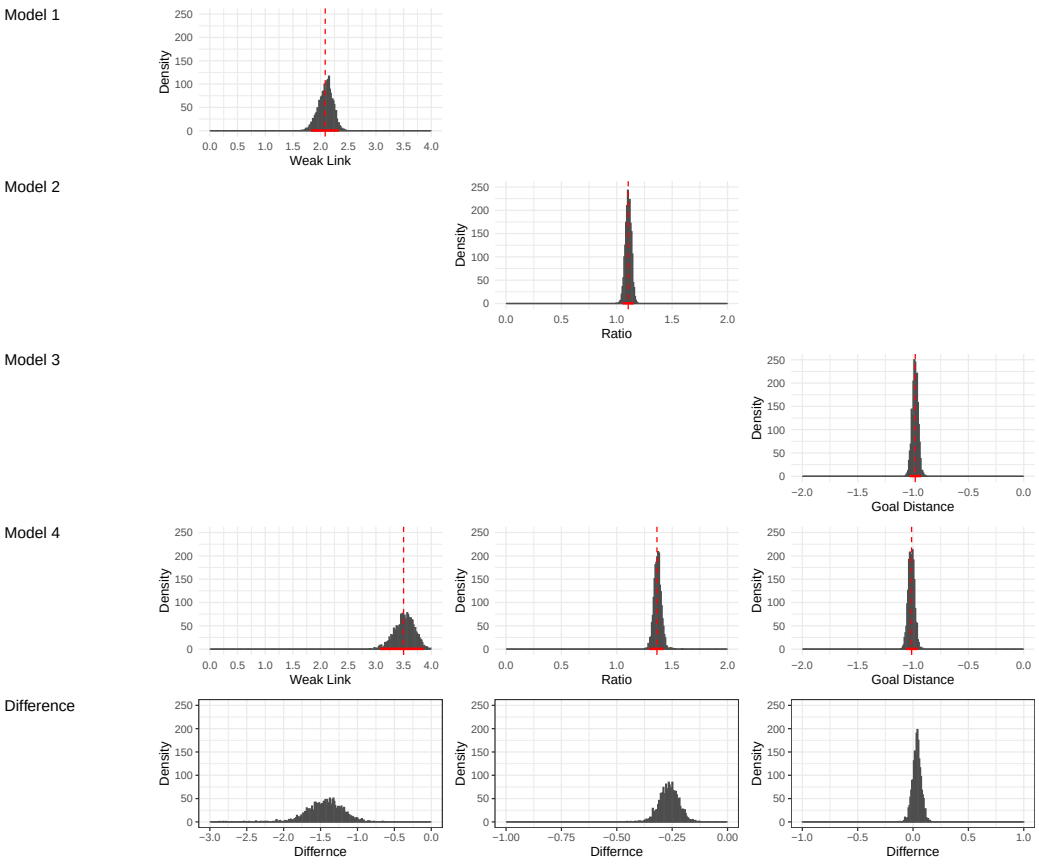
	AIC	BIC	AUC
Model 1	58,143.820	59,179.380	0.693
Model 2	57,301.490	58,337.050	0.714
Model 3	57,606.670	58,642.220	0.710
Model 4	54,195.660	55,249.230	0.757

Comparing the Weak Link variable in Model 1 and Model 4 shows that accounting for all factors leads to an increase in the expected effect of the variable. The point estimate of the coefficient is almost twice as large in Model 4.[23] The bottom left graph in Figure 21 shows the absolute difference between the two distributions. Further, a T-test of the distribution of coefficients shows that the mean of the estimates for Model 4 is statistically larger than in Model 1. Further, the Mann–Whitney U Test shows that the distribution of coefficients is statistically different. This suggests that models of alliance formation that do not account for Goal Distance are possibly underestimating the effects of the strength of the dyad on alliance formation. This may, for example, provide one explanation for the different

[23]The results are similar in a model without the Ratio variable.

findings in Bapat and Bond (2012) and Popovic (2018) about the statistical significance of this variable. Without properly specified models, the results for this variable may be unreliable.

Figure 21: Distribution of Bootstrap Coefficient Estimates



Notes: The vertical line represents the coefficient estimate and the horizontal line the 95% confidence interval of that estimate.

Turning to the Ratio variables analyzed in Models 2 and 4, I examine the impact of accounting for all variables on the estimates of the effects of Ratio on alliance formation. There is a significant increase in effect size in the complete model. [24] The center-bottom graph illustrates the absolute difference between the two distributions. The T-test and

[24] Again, the results are similar for models that account for Ratio and Goal Distance.

Mann–Whitney U Test show that the estimates are statistically different.[25] This suggests that models of alliance formation that do not incorporate Goal Distance may underestimate the effects of power differentials between two groups in a dyad. Additionally, Models 3 and 4 allow us to compare the estimates of Goal Distance when accounting for variables that measure power dynamics versus when not accounting for them. Although the effects in Model 4 are slightly more negative, the difference is statistically significant but marginal in size. However, it does suggest that neglecting to account for power dynamics could lead to an underestimation of the negative effects of goal distance.

These models collectively indicate that the ABM framework can generate data that, when analyzed, is consistent with previous research on alliance formation in civil wars, thereby providing some validation for the model. Additionally, the results show that logistic models can capture the underlying data-generating process despite the complex nature of the mechanisms involved in the decision-making process of alliances between rebel groups. Nevertheless, the outcomes imply that neglecting either goal preferences or power dynamics may lead to the underestimation of variables. This underestimation is particularly visible when comparing the effects of the power dynamics variables when goals are included and excluded. Furthermore, the models indicate that even without considering goal distance, the Weak Link and Ratio variables still exhibit positive coefficients, with confidence intervals not crossing 0. These findings suggest that the discovery of statistically significant effects for power-related variables alone does not offer any evidence regarding the importance of goal and preference variables.

Next, I analyze how the importance of goals in society influences the effects of different factors in logistic regressions. To do so, I conduct a series of virtual experiments where I vary the weight of the preferences in each dimension, W for all individual and group agents in the model to see how it influences our estimates of key variables. To run this analysis, I select the first 50 randomly created societies used in the previous analysis. However, instead of the weights being randomly drawn for each agent based on their prototype, I fix the weight for all agents to be the same value in each run where the value

[25]Kolmogorov-Smirnov Test also shows that the cumulative distribution of the two sets of estimates for both the Ratio and Weak Link variables are statistically different.

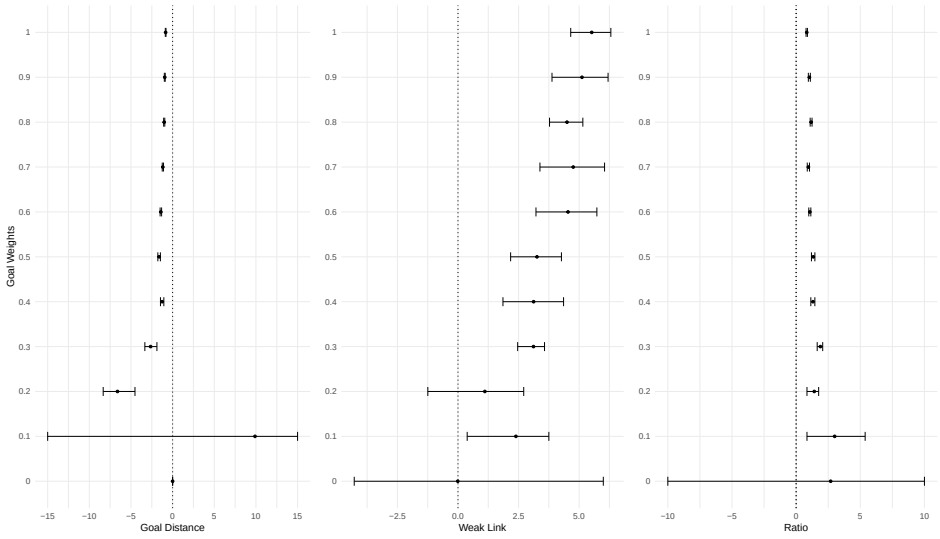
$W \in (0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1)$.[26] In essence, by fixing these values I am altering how important goals are for alliance decisions as the negative effects of different goals are smaller as the value of W decreases, and, eventually, there are no negative effects when $W = 0$. Importantly, all other aspects of societies are equal across all runs. For each society, for each value of W, I run the for $t = 300$ iterations.

Like in the previous analysis, data on each run is collected for each group at each iteration of the model. This data is then transformed into a dyad for each group in a given interaction. I group the data every 100 iterations and retain the last successful alliance between two groups in a dyad within that 100-iteration period. If there is no alliance in a given dyad, then the last failed interaction is kept. Lastly, I assume that the largest group at the 100th iteration represents the government, and we exclude all dyads involving the government from the data. Again, I create the same variables used in the previous analysis for each model run and standardize their values to two standard deviations. Further, by standardizing the goal distance variables I ensure that the coefficients of the Goal distance variable are on the same scale across the different weights and can be compared. This means that the variable captures the distance between positions regardless of weights. Again some of the variables have been transformed.

For each data set, I run a logistic regression with Alliance Success as a dependent variable and Position Distance, Weak Link, Ratio, Group Alliance Count, and Other Alliance Count as independent variables. For all models where $W > 0$, I use society-fixed effects. I do not include these for the models when $W = 0$ as the small sample size of alliance decisions and a small number of successful cases prevent models with fixed effects from estimating. Again I run 2000 bootstrap samples for all model specifications. The coefficient estimates for the full model are shown in Table 9 in the Appendix, while the coefficients point estimates and their 95% confidence intervals for the key variables are plotted in Figure 22.

[26] I select the first 50 analysis instead of using all 170 societies due to limited computational resources. Running the analysis on 170 societies for each of the 10 values of W would result in 1700 model runs.

Figure 22: Bootstrap Coefficients Estimates Varying Weights



Notes: The vertical dotted line represents a coefficient point estimate at a value of 0. In the model where Goal Weight is 0 for Position Distance, no coefficient can be computed given that all values of the variable are 0. However, to facilitate interpretation, I include a value of the coefficient with all values at 0. Further, the confidence intervals for the Position Distance variable at a value of $W = 0.1$ and Ratio at $W = 0$ extend significantly beyond the bounds of the y-axis but have been limited here to facilitate visualization. The exact 95% for these coefficients are shown in Table 9.

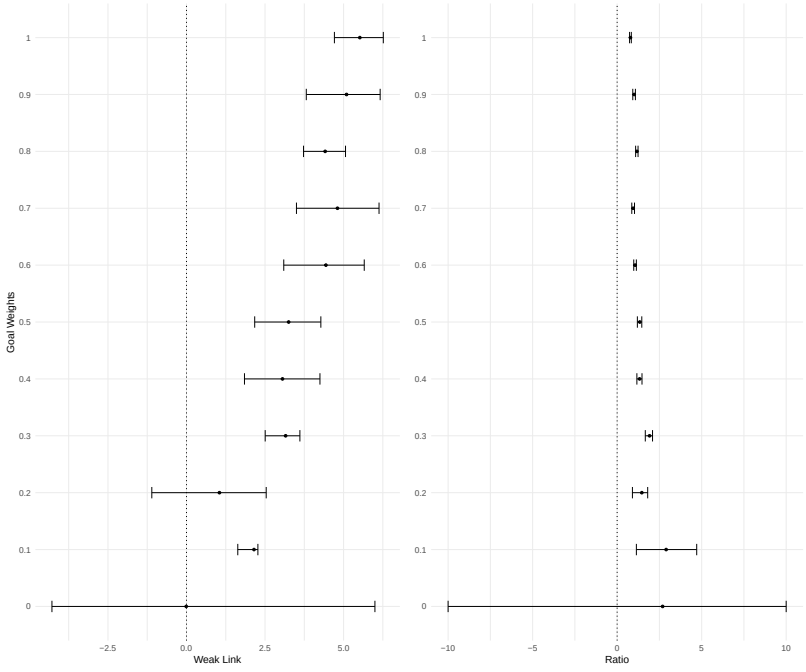
Turning first to the estimates of the coefficients for Goal Distance in Figure 22. The figure shows that, as the value of W increases, the importance of the goal distance decreases until $W = 0.4$, and then stays relatively stable. When $W = 0$ such that goals do not matter any differences in preferences are not relevant. Given the logic of the model, this makes sense: as W increases, the distance between the position of groups in the model is weighted more heavily and thus has a larger impact on the decision-making process of groups. However, when $W = 0.1$ the point estimate of the coefficient is positive, and the 95% confidence interval overlaps with 0. This indicates, that if we assume that people care very little about the differences in their positions, we are likely to observe positive and not statistically significant effects for the distance in group goals on alliance outcomes.

Next, I turn to the Weak Link coefficients. Here, as the value of W increases, the point

estimate coefficient of the Weak Link variable increases. This analysis suggests that group power is likely to have its largest effect when goals are important in the decision-making process of groups. Further, when goals are irrelevant or very small ($W \in (0, 0.2)$), the 95% confidence interval for the coefficient for the Weak Link variable overlaps 0. While when $W = 0.2$, the confidence interval approaches 0. This suggests that when the individuals have small weights in their positions, we are likely to observe insignificant or small effects for the Weak Link variables. There are two main reasons for these small and/or insignificant effects in the ABM framework at the specified values of W. First, when W is assumed to be small for all individuals, there are very few cases of alliances not involving the largest group in the model (the stand-in for the government) as there is a small number of groups likely to form. This small sample can be observed in Table 15 in the "¬Goal, Alliances" plot. Second, in this scenario, groups are likely to form alliances with each other regardless of the size as the costs are small in the logic of the model. However, this does not match with existing evidence such as the results in Bapat and Bond (2012).

Turning to the Ratio variable, we see that, when the goal weight is 0, the point estimate of the coefficient for the variable is positive but not statistically significant. Again, this is caused by the extremely small sample size. However, as the value of W increases, this value becomes statistically significant, and relatively stable across all values of W. In existing works such as Blair et al. (2022) and Popovic (2018), the estimates of the Ratio variable are positive and statistically significant. This suggests that in the framework of the ABM when goals are assumed to be irrelevant we are unlikely to generate data that is consistent with findings in actual world data. This suggests that assuming away the role the goals play in alliance decisions is unlikely to match actual patterns of group alliances.

Figure 23: Bootstrap Coefficients Estimates Varying Weights



Notes: The vertical dotted line represents a coefficient point estimate at a value of 0. Further, the confidence intervals for the Ratio at $W = 0$ extend significantly beyond the bounds of the y-axis but have been limited here to facilitate visualization. The exact 95% for these coefficients are shown in Table 9.

Lastly, I replicate all the models described above but without the Goal Distance variable. Figure 23 shows the bootstrap coefficient estimates for these regressions for the Weak Link and Ratio variables. These models show two notable findings.[27] First, the Weak Link variable coefficient sizes are slightly smaller compared to their equivalent full model, for all goal weights. This matches with expectations from the analysis of different model specifications conducted on the full sample of societies with the individual values of W generated by the society creation model. Second, the plot shows the same patterns observed in the full model regarding the relevance of the Weak Link and Ratio variables, including the relative stability of the estimates at values of W greater than 0.2. These results show that finding statistically significant coefficients in logistic models when not accounting for Goal Distance is consistent

[27]The full model result can be found in Appendix Table 10.

with goals being relevant to alliance decisions, but provides little information about how important these goals are to both groups and individuals.

In sum, these results suggest that the ABM framework is only consistent with existing research on alliances between rebel groups when individuals care about the differences in their preferences. In a world where goals are not relevant, the model is unable to reproduce results that match expectations derived from existing research. However, as goals become important to individuals the results of logistic models approximate the findings of previous research. Thus, assuming away the relevance of individual-level preferences and how these preferences influence group-level decisions in theoretical models can lead to incorrect predictions about alliance decisions.

4.4 GOALS AND TPLF ALLIANCES

In the first chapter, I recounted the alliances of the TPLF with the EPRP and the EPDM. This analysis demonstrated the role of goals in shaping the cooperative decisions of rebel groups. I highlighted how as the goals of the TPLF and EPLF changed throughout the conflict so did their desire to cooperate. Further, the case demonstrates how alliances shape the perception of a group's goals through formal cooperation agreements, but also simply by their existence. Overall the patterns of cooperation in the Ethiopian Civil War stress important features of the Agent-Based Model of group cooperation presented in this chapter.

While the TPLF formed an on-and-off alliance with the EPLF, the TPLF's choices regarding which groups not to align with reveal significant insights. Among the groups operating in the region were the EDU, EPRP, and ELF. Collaborating with these groups could have resulted in a greater mobilization of soldiers and resources to combat the Derg regime. However, the TPLF opted not to cooperate with either of these groups and instead engaged in conflict with both of them. The TPLF never considered an alliance with the EDU as they perceived it as a counter-revolutionary group whose goals were orthogonal to the TPLF. For the TPLF and its members, the EDU had to be defeated to safeguard

the TPLF's power in Tigray, but more importantly, their goals for a post-conflict Ethiopia. In contrast, cooperation with the EPRP was discussed, especially after the release of their platform in 1975. However, no the two groups never reached any agreement. The views of the EPRP about the national question and their views about the role of peasants in the revolution were too different to form the basis for cooperation. As such, like the EDU the TPLF entered into conflict with them.

Unlike both previous groups, the TPLF did cooperate with the ELF in the early stages of the TPLF's mobilization in Tigray. At the time the ELF was powerful, and their goals did not seem contradictory to those of the TPLF. However, two factors ended this early cooperation. First, the support given by the ELF to the EDU and their relations with Arab monarchies led the TPLF to perceive them as counter-revolutionary. Second, the rise of the EPLF, which originated as a splinter group from the ELF, not only had better Marxist credentials but also included mostly Tigrigna-speaking highland peasants who shared much with the TPLF's supporters and presented a better opportunity for cooperation. Overall, the ELF, EDU, and EPRP groups exposed goals that were too different from the TPLF for alliances to form. This set of behaviors matches the modeled behavior of group agents in the ABM and the outcomes observed in the analysis of the data generated by the model.

In contrast, the EPLF shared much with the TPLF. Both drew mainly from Tigrigna-speaking highland peasants for their supporters, the EPLF was not against the TPLF's view on the self-determination of Ethiopian nationalities (as long as it did not extend to Eritrean ethnic groups), and both shared a Marxist worldview. This led to a cooperative relationship between the two groups between 1974 and 1985. However, as the war progressed the goals of both groups changed. By 1985 more nationalist contingents of the TPLF were in power (possibly due to the growth of the group to include many more peasants and members not in the original student movement) and shaped the group's goals. This change categorized by the rise of the MLLT within the group pushed for the self-determination of nationalities in Eritrea and a more strict Marxist-Leninist world view which clashed with the EPLF's goal of Eritrean independence and their relation with the Soviet Union. These changes led to a breakdown in cooperation. However, by 1988 the retreat of the Soviet Union from the region, a more pragmatic leadership in the EPLF coupled with a TPLF less ready to push

for self-determination of Eritrean nationalities decreased the difference in the goals of both groups which contributed to a return to the cooperative relationship of the groups.

This narrative underscores two crucial aspects of the ABM. Firstly, it highlights the interconnectedness between mobilization and cooperation with other groups. As the TPLF and EPLF expanded their memberships, incorporating individuals with diverse perspectives from their initial goals, their objectives also evolved. These evolving goals played a pivotal role in shaping the extent of cooperation between the two groups throughout the conflict. Additionally, as the TPLF grew in strength and reduced its dependence on the EPLF, it sought to negotiate more favorable agreements rather than being perceived as the subordinate partner. A similar pattern emerges in the TPLF's relationship with the EPDM. While the TPLF did not cooperate with the EPRP, it swiftly allied with the EPDM when some members of the EPRP, who held less divergent views on the nationalities question, splintered to establish the EPDM. In summary, the goals of groups change as they mobilize new supporters, and these transformations significantly influence alliance decisions.

However, alliances also shape group goals, or at least how other actors perceive those goals. When the EPLF and TPLF reestablished their alliance in 1988, they outlined shared objectives for their cooperation, requiring both groups to compromise in various ways. These joint statements are intended to influence how all actors involved in the conflict perceive the goals of both groups. Nevertheless, alliances also shape goal perceptions even in the absence of any explicit agreements.This is evident in the early relationship between the TPLF and EPLF and the relationship between the TPLF and EPDM. During the initial years of the conflict, many observers, including the United States and the Ethiopian government viewed the TPLF simply as a puppet of the EPLF due to their cooperation and the significant power disparity between them. Although this perception may not have been entirely accurate, it underscores the fact that the goals of the stronger group have a greater impact on shaping the perception of the weaker group. This observation is consistent with the behavior encoded in the ABM, where the agreements reached within alliances tend to align more closely with the preferred positions of the stronger group. A similar pattern emerges in the relationship between the TPLF and EPDM.

These shifts in group goals caused by alliances can lead to internal issues in rebel groups.

One primary example of this was in 1989 when the TPLF decided to fight outside of Tigray in support of the EPRDF coalition. Many TPLF fights saw this as not in their interest as they were fighting for Tigray, not Ethiopia (Berhe, 2009). During the offensive thousands of fighters stopped the offensive and returned to Tigray. These desertions led to a short stall in the offensive where the TPLF held a series of meetings to decide on the next steps. Eventually, the group decided (and convinced its members) that fighting outside of Tigray was essential to guarantee their rights to self-determination. Thus, most but not all fighters rejoined the offensive (Young, 1996). This episode highlights how differences between individual preferences and the group's goals caused by their alliances can lead to desertion in the ranks, which is a key feature of the ABM, as it explains links between individual preferences, goals, and alliance decisions.

4.5 SUMMARY

In this chapter, I highlight the significance of understanding individual preferences and group goals in understanding patterns of alliances between rebel groups during civil wars. By integrating alliance decisions between groups with the theory of group formation discussed in Chapter 3, I demonstrate the interdependence between group formation and alliance behaviors. While prior research has emphasized the role of power, ideology, and identity in alliance decisions, I argue that accounting for the individual level preferences and incorporating the theoretical framework of group formation provides a more comprehensive understanding of the complex mechanisms involved in alliances between rebel groups.

To explore the relationship between goals and alliance decisions, I expend the ABM of rebel group formation to allow the groups that emerge in the model to form alliances. Specifically, the ABM framework mirrors individual-level cooperation at the group-level cooperation by conceptualizing alliances as an agreement between two groups that define the goals that would be implemented if the two groups win the conflict. This conceptualization aligns with the definition of alliances in the context of civil wars, (Leeds, 2003; Keohane, 2005; Balcells, Chen and Pischedda, 2022; Blair et al., 2022). The agent-based model offers

a valuable tool for exploring the complex mechanisms involved in alliance decisions and provides insights into the costs and benefits of alliances, which can ultimately lead to a better understanding of armed conflict dynamics.

I then systematically analyze the implications of the model and the theory using computational experiments. These experiments allow me to compare the data generated by different specifications of the ABM to real-world data. The analysis shows that accounting for goals is essential to generate data consistent with observed patterns of group formation in real data. Further, the interdependence of cooperation at the individual and group levels leads to patterns that more closely match actual world data on armed groups. I then use a series of logistic models to further explore data generated by the ABM. The analysis demonstrates the similarities between ABM and existing models of rebel group alliance and emphasizes the importance of accounting for individual-level preferences in alliance decisions in civil wars. Lastly, I revisit the Ethiopian Civil War to highlight how group level goals influenced alliance decisions in the conflict, and how these behaviors also influenced individual level decisions to join, or stay in the groups. This interconnection is consistent with the findings of the modeling framework about the interconnected and complex nature of cooperation decisions. Overall, this chapter highlights the importance of understanding the interdependence between group formation and alliance behaviors. More specifically it shows how individual-level preferences, which aggregate to the group-level drive alliance decisions during civil wars.

5.0 LATENT VARIABLE MODEL FOR THE EFFECTS OF GOAL DISTANCE BETWEEN REBEL GROUPS

In previous chapters, I have outlined a theory of alliance-making between rebel groups in civil wars and encoded it in an Agent-Based Model framework to explore its implications. Particularly, I have demonstrated the role of rebel group goals in the alliance decisions of rebel groups. In this chapter, I create a latent variable model to measure the distance between rebel group goals and analyze the impact of this variable on alliance decisions on real-world data. The model incorporates the insights of the ABM about the role of the distance between the weighted preferences of groups across multiple dimensions. I first describe how a Bayesian multidimensional ideal point model can be applied to capture the underlying goals of groups and how these goals can be incorporated into a model that uses the distance between group goals to predict cooperation in civil wars. I then present the data used by the model. Next, I validate the model's ability to capture latent parameters using simulated data. Lastly, I present the results of the model and discuss the implications of the findings.

5.1 MODEL DESCRIPTION

The Agent-Based Modeling framework demonstrates the theoretical importance of the distance between the goals of groups to alliance decisions and demonstrates how models that account for it are consistent with actual world data on rebel groups. However, no such measure exists in the rebel group alliance literature. Rather, previous studies such as Balcells, Chen and Pischedda (2022) and Blair et al. (2022) rely on binary measures that

indicate shared measured on categorical indicators such as communist, right-wing, Islamic ideology, coreligionist, and/or co-ethnicity. While these measures capture similarities in rebel goals, they do not account for the multidimensional and continuous nature of the goals of many actors in civil wars. Such measures for example could not indicate the differences between the TPL and EPRP who shared a leftist-communist ideology and recruited primarily from Tigrayan Ethiopian Orthodox Christians. Thus, in this section, I first describe a Multidimensional Ideal Point Model to capture the latent goals of rebel groups. I then posit a unified Bayesian model that uses the ideal points generated by an ideal point component to create a distance variable in a logistic model of cooperation in civil wars.[1]

5.1.1 Ideal Point Models

Ideal Point modeling is a popular modeling approach used to capture the preferences of diverse sets of actors such as judges (Martin, and Quinn, 2002), members of Congress (Poole and Rosenthal, 1985; Jackman, 2001), and states in the United Nations(Fariss, 2014; Bailey and Voeten, 2018). The ideal points of rebel organizations' goals can be measured using a similar approach. Specifically, I draw on a vast literature on item-response modeling, which has been widely employed in psychology and educational studies to assess the ability and other traits of test subjects (Reckase and Reckase, 2009). The general idea of Item-response models is to infer performance in psychological constructs such as ability and predisposition based on responses to items, or questions. In this chapter, I propose a model based on the 2PL model which extends the original Rash item response model by adding an item discrimination parameter. Rasch (1993(1980) These models take the form of J individuals in a testing situation where correctly answering an item k from a test with K items is modeled as a logistic model. Because not every individual needs to receive every item, it is common to index each response as $i \in (1, x)$ such that each i corresponds to an individual $j(i)$ and an item $k(i)$. Thus, y_i is individual $j(i)$'s response to the item $k(i)$.

These models are therefore written as:

[1]The model is coded using the Stan programming language (Carpenter et al., 2017) and the Rstan package in R (Stan Development Team, 2018), the Stan model can be found in the Appendix.

$$Pr(y_i = 1) = logit^{-1}(\theta_{j(i)} * \alpha_{k(i)} - \beta_{k(i)})$$

Where $\theta_{k(i)}$ represents the individual's ability. The parameter $\beta_{k(i)}$ is the difficulty parameter which is estimated based on the probability of a correct response to the item as a function of the respondent's level of the latent trait being measured. If the ability of an individual $\theta_{k(i)}$ is greater than the difficulty of a given item $\beta_{k(i)}$, then the individual has a better-than-random probability of correctly responding to the item, such that the probabilities are dependent on the relative values of the parameters. Lastly, the parameter $\alpha_{j(i)}$ is the discrimination parameter which indicates a high correlation between an individual's j ability and the probability of getting the correct response in item $k(i)$. The 2PL model can further be extended to account for D dimensions by adding terms corresponding to $\theta_{k(i)}$ and $\beta_{k(i)}$ for each dimension (Jackman, 2001; Bafumi et al., 2005). This model takes the form:

$$Pr(y_i = 1) = logit^{-1}(\mathbf{\Theta}_{j(i)} * \mathbf{A}^{\intercal}_{k(i)} - \beta_{k(i)})$$

Where $\mathbf{\Theta}_{j(i)}$ is a JxD matrix such that $\mathbf{\Theta}_{j(i)d}$ indicating the ability of individual $j(i)$ in dimension d and $\mathbf{A}^{\intercal}_{k(i)}$ is the transpose of a KxD matrix where $\mathbf{A}_{k(i)d}$ indicates the discrimination of item $k(i)$ in dimension d. In this specification, $\beta_{k(i)}$ does not vary within dimensions and remains a vector of length K.

These Item-response models can be applied to ideal point estimation in political science research (Bafumi et al., 2005). The relationship between item responses and ideal point models is close. When analyzing votes in legislation, court decisions, or the UN general assembly, each vote is analogous to an item in a test. Likewise, it is possible to treat the data on rebel group characteristics described previously as expert votes on how each rebel group in a given year corresponds to a given category. However, unlike Item-response models in ideal points in political science research, there is no "correct answer" to a given item thus, whereas, in traditional Item-Response models where the α parameters are constrained to be positive (such that a correct answer is associated with a higher estimated ability), there is no constraint on the sign o the α parameters. Another minor difference is that in the context of ideal point models, the main parameter of interest is usually on the $\theta_{k(i)}$ parameter. In IRT

models in the educational and psychological literature the ideal point parameter is usually treated as random effects (Jackman, 2001).

Ideal point models as defined above, especially in multidimensional contexts, are not identified due to the allowance of adding a constant to all parameters, which does not affect the model's predictions. As a result, any translation or rotation of the ideal point model would not alter the distance between ideal points and alternatives. A second issue of identifiability, known as rotational invariance, arises from the model's potential to reverse the orientation of the ideal point parameter (by multiplying it by -1) and still achieve the same fit to the data. As the number of dimensions in an ideal point model increases, so does the number of equivalent rotations, meaning that the model becomes more difficult to identify. For instance, a two-dimensional model has eight equivalent rotations. This number increases to 27 in a three-dimensional model (Jackman, 2001). Several studies in political science have recognized these issues and developed methods to address them (Jackman, 2001; Rivers, N.d.; Bafumi et al., 2005; Clinton, Jackman and Rivers, 2004). To address the problem of non-identifiability, I adopt the Bayesian approach proposed by Jackman (2001) and Clinton, Jackman and Rivers (2004), which uses priors on the different parameters to identify the mode

The Bayesian perspective to ideal point models treats the unknown parameters as random variables that are conditioned upon the data of the responses to the items and prior information about these parameters. Therefore, we can use priors on the θ and α parameters to constrain the model and allow for its identification. For instance, in their analysis of the US Congress Clinton, Jackman and Rivers (2004) used priors on the ideal point θ of Congress members Kennedy and Helms to solve the rotation invariance issue. They constrained the very liberal Kennedy ideal point to -1 and the very conservative Helms to 1 to ensure that the model did not switch between the two possible modes of the data. These issues increase in scale as the dimensionality of the model increases. A model with D dimensions, $D(D+1)$ linearly independent a priori restrictions on the θ parameters are needed for identification.[2] Moreover, the α parameters often require priors to aid identifiability and prevent dimension

[2]For instance, in a model with $D = 3$, the ideal point can be identified by fixing 12 θ parameters, ensuring that the ideal point is set at 4 units in each of the three dimensions.

swapping, as demonstrated by Jackman (2001). These priors act as "reference items" that inform the model about which items are more likely to discriminate between each dimension. However, it is crucial to set priors carefully to ensure that the parameter estimates are theoretically and statistically valid.[3] Additionally, the Bayesian approach not only provides a solution to model identification issues but also enables parameter estimation in the face of a proliferation of parameter issues stemming from an increase in units, items, and dimensions, and allows for easy extensions of the model Clinton, Jackman and Rivers (2004); Martin, and Quinn (2002).

Thus, the ideal point model can be written as:

$$Y_i \sim Bernoulli(logit^{-1}(\mathbf{\Theta}_{j(i)} * \mathbf{A}^{\intercal}_{k(i)} - \beta_{k(i)}))$$

$$\mathbf{\Theta}_{j(i)d} \sim N(\mu_{\mathbf{\Theta}_{j(i)d}}, \sigma_{\mathbf{\Theta}_{j(i)d}})$$

$$\mathbf{A}_{k(i)d} \sim N(\mu_{\mathbf{A}_{k(i)d}}, \sigma_{\mathbf{A}_{k(i)d}})$$

$$\beta_{k(i)} \sim N(0,1)(\beta_{k(i)} > 0)$$

Where $\mu_{\mathbf{\Theta}_{j(i)d}}$ and$\mu_{\mathbf{A}_{k(i)d}}$ represent the mean of the priors for the θ and α parameters respectively, while $\sigma_{\mathbf{\Theta}_{j(i)d}}$ and $\sigma_{\mathbf{A}_{k(i)d}}$ are the variance of their respective distributions. These can be set such that for all parameters $\mu_{\mathbf{\Theta}_{j(i)d}} = 0$ and $\sigma_{\mathbf{\Theta}_{j(i)d}} = 1$ such that the priors are simply a standard normal distribution, while for the priors that are used to solve identification issues are specified separately. For example, if we were to use units $j(1)$ and $j(2)$ as the reference for dimension 1, then $\mu_{\mathbf{\Theta}_{j(1),1}} = -1$ and $\mu_{\mathbf{\Theta}_{j(2),1}} = 1$ while their respective variances are $\sigma_{\mathbf{\Theta}_{j(1),1}} = 0.01$ and $\sigma_{\mathbf{\Theta}_{j(2),1}} = 0.01$. This can be done for the needed number of identification constraints on both the θ and α parameters.

5.1.2 Model of Cooperation in Civil War

I now specify the complete model alliances and how the ideal point estimates create a distance measure, which in turn, is used in a logistic model to predict cooperation between rebel groups along with other variables. The Bayesian logistic model I propose is a standard logistic model with random intercepts at the country level. It can be written as:

[3] I discuss the priors' setting for my proposed model in the section on the Analysis of Actual Data.

$$C_n \sim Bernoulli(logit^{-1}(\zeta_{l(n)} + \delta_n * \gamma_\delta + x_1 * \gamma_1 + ...x_X * \gamma_X))$$

$$\zeta_{l(n)} = \mu_{\zeta_{l(n)}} + \sigma_{\zeta_{l(n)}} * \omega_{\zeta_{l(n)}}$$

$$\mu_{\zeta_{l(n)}} \sim N(0, 1)$$

$$\sigma_{\zeta_{l(n)}} \sim N(0, 1)$$

$$\omega_{\zeta_{l(n)}} \sim N(0, 1)$$

$$\gamma_\delta \sim N(0, 1)$$

$$\gamma_X \sim N(0, 1)$$

$$\delta_n = \sum_{d=1}^{D} (\theta_{n(1)d} - \theta_{n(2)d})^2$$

Where C_n is a binary indicator that takes a value of 1 if cooperation exists between the two groups in the dyad-year n. Further, n is a set of size 2 indicating a rebel group dyad-year observation, and each item in the set contains the value $j(i)$ for each group in the dyad in a given year. Thus, δ_n represents the sum of the squared distances between the ideal points defined by the θ parameters of the ideal point component of the model of each of the two groups across all D dimensions, this is the goal distance measure. This value is then used as an independent variable in the model alongside X other variables predicting cooperation and the random country intercept $\zeta_{l(n)}$.[4] The coefficients for both the goal distance variable and all other covariates are given a loosely informative prior defined by a standard normal distribution.

Defining the logistic model of cooperation from a Bayesian perspective has the main advantage of enabling joint estimation of the ideal point model and logistic model of cooperation. This joint estimation propagates uncertainty through the two components of the model, utilizing the full posterior distribution of parameter estimates for both the ideal point and dyadic components. Therefore, the estimated ideal points of the groups are informed by the data on cooperation, resulting in a better model fit for that component. In addition,

[4]The random intercept $\zeta_{l(n)}$ uses a Non-Centered Parameterization Betancourt and Girolami (2015) to facilitate sampling from distributions with difficult posterior geometries that arises from the hierarchical structure of the data (Neal, 2003).

the full posterior distribution of the ideal points informs the coefficients for the cooperation model rather than relying only on point estimates of those parameters, and therefore fully incorporate the uncertainty in the position estimates into the logistic component of alliances in the model.

5.1.3 Connection with the ABM

The model described in this section is derived from the Agent-Based Model of cooperation defined in previous chapters. At the most basic level, the ABM highlights the role of goals in shaping group decisions to form alliances, while the Latent variable model described above measures the goals of different groups. However, the connection between the two models goes deeper. The ABM starts by positing that all individuals in a society have ideal points on different policy dimensions, which are then aggregated through some process (simplified in the model as the assumption of the average of all members) to the ideal point of the groups. Further, different dimensions have different weights for different actors (individuals and groups) that describe how important a dimension is to that actor. Again these weights are aggregated to the group level to indicate the importance of each dimension for the group. Further, the group-level ideal points and weights are influenced by the goals of their allies. To account for the influence of allies, the ABM defines the parameters $\hat{P}_{gt_d}$ and $\hat{W}_{gt_d}$ which describe the perceived ideal points and weights for a group in a given dimension. When these values are multiplied such that $\hat{P}_{gt_d} * \hat{W}_{gt_d}$, they give the weighted ideal point for a group in a policy dimension, in other words, this value represents the group's goal for a policy dimension. This is the value that the latent variable model attempts to estimate in the parameter $\mathbf{\Theta}_{j(i)_d}$.

However, as the ABM shows us in the function R, the mechanism which connects the rebel group goals with failure to cooperate is the distance between the goals of the two groups.[5] More specifically, the larger this distance, the larger the change in the group goals given the alliance. If two groups z and w consider an alliance q such that if they decide to cooperate, their list of allies will change to $Q_{wt} \cup \{q\}$ and $Q_{zt} \cup \{q\}$. As $|\hat{P}_{zt} * \hat{W}_{zt} -$

[5]Please refer to section 4.2 for a full description of the function R.

$\hat{P}_{wt} * \hat{W}_{wt}| \uparrow$, $\Delta(\hat{P}_{gt} * \hat{W}_{gt}|Q_{gt} \cup \{q\})) \uparrow$.[6] As $\Delta(\hat{P}_{gt} * \hat{W}_{gt}|Q_{gt} \cup \{q\})) \uparrow$, the more likely it is that preferences of group members will no longer align with the groups. If the preference of an individual group member i is less aligned with the group's goals if the alliance forms, such that $|(\hat{P}_{gt} * \hat{W}_{gt}|Q_{gt} \cup \{q\}) - P_i * W_i| > |\hat{P}_{gt} * \hat{W}_{gt} - P_i * W_i|$, the group member i is likely to leave the group if the alliance forms. Again, function R demonstrates this is because the payoff of being part of that group decreases. Therefore, this group member does not support the alliance, and if enough members are in such a position, any material capacity increase caused by the alliance is negated by the decrease in capacity caused by the decreased membership. In the latent variable model, the parameter δ_n captures the average distance between the goals of two groups $\mathbf{\Theta}_{j(i)_d}$ across all the relevant dimensions. As demonstrated, this explicitly captures the mechanism described in the ABM connecting $|\hat{P}_{zt_d} * \hat{W}_{zt} - \hat{P}_{wt} * \hat{W}_{wt}|$ with alliance decisions by groups.

5.2 DATA

After outlining the Bayesian ideal point model framework that I will employ to model cooperation in civil wars, I now proceed to explain the data that will be utilized to estimate the model. Since the model consists of two components, it requires two distinct yet interrelated datasets for accurate estimation. The first dataset comprises dyadic data of rebel group alliances, with a binary indicator of cooperation serving as the dependent variable. The second dataset is a rebel group-item dataset that includes a binary indicator of how the group relates to items concerning their goals.

I use the Rebel Organization Alliance Dataset (ROAD) from Balcells, Chen and Pischedda (2022) to measure alliances between rebel groups. The unit of analysis in this dataset is undirected rebel dyad years. It consists of all pairs of rebel organizations engaged in a civil war against the same government in a given year from 1946-2015. The dataset contains alliance information for 320 unique rebel groups for 2,496 dyad-years based on the Uppsala Conflict

[6] In the notation here g represents both groups z and w, while any parameter such as P without the d subscript indicates the average across all d dimensions.

Data Program (UCDP) Dyadic Dataset 17.1 Harbom, Melander and Wallensteen (2008). The data set uses encodes three alliance variables between rebel organizations yearly following the definition of alliances used Akcinaroglu (2012) which accounts for both formal and informal alliances. The first variable is the informal alliance which is a binary variable indicating that a dyad cooperates on the battlefield, or shares resources such as training, weapons, intelligence, and logistic networks. The formal alliance variable is also a binary variable that indicates dyads whose groups have publicly announced an alliance with a specific name. The last variable is also a binary variable indicating the existence of either formal or informal alliances in the dyad year. The main set of analyses is conducted on the alliance variable that captures both formal and informal alliances.

I opt to use this dataset to capture alliances between rebel groups due to its better data coverage and alignment with rebel group characteristics. The Militant Group Alliances and Relationships (MGAR) dataset (Blair et al., 2022) is also available for alliances, but I choose not to use it for two main reasons. Firstly, it covers not only alliances between rebel groups but also includes transnational terrorist organizations and other armed non-state actors. Additionally, it includes alliances between actors that are not necessarily fighting in the same conflict. While the theory of alliance formation I have outlined may share similarities with different sets of armed non-state actors, this falls beyond the scope of this dissertation. Regardless, these groups are not covered in datasets used to measure rebel characteristics and would therefore be removed from the analysis due to systematic missingness. Bapat and Bond (2012) provides another potential dataset. However, this dataset only covers alliances until 2001 and therefore has a more limited temporal scope.

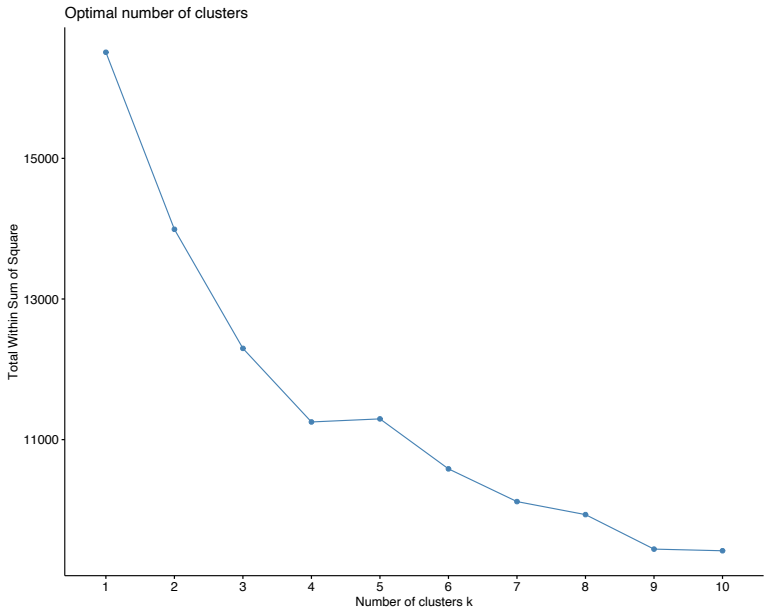
To gather the group-item data on rebel group characteristics I rely on a series of datasets that captures the goals, ideologies, identities, and behaviors related to those factors of rebel organizations in the ROAD dataset. First, I use the data on rebel group ideology coded by Balcells, Chen and Pischedda (2022) in the ROAD dataset itself. I complement this data with information from the foundations of rebel group emergence (FORGE) (Braithwaite and Cunningham, 2020), The Dangerous Companions (NAGs) data set (San Akca, 2015), the Rebel Quasi-state Institutions (QSI) Dataset (Albert, 2020), and the Armed Group Dataset (AGD) (Malone, 2022). From each of these data sets, I select all variables related

to characteristics related to ideology, goals, identity, and behaviors associated with any of the three factors.

I convert each variable to either a binary or categorical measure and place them in a long format such that each observation is a rebel-year-item (or binary variable). For the categorical variables, I generate new binary variables to indicate if a group is associated with a specific category. Additionally, I create a new variable to categorize anti-communist groups using the notes on rebel group goals in the FORGE dataset. I remove all variables for which no group in the sample has a positive measure since they offer no information for the model. For some measures capturing similar characteristics and having few positive cases in the data, I combine them into one measure to increase variance and facilitate the model fit. For instance, I merge the QSI indicators that capture if a group provides Housing, Education, Transportation, Infrastructure, and Health into one Service variable as they all capture a similar public goods provision behavior. I further, make small corrections to the data. These include correcting mislabeled identity features and creating consistency in the coding within each dataset. For example, in the FORGE dataset, all groups labeled with a communist ideology are also labeled as having a left-wing ideology, given that communist ideology expresses a more extreme form of leftist thought.[7] Further, given that not all groups are coded for each item, these missing variables are dropped from the analysis. This is possible in the modeling framework defined above, and it simply means that that item provides no information across dimensions for the groups in which they were not coded. Lastly, given the joint coverage of the different datasets that capture group characteristics extends only until 2010, I drop all observations past that year from both the dyadic and group characteristics data sets. In summary, this leads to a total of 2223 dyad-year observations of rebel alliances and 219,971 group-year-item of rebel characteristics.

[7] All changes to the data are found in the replication file.

Figure 24: K-plot of Item dimensionality



The rebel characteristics data is composed of 154 items as demonstrated in Table 11 in the Appendix. A qualitative analysis of the item suggests that they can be broken down into three dimensions: 1) left-right, 2) centerseeking-independence, and 3) identity. The first two dimensions are relatively simple and map on to standard ways of describing rebel group goals. The identity dimension on the other hand is more complicated. This feature maps groups that represent different ethnic, religious and other identity groups. While no standard spectrum exists to differentiate such identities, the model is still capable of placing groups in the same conflict with distinct identities away from each other.[8] This identity dimension is important given that, as argued in Section 1.1, identities can be thought of as clusters of preferences and believes which describe those that belong to it. Thus, such a dimension not only captures that groups recruit from or claim to represent different groups, but also likely captures underlying differences in goals between groups.

Figure 24 shows an elbow plot to quantitatively analyze the dimensionality of this data.[9]

[8] I explain this dimension in more detail in Section 5.4.

[9] The data for the items used in Figure 24, was inputted to deal with missing variables as it is not possible to conduct this clustering analysis with missing data. The imputation uses the mice package in R through a classification and regression tree method. This data is however not used in the latent variable model where

The plot suggests that the optimal number clusters in the data is closer to 4. However, in the multidimensional IRT framework increases in dimensions are costly due to increasing need for constraints for model identification.[10] Further, the plot does show that 3 dimensions does capture a substantial amount of the variation in the data. Analyzing the data qualitatively shows that a likely fourth cluster can be described as democratic-authoritarian dimensions in the data as seen by items that describe democratic, theocratic and authoritarian aims of rebel groups. Such a dimension is difficult to fit into the distance framework as it is unclear if two authoritarian groups are more likely to cooperate and is likely dependent on the type of authoritarian ideology the group has. This dimension can however be neatly mapped onto the left-right dimension where authoritarian leftist ideologies such as Maoism and authoritarian right ideologies such theocratic goals and aims to establish a military government push groups to the extreme of the dimensions while, democratic goals push them to the center. Thus, the data on the items is best used to fit a model with three dimensions.

5.3 ANALYSIS ON SIMULATED DATA

Having described the latent variable model of goal distance and the dataset which will be used in the model to test the role of goal distance in group-level cooperation, I now will simulate a dataset that has comparable characteristics to the actual data previously described, and analyze how the model fits this data. The aim of examining the model's performance on simulated data is not to gain insight into actual-world patterns of alliance decisions between rebel groups, but rather to evaluate the properties of the model, given an assumed data-simulation model.(Gelman, Hill and Vehtari, 2020) Specifically, with this analysis, I aim to show how the model can successfully estimate key parameters of interest, such as the ideal points of the groups, the goal distance measure, and the coefficients of the goal distance measure in the logistic model component. This analysis highlights key

missing observation about the item are dropped.

[10] Attempts to fit the model with 4 dimensions were unsuccessful as the model was not identified and the stan algorithm had convergence issues.

features of the model, such as the role that priors play in identifying the model, and provides internal validity to the model. In other words, given that the real data on rebel group cooperation is similar to the simulated data, the model should provide accurate estimations of key parameters.

The first step to analyzing the model's performance is to describe the assumed data-generating process behind the simulated data. I begin by creating a well-behaved and informative dataset where there are $G = 300$ groups that are equally divided between $C = 20$ countries such that each country c has 15 groups in it. I then assume that all groups in all countries are active for 2 years. This creates $J = 600$ group-year observations. Next, I assume that data has been gathered for all groups for $K = 27$ items containing binary variables that indicate how each group responds to the item k such that all groups have a response for all items. This results in a dataset of $i \in (1, J * K = 16200)$ group-year-items thus, Y_i represents group-year $j(i)$'s response to item $k(i)$. The probability that $Y_i = 1$ is given by the ideal point formula such that:

$$Pr(Y_i = 1) = logit^{-1}(\mathbf{\Theta}_{j(i)} * \mathbf{A}^{\intercal}_{k(i)} - \beta_{k(i)})$$

In this simulated data, I assume that there are $D = 3$ dimensions for which groups can have ideal points. Thus, $\mathbf{\Theta}_{j(i)}$ is a 600x3 matrix and $\mathbf{\Theta}_{j(i)d}$ indicating the ability of individual $j(i)$ in dimension d and $\mathbf{A}_{k(i)}$ is a 27x3 matrix where $\mathbf{A}_{k(i)d}$ indicates the difficulty of item $k(i)$ in dimension d. Lastly, $\beta_{k(i)}$ does not vary within dimensions and remains a vector of length $K = 27$.

I then assume that for $g > 4$, the ideal point θ_{gd} of each group is randomly drawn for a standard normal distribution truncated at -1 and 1, such that $\theta_{gd} \sim N(0, 1)(-1 < N > 1)$. Note that the parameters are selected by the group, not group-year observation, thus this simulated data assumes no change of ideal points across time.[11] However, for groups $g \leq 4$, I manually input the ideal points manually. These g groups will serve as the reference group that I will priors in their ideal points for model identification. For these, I assign their ideal points to be: $\theta_{g=1} = \{1, 1, 1\}$, $\theta_{g=2} = -1, 1, -1$, $\theta_{g=3} = \{1, -1, 1\}$, $\theta_{4=1} = \{-1, -1, 1\}$.

[11] In other words the $\theta_{g(j(i))d} = \theta_{g(j(i)+1)d}$.

Next, I assume that the value $\alpha_{k(i)}d$ for all $3 > k < 25$ are drawn from multi-normal distribution such that $\alpha_{k(i)}d \sim N(\nu, \Pi)$ where:

$$\nu = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$$

$$\Pi = \begin{bmatrix} 2 & 0.01 & 0.01 \\ 0.01 & 2 & 0.01 \\ 0.01 & 0.01 & 2 \end{bmatrix}$$

The α parameter is drawn from a multinormal distribution to simulate the observation that in our data most rebel characteristics do not provide a high level of discrimination for only 1 dimension. In other words, most items in our data are unlikely to provide a lot of information about an ideal point in all dimensions. The discrimination parameters for $k(i) \in \{1, 2, 3, 25, 26, 27\}$ are manually inputted again as these will serve as reference items to help with model identification and prevent dimension switching in the model. These values will be: $\alpha_{k(i)=1} = \{3, 0, 0\}$, $\alpha_{k(i)=2} = \{0, 3, 0\}$, $\alpha_{k(i)=3} = \{0, 0, 3\}$, $\alpha_{k(i)=25} = \{-3, 0, 0\}$, $\alpha_{k(i)=26} = \{0, -3, 0\}$, $\alpha_{k(i)=27} = \{0, 0, -3\}$. Lastly, I each difficulty parameter from a half-normal distribution such that $\beta_{k(i)} \sim N(0, 1)(\beta_{k(i)}) > 0)$. I then use a Bernoulli distribution to draw a binary value for each observation i given the probability $Y_i = 1$ calculated via the ideal point formula and the simulated θ, α, and β parameters such that $Y_i \sim Bernoulli(Pr(Y_i = 1)$. This creates the group-year-item data used in the ideal point estimation component of the model.

Next, I create the dyadic data of alliances. I begin creating dyadic data for all groups within each country c year t. This creates $n = 8400$ dyad-year observations. I then create the covariates that predict alliances. First, I calculate the squared distance between the θ parameters of each group in the dyad for each dimension $D = 3$, which creates the distance variable δ_n and create another variable $X_n \sim N(0, 1)$. I standardize both variables to two standard deviations following the suggestion of Gelman (2008) to facilitate model convergence. I then assign the "true" coefficient values for δ and X_n such that $\gamma_\delta = -1$ and $\gamma_X = 0.5$. Lastly, each country that the dyads are part of is assigned a random intercept such that $\zeta_l \sim N(0, 1)$. Using these values, the probability of alliance between the two

groups in each dyad year is calculated and used to create the binary alliance indicator by $C_n \sim Bernoulli(Pr(C_n = 1))$.

I now have two data sets, the first is group-year-item data containing a variable Y_i indicating how each group responds to each item in a given year, and the second has dyad-years for all groups within a country-year with a binary C_n indicator if the two groups in the cooperated that year, plus a variable X. I now run the latent variable model to examine if it can retrieve key parameters used to create the simulated data. To ensure the model is identified I use the following priors in the model:[12]

$$\mathbf{\Theta_{g(i)_{t=1}d}} \sim N(0, 1)$$

$$\mathbf{\Theta_{g(i)_{t}d}} \sim N(\mathbf{\Theta_{g(i)_{t-1}d}}, 0.25)$$

$$\begin{array}{ccc}
\mathbf{\Theta_{j(i)=1,d=1}} \sim N(1, 0.01) & \mathbf{\Theta_{j(i)=1,d=2}} \sim N(1, 0.01) & \mathbf{\Theta_{j(i)=1,d=3}} \sim N(1, 0.01) \\
\mathbf{\Theta_{j(i)=3,d=1}} \sim N(-1, 0.01) & \mathbf{\Theta_{j(i)=3,d=2}} \sim N(1, 0.01) & \mathbf{\Theta_{j(i)=3,d=3}} \sim N(-1, 0.01) \\
\mathbf{\Theta_{j(i)=5,d=1}} \sim N(1, 0.01) & \mathbf{\Theta_{j(i)=5,d=2}} \sim N(-1, 0.01) & \mathbf{\Theta_{j(i)=5,d=3}} \sim N(1, 0.01) \\
\mathbf{\Theta_{j(i)=7,d=1}} \sim N(-1, 0.01) & \mathbf{\Theta_{j(i)=7,d=2}} \sim N(-1, 0.01) & \mathbf{\Theta_{j(i)=7,d=3}} \sim N(1, 0.01)
\end{array}$$

$$\mathbf{A_{k(i),1}} \sim N(0, 1)$$

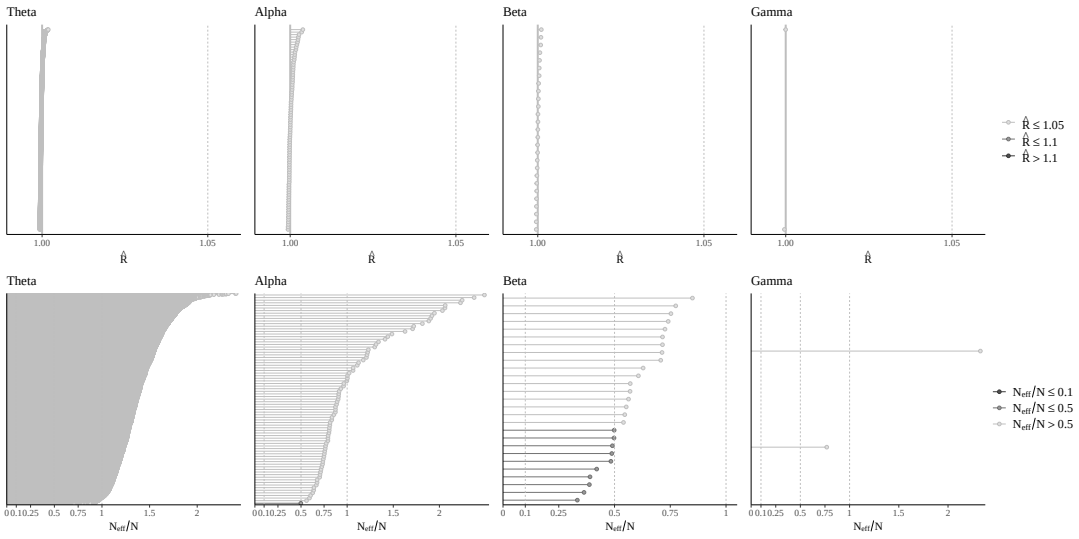
$$\begin{array}{ccc}
\mathbf{A_{k(i)=1,d=1}} \sim N(3, 0.01) & \mathbf{A_{k(i)=1,d=2}} \sim N(0, 0.01) & \mathbf{A_{k(i)=1,d=3}} \sim N(0, 0.01) \\
\mathbf{A_{k(i)=2,d=1}} \sim N(0, 0.01) & \mathbf{A_{k(i)=2,d=2}} \sim N(3, 0.01) & \mathbf{A_{k(i)=2,d=3}} \sim N(0, 0.01) \\
\mathbf{A_{k(i)=3,d=1}} \sim N(0, 0.01) & \mathbf{A_{k(i)=3,d=2}} \sim N(0, 0.01) & \mathbf{A_{k(i)=3,d=3}} \sim N(3, 0.01) \\
\mathbf{A_{k(i)=25,d=1}} \sim N(-3, 0.01) & \mathbf{A_{k(i)=25,d=2}} \sim N(0, 0.01) & \mathbf{A_{k(i)=25,d=3}} \sim N(0, 0.01) \\
\mathbf{A_{k(i)=26,d=1}} \sim N(0, 0.01) & \mathbf{A_{k(i)=26,d=2}} \sim N(-3, 0.01) & \mathbf{A_{k(i)=26,d=3}} \sim N(0, 0.01) \\
\mathbf{A_{k(i)=27,d=1}} \sim N(0, 0.01) & \mathbf{A_{k(i)=27,d=2}} \sim N(0, 0.01) & \mathbf{A_{k(i)=27,d=3}} \sim N(-3, 0.01)
\end{array}$$

Using Rstan Carpenter et al. (2017); Stan Development Team (2018) I estimate the model by running two chains for 3000 iterations, with the first 1500 iterations representing

[12]The priors for the θ parameters use a random walk prior such that for each group, the prior for observation at time t is the posterior of the observation at $t-1$. If an observation is the first for a group such that $t = 1$, the standard normal prior is used. By using the structure, the model can learn from the group's position in the previous to estimate the current position. This is a middle ground to assuming that group positions are static across time or that they are completely independent across time.

warmup iterations and the latter 1500 used for sampling. The Markov Chain Monte Carlo (MCMC) algorithm implemented by stan to estimate the parameters, only generate samples from the target distribution if the algorithm has converged to an equilibrium. To monitor the convergence of the algorithm, Figure 25 plots the split-Rhats and Effective Sample Size (ESS) Ratio for each parameter of the model. The ESS measures the amount by which auto-correlation within the chains increases uncertainty in estimates, the larger the ratio of ESS to samples the better Geyer (2011). Usually, an ESS ratio smaller than the arbitrary values of 0.1 and 0.5 indicates convergence issues.[13] The split-Rhat statistic, on the other hand, compares the behavior of the randomly initiated chain, more precisely it measures the ratio of the average variance of draws from each chain to the variance of the draws of both chains combined. If the chains are in equilibrium indicating model convergence, then the value of the split-Rhat for that parameter approaches 1. The figure shows that for all parameters the values of the convergence statistics are consistent with model convergence. This provides some evidence that the algorithm has explored the posterior distribution sufficiently to provide accurate estimates of the model parameters. This further suggests that the ideal-point model is identified as identification issues often manifest in poor model convergence.

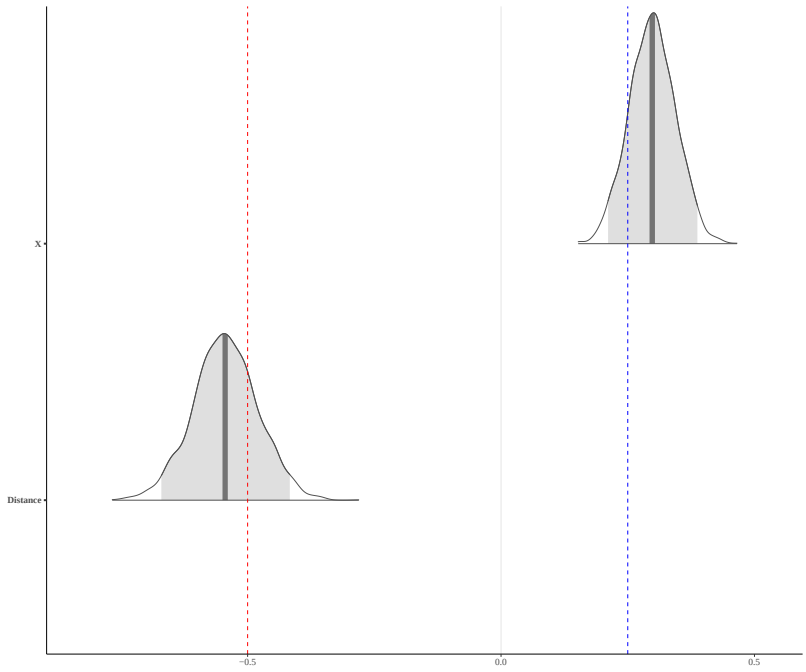
Figure 25: Convergence Diagnostics of Model on Simulated Data



[13]The ESS can be described as playing a similar role as independent draws in the Central Limit Theorem, but in the context of Markov Chain Monte Carlo (MCMC) Carpenter et al. (2017).

Next, I examine how well the model is able to retrieve the parameters of interest. Figure 26 plots the posterior distribution for the coefficient γ for the goal distance measure and the variable X . The vertical red line indicates the "true" value of the coefficient for the Distance variable according to the data generating process behind the simulated data, while the blue indicates this value for the X variable. The figure shows that the model is able successfully to recover the coefficient estimates of the simulated data as the "true" values of both parameters are inside of the posterior distribution.

Figure 26: Posterior Distribution of γ Parameters of the Simulated Data

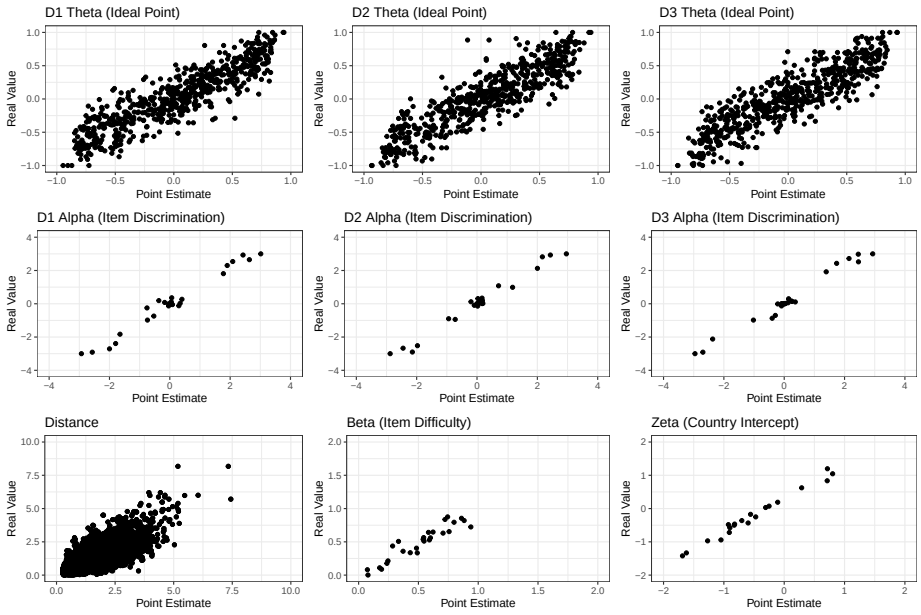


Notes: The vertical red line indicates the "true" value of the Distance variable. The vertical blue line indicates this value for the variable X. The Gray area of the posterior distribution indicates 95% of the area of the distribution

Figure 27 plots the true value of key parameters given the data-generating process behind the simulated data versus the mean of the posterior distribution of the estimates of those parameters in the model. The first row of the figure demonstrates that the point estimates of the θ parameters are highly correlated with their "true" value in the data-generating process

of the simulated data across all three dimensions. Similarly, the second row shows a similar pattern for the α parameters of each item across all dimensions. This demonstrates the model's ability to capture each group's ideal point and distinguish how much each item is discriminating between the three dimensions in the model when the model is identified and converges. The third row first shows the correlation between the Distance parameter, as well as the β and ζ. Again, the figure shows a high correlation between the point estimates of the model and the actual values according to the data-generating process.

Figure 27: Plots of True Values vs. Model Point Estimates



Overall, these figures demonstrate that given a properly identified model in which the Stan algorithm converges and data that is consistent with the simulated data, the estimates of the proposed models are internally consistent. In other words, the model should recover sufficiently consistent parameter estimates for the data-generating process. While these results show no relationship between goal distance and alliances in actual data, it does build our confidence that the model is able to estimate these effects if they are present in the data. Further, the model shows that estimates of other parameters such as the ideal points are also validated, showing the model's possible uses as a measurement model of group goals that may be used in other models.

5.4 ANALYSIS ON REBEL GROUP ALLIANCE DATA

In this section, I finally use the proposed model to analyze the data on rebel group alliances. I begin by describing the model's constraints and control variables. I then show the model's convergence statistics and analyze the point estimates of some groups along the dimensions of the data. Next, I present the model's results and discuss their relevance to the theory of group alliance proposed in the model. Last, I present a series of other models of alliances between rebel groups. I compare the in-sample fit of the different models and discuss how the goal distance measure affects the model fit.

As previously discussed, for the IRT component of the model to be fit, I add constraints for both the Θ and $\mathbf{A}$ parameters via strong priors on the positions of some groups and the discrimination of some items across the three dimensions. These constraints are fully described in the Appendix. The values for the constraints on the position Θ for all three dimensions for each of the groups were chosen based on a qualitative analysis of the item level data, the notes on the goals and ideologies of the groups on the different data sets used to create the item data, and information about the civil war actors found in the UCDP Conflict Encyclopedia (Sundberg, Eck and Kreutz, 2012).

For example, in the left-right dimension, the Communist Party of India-Maoist (CPI-Maoist) in its first year of observation is fixed to have a goal of negative -1 in dimension 1 due to its extreme Marxist position and their ideology of annihilation of, and no compromise with, "class enemies," which guided their violent attacks on civilians and politicians. Further, given their goal of taking over the government of India, the group is fixed a value of -1. In contrast, the Taliban in its first year of observation is fixed at a value of 1 for the first dimension given their staunch traditionalist goals and desires to create a theocracy. Yet, like CPI-Maoist, the group's main goal is to take over the government of Afghanistan and therefore they are also fixed at a value of -1 for dimension two.

While understanding the fixed goals in the first two dimensions is relatively straightforward, the identity dimensions require more specification. The first captures the left-right and authoritarianism of the groups, and the second dimension captures the desire for independence against the desire to capture the central state. However, the identity dimensions

use binary ethnicity and religion-related items to constrain that dimension. The aim is to use the groups whose identity-related differences were a major source of conflict between them to fix that dimension. For example, the ethnic and religious identities of the Serbian Republic of Bosnia-Herzegovina and the Croatian Republic of Bosnia-Herzegovina were major factors separating those groups in the conflict. As such, I fix them at opposite ends of the dimensions, and the items for their respective identities – Croatian and Serbian/Orthodox – are given high discrimination in the corresponding direction. This dimension, therefore, captures these identity-related differences, and differences in other items that are correlated with identity and not neatly related to the first two dimensions. Yet, this dimension should is not a co-religion or co-ethnicity dimension or even a distance between all of those identities. Rather, it is more appropriately conceived as a dimension that uses data on those identities to help capture other differences between groups.

Fixing the position for 12 group years may be seen by some as excessive use of priors in the model, I note that this accounts for about 4% of the 320 groups in the dataset and 0.5% of the total group year observations. Further, these priors are a way to include qualitative information in the model. While the 3-dimensional ideal point model can fit by constraining only four groups on the three dimensions, I added further constraints to account for the poor quality of the data and the fact that no four groups could fix the extremities of the 3-dimensional policy space as in the simulated example.

I further constrained 21 of the items in the model. The items selected for these constraints are relatively self-explanatory. For example, the right-wing variable in the AGD dataset has a fixed $\mathbf{A_{k(i),d}}$ of 4 for dimensions 1, and 0 on the other two dimensions, indicating it provides information that a group is left wing, but no information in the other dimensions. While the center-seeking item has a $\mathbf{A_{k(i),d}}$ of -4 in dimension two and 0 in all other dimensions indicating that it provides information that a group is center-seeking. Further, in dimension three, the Serbian item is fixed to have an alpha $\mathbf{A_{k(i),d}}$ of 4, and the Croatian item is fixed at -4, indicating that those items discriminate in dimension 3 in the given directions.

However, not all of the 21 items are constrained on all three dimensions. This large amount of constraints is again necessary for model convergence due to large amounts of missingness on many of the items. Further, these constraints better help connect the

model dimensions with their expected theoretical meaning (the left-right, center seeking-independence, and identity dimensions) given the variables available in the data. This allows for more easily interpretable dimensions and the fixed items account for only 14% of the 154 items in the data, and the fixed item dimensions are about 10% of the total 462 **A** parameters in the model.

The model further includes a set of covariates that serve as control variables based on the analysis of rebel alliances in Balcells, Chen and Pischedda (2022). Table 6 shows the variables along with the Co-Ideology variable used for the analysis in Balcells, Chen and Pischedda (2022). However, there are a few differences in the model specification I present here and in the main analysis of Balcells, Chen and Pischedda (2022). First, I include two power-related variables Weak Link and Ratio. I calculate these variables using data from Cunningham, Gleditsch and Salehyan (2013). As in previous chapters, the Weak Link variable captures the strength of the weakest member of the dyad, while the Ratio variable captures the difference (ratio) of the strength of the two groups. Further, the model includes the binary variables Co-religious which indicates that the groups in the dyad share a religion, Co-Sponsor which indicates the dyad members received support from the same state.[14]

Table 6: Control Variables

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
WeakLink	2,233	3,707.633	6,221.504	100	600	4,500	65,000
Ratio	2,233	0.371	0.295	0.002	0.104	0.600	1.000
Gov Mil Size	2,233	0.353	0.495	−0.009	0.050	0.282	4.015
Log GDP per Capita	2,233	7.566	0.900	5.813	6.543	8.095	10.129
Log Population	2,233	3.793	1.615	0.741	2.953	4.022	7.116
Number of Rebels	2,233	5.531	2.608	2	3	7	12
Terrain	2,233	0.026	0.011	0.002	0.017	0.034	0.091
Co-sponsor	2,233	0.162	0.368	0	0	0	1
Co-Ethnic	2,233	0.070	0.256	0	0	0	1
Co-Religion	2,233	0.548	0.498	0	0	1	1
Splinter	2,233	0.052	0.221	0	0	0	1
Post Cold War	2,233	0.370	0.483	0	0	1	1
Co-Ideology	2,233	0.303	0.460	0	0	1	1

[14]These variables were not present in the main analysis in Balcells, Chen and Pischedda (2022) mostly due to missingness in the data but were used in subsequent robustness checks.

As Table 6 demonstrates, I conduct multiple imputation to deal with missing data in these control variables. While a fully Bayesian approach which treats missing data as parameters estimated within the model structure is preferable, it is often computationally expensive and can lead to issues in model fit. These issues are especially problematic given the already computationally expensive nature of the proposed model. Thus, I follow the suggestion in Gelman et al. (2013) and split the data analysis into two parts. First, I impute missing values and then perform inference using the model described above on the imputed dataset. To conduct the multiple imputation, I use a classification and regression tree method to impute the missing observations using the mice package in R. The classification and regression tree method has particularly attractive for this analysis as it is robust against outliers, and it is suited to deal with multicollinearity and skewed distributions in dichotomous and continuous variables (Bergette and Reiter, 2010). Beyond these specific benefits, in most cases, any form of imputation is preferable to deletion of data (King et al., 2001), even when there are relatively high levels of missingness in the data (Madley-Dowd et al., 2019).[15]

Further, all non-binary variables have been standardized. I follow the recommendations in Gelman (2008) and standardize the variables by dividing by two times the stand deviation so the resulting coefficients are directly comparable to untransformed binary predictors. Besides facilitating the comparison of effect size, standardizing the variable allows for the stan algorithm to be more computationally efficient and facilitates model fit (Carpenter et al., 2017).[16]

5.4.1 Main Analysis

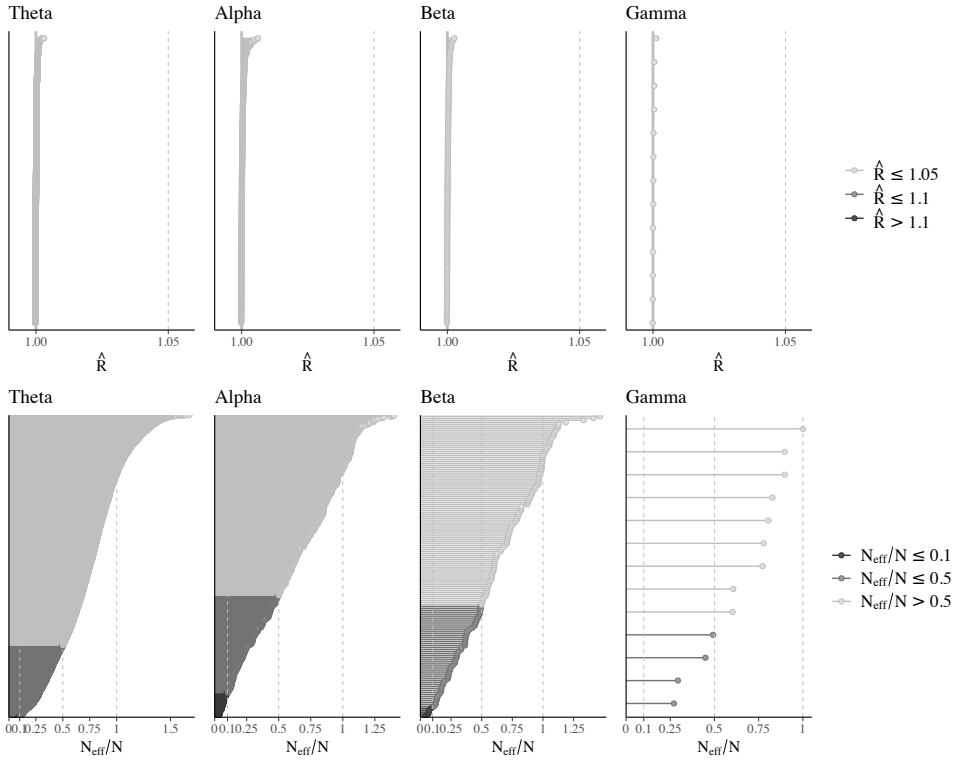
Finally, I run the complete model as described in the previous section with the constraints and control variables described above.[17] Figure 28 shows the split-Rhats for all parameters approaches 1, which suggests the model did not have convergence issues.

[15]Table 12 in the Appendix shows the percentage of missing data for each variable in the analysis.

[16]The distance variable δ estimated via the ideal point component of the model also is standardized in the stan model.

[17]More specifically, I run two chains of the model for 10000 iterations. This relatively large number of iterations is needed due to the low effective sample size of some parameters as shown in Figure 28 due to the poor quality of the data for some items and groups.

Figure 28: Convergence Diagnostics of Model



Next, Figure 29 plots the distribution of the coefficient parameter estimates for the distance variable and all control variables in the model.[18] The first finding these coefficients show is that the distance variable is negative and sizable and the estimate distribution does not cross 0. This suggests that as the distance between the ideal points of two groups increases, the less likely these groups are to form any alliance. This demonstrates that goal distance is an important factor in explaining the data on alliance formation. Further, given that I standardized non-binary variables by two standard deviations, the effect sizes are on the same scale as those of binary variables. The coefficient estimate of goal distance is larger than other variables highlighted by the literature such as sharing a foreign sponsor. Overall, the effect of goal distance is in line with expectations about its effect derived from the theory and Agent-Based model presented in earlier chapters.

Along with the goal distance variables, other coefficient estimates have demonstrated

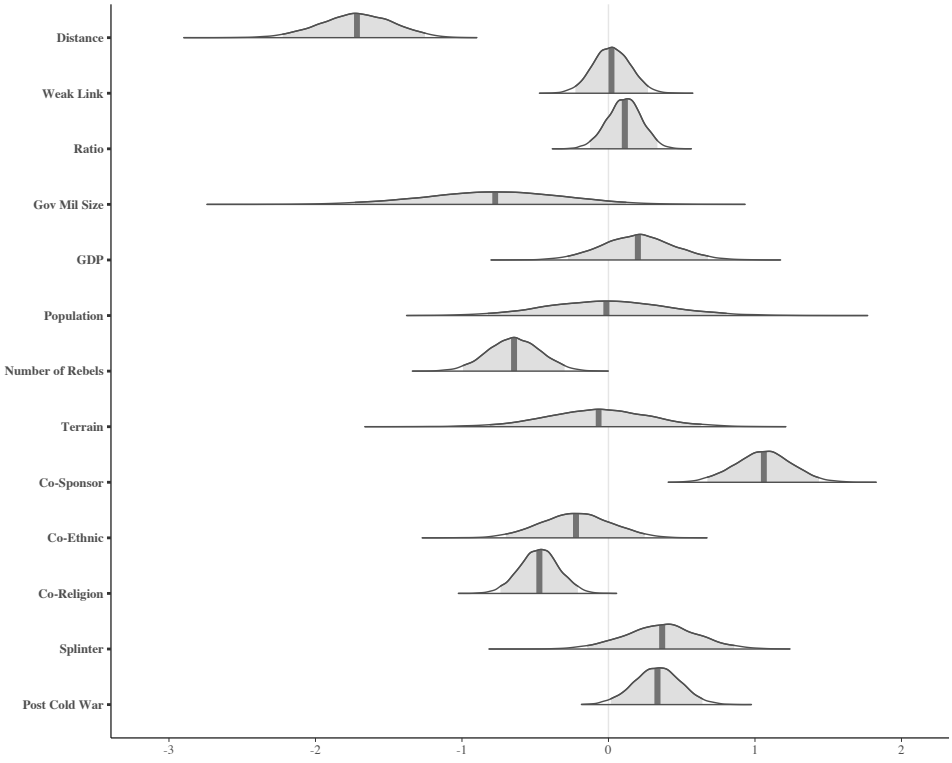
[18] A table with the coefficient estimates can be found in the Appendix.

standard markers of statistical significance. First, in line with expectations with previous findings, the number of rebel groups present in the conflict has a negative effect on the likelihood of alliance, while sharing a foreign sponsor has a positive effect (Balcells, Chen and Pischedda, 2022; Popovic, 2018). Further, the model suggests that two groups are more likely to be allied in the post-Cold War era, possibly due to a less bipolar international system with less interference by the U.S. and U.S.S.R. pushing groups apart. Lastly, the model suggests that sharing a religion makes groups less likely to form alliances. At face value, this result may seem in contrast with findings in (Balcells, Chen and Pischedda, 2022) that suggest that alliances are more likely between Islamist groups. However, this is not necessarily true. First, the variable used in this model accounts for all religions, not just Islamic groups.[19] Second, and most crucially, once differences in the goals of groups are better captured, the ideological similarity correlated with shared religious belief is no longer informing its expected effect. This negative and significant effect might provide some support for the proximity-distance paradox suggested by Hafez (2020). The paradox argues that extremists with similar preferences are more likely to engage in violence. In this case, the co-religion variable is more likely to be 1 when groups express religious extremism and are part of the same faith. A similar effect is observed with the co-ethnic variable as it is also negative. However, the effect is not traditionally statistically significant.

Another finding shown in Figure 29 is that while in the expected direction, neither of the power-related variables have large effect sizes that are distinguishable from 0. However, I would not suggest that these findings are evidence for the lack of an effect for these two theoretical factors. The data on rebel group strength is most likely not sufficiently fine-grained to find the expected effects as it is not collected yearly (or better yet in smaller time periods), which is problematic considering the often large fluctuations in power experienced by some groups throughout the conflict. Further, this variable has a large amount of missingness. This can create further difficulties in capturing the expected effects even after dealing with the missing observations through multiple imputation.

[19]Further, the variable accounts for differences with broader religious categories, and differentiates such as between Sunnis and Shias.

Figure 29: Coefficient Estimates: Full Model



While demonstrating the large and significant effect size of the goal distance variable is important, it is also essential to show if and how this variable increases the out-of-sample predictive accuracy of models of rebel group alliances. The predictive capacity of a model is relevant even outside of predictive exercises. If a model captures the underlying relationship between dependent and independent variables, it should continue to perform well in new data. However, overfitted models – models that fail to capture the underlying causal relations but rather provide a detailed description of the original data– will perform poorly in explaining new data (Beck, King and Zeng, 2000; Ward, Greenhill and Bakke, 2010). Therefore, models with good out-of-sample predictive capacity are more likely to capture the underlying causal relations between variables. Further, demonstrating statistical significance does not imply that a variable is associated with significant improvements in predictive power. Thus framing the analysis around statistically significant results might lead us to focus on results that are artifacts of the specific cases in the study. In other words, this may lead to inferences that

are overfitted to the data which can hinder the model's predictive capacity (Ward, Greenhill and Bakke, 2010; Colaresi and Mahmood, 2017).

To compare the gains in predictive capacity resulting from the ideal point component of the model which creates the goal distance measure I use a leave-one-out (LOO) cross-validation approach implemented via the loo package in r (Vehtari et al., 2021). Cross-validation deals with the overfitting problem that results from using the same data to estimate and evaluate the model by essentially using a different dataset (the left-out observation) to test the fit (Gelman et al., 2013). Traditional implementations of LOO cross-validation require fitting the model as many times as there are observations, once for each held-out data point. However, using Pareto smoothed importance sampling (PSIS), the out-of-sample model fit statistic can be accurately and reliably estimated (Vehtari, Gelman and Gabry, 2017), without refitting the model with each data point held out as it would be computationally intractable.

Analyzing a model's predictive accuracy for its own sake is important, however, it is often more useful to compare these statistics with other models. This comparison between models allows researchers to better observe discrepancies between the fitted representations (model results) and the data-generated process. Specifically, analyzing the influence of the goal distance variance compared to models that exclude it can demonstrate underperformance in existing models, meaning that significant features of the data-generating process remain unexplained. The aim is not to find a "true" model of cooperation in civil wars out of the set of given models but to build useful models that better capture the underlying data-generating process as demonstrated by a better out-of-sample fit, which provides a further step for future model building and evaluation (Colaresi and Mahmood, 2017).

For this purpose, I create four other models predicting rebel group alliances. These models take the same form as the logistic model proposed in section 6.1.2 where a series of predictors X and country-level random effects are used to predict the y variable. In short, these models exclude the goal distance variable and the ideal point estimate component of the model. These model specifications are 1) a model that includes all control variables (All Controls); 2) a model which includes all the control variables except the Weak Link and Ratio variables (Controls - Power Variables); 3) a model that includes all control variables and the

binary indicator of co-ideology used in Balcells, Chen and Pischedda (2022) (Controls + Binary Ideology); and last the model specified in Balcells, Chen and Pischedda (2022) with the country level fixed effects (Balcell et al (2022)). The four models allow the comparison of the full model with models that do not account for goals and models that use rough binary measures of the same theoretical concept.[20]

Figure 30: PSIS Model Comparison

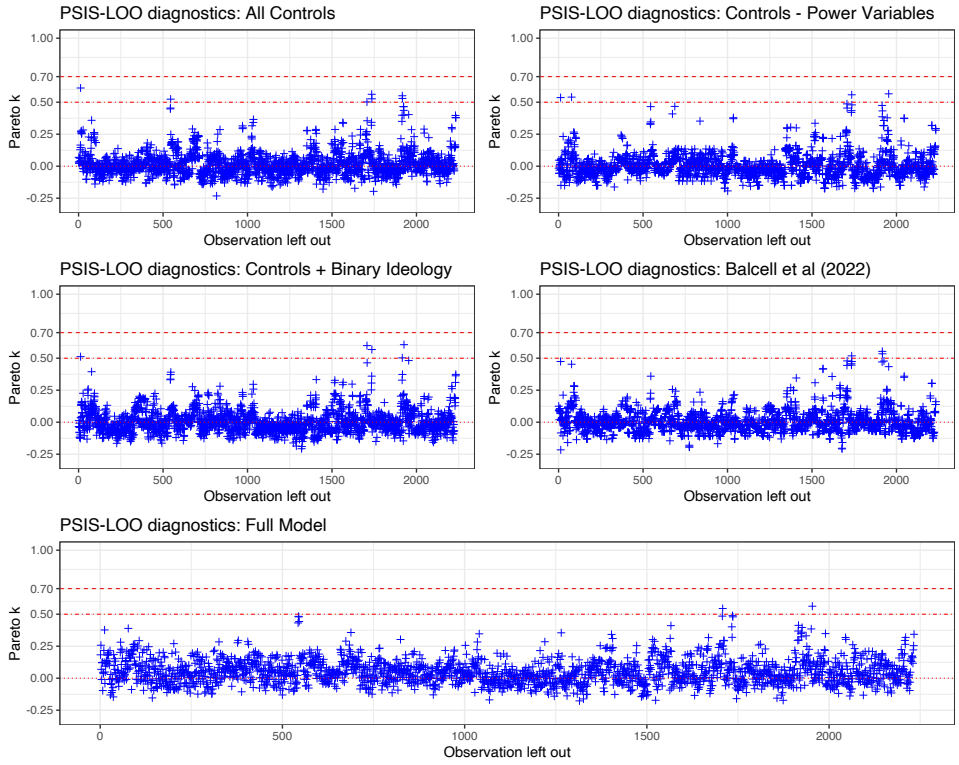


Figure 30 plots the Pareto K statistic for each observation left out for each of the four comparison models and the full model which includes the goal distance measure. This figure shows that the estimated shape parameters k are mostly below 0.5 and all are below 0.7. Values lower than 0.5 indicate the LOO test statistics converge are accurate Vehtari, Gelman and Gabry (2017). Further, Vehtari et al. (2015) argues that the Pareto K can serve as a diagnostics of the model's convergence behavior. In short, the figure shows further evidence that the complete model successfully converges as no value is higher than 0.7. The same

[20]The coefficient estimates of the four models are shown in the Appendix.

holds for the other four models.

Table 7: Model Fit Comparison

	ELPD Diff	ELPD Diff SE	ELPD LOO	ELPD LOO SE	P-LOO	P-LOO SE	LOOIC	LOOIC SE
Full Model	0	0	−1,075.574	25.898	65.948	2.984	2,151.147	51.797
Controls + Binary Ideology	−26.859	10.775	−1,102.432	25.893	41.364	2.250	2,204.865	51.785
Balcell et al (2022)	−36.700	11.881	−1,112.273	25.414	37.751	2.230	2,224.547	50.828
Controls - Power Variables	−40.033	9.670	−1,115.606	25.435	38.170	2.223	2,231.212	50.871
All Controls	−41.377	9.587	−1,116.950	25.525	40.511	2.284	2,233.901	51.050

Table 7 shows the ELPD (expected log probability density) of the five models and the difference between the EPLDs of the models with standard errors. The ELPD is a measure of predictive accuracy calculated via LOO cross-validation with useful characteristics in line with information theory, essentialy it is a measure of how likely a specific data point is, given the model fit of the sample that does not include it (Gelman et al., 2013). In short, smaller values indicate better out-of-sample predictive capacity. The table shows that the Full model has a significantly smaller EPLD than all four models suggesting that the full model has the most predictive capacity out of all the specified models. Thus, the goal distance variable significantly improves the predictive capacity compared to the model with all the same controls, demonstrating the importance of goal differences in explaining alliances. Also, the full model significantly outperforms the two models that include the binary co-ideology variable, further demonstrating the usefulness of the measure.

Table 7 also shows P-LOO and LOOIC statistics. The P-LOO value can be interpreted as the effective number of parameters. In well-behaved models where Pareto k is less than 0.7 if P-LOO is higher than the number of observations and parameters, it indicates weak model predictive capacity and possibly model misspecification. This statistic shows that all models are well-behaved and have sufficient predictive capacity.[21] Lastly, the table also shows the loo information criterion (LOOIC) used in the calculation of the EPLD. This statistic is roughly equivalent to AIC in a frequentist framework and it again shows better predictive capacity for the complete model.

In summary, the Full Model which uses the goal distance measure demonstrates all-around greater out-of-sample predictive capacity than the other comparable models of rebel

[21] There are no data points with Karato K greater than 0.7 and the P-LOO value for all of the models is lower than the number of parameters and observations in the models.

alliance presented. This increased capacity suggests that the goal distance variable is capturing underlying features of the data-generating process behind cooperation decisions in civil wars rather than overfitting the model to the observed data.

5.4.2 Formal and Informal Alliances

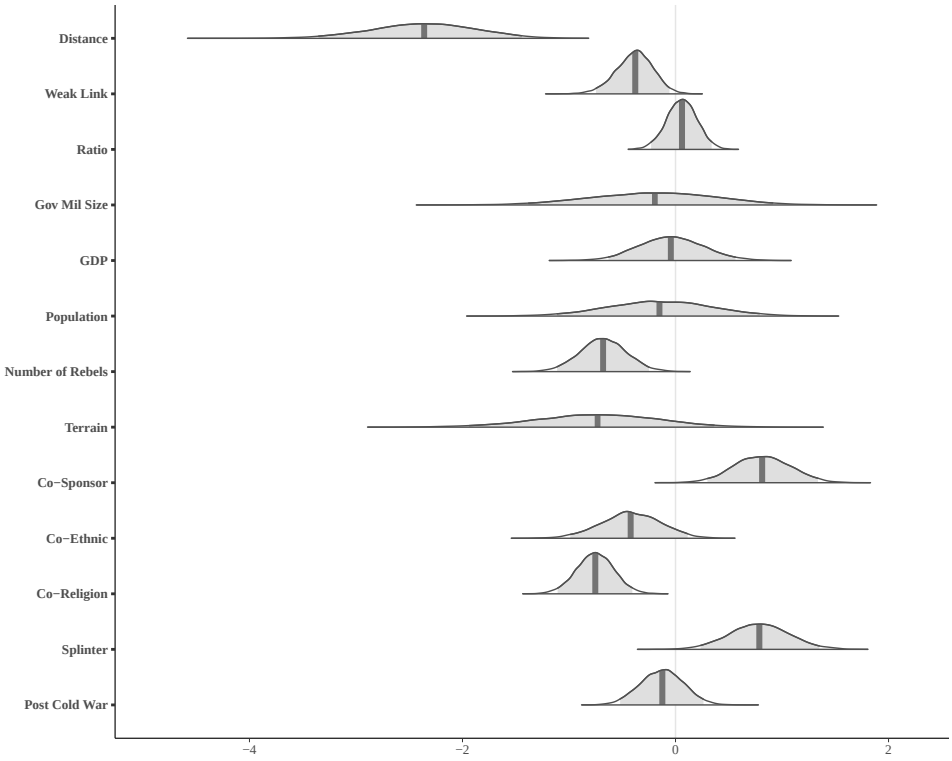
Analysis of rebel alliances often differentiates between formal and informal alliances. Informal alliances are defined as two groups cooperating on the battlefield or sharing resources such as training, weapons, intelligence, and logistic networks. On the other hand, formal alliances exist when two groups publicly announced an alliance with a specific name. While such a differentiation makes sense, formal and informal alliances may be distinct processes, given that formal alliances are announced publicly and entail higher levels of coordination. However, I argue and demonstrate in the logic of the ABM that formal and informal alliances can both be studied within the same framework as they represent cooperative behaviors, and the difference between them is simply one of scale. In the terminology of the ABM, it is a difference in the A parameter. However, the logic developed in the ABM also suggests these different scales of cooperation are determined and explained by the complex interactions between group goals and power factors. As such, it is still relevant to analyze the two levels of alliances separately to understand the role of the difference in group goals in explaining both types of alliances.

Therefore, I re-run the full model presented in the previous section but break down the dependent variable between formal and informal alliances. In Figure 31, I code the dependent variable as 1 when a formal alliance exists, and everything else as 0.[22] The figure shows two noteworthy results. First, the Distance variable is still significant and negative. But also the point estimate of the effect size is slightly larger than when all alliances are included (-2.37 compared to -1.72). Second, the effect of the Weak Link variable is negative and significant, although relatively small. This finding suggests that formal alliances are less likely to form between powerful groups. This finding is contradictory to previous findings in Bapat and

[22]The model convergence diagnostics are shown in Figure 38 in the Appendix while the effective sample size of some parameters is relatively small, all r-hats are in the acceptable range given the large number of iterations that the model runs for.

Bond (2012). However, there are two major differences in the model besides the breakdown of formal and informal alliances, the first is the inclusion of the goal distance variable, and the second is the non-interaction of the Weak Link variable with co-sponsors. Further, the ABM provided one possible explanation for this finding. Dyads of powerful groups might be less likely to form formal alliances, where the relative gains of cooperation are larger, as such an alliance is likely to put both groups over the power threshold of 50% + 1, where the benefits of increased power start to decrease.

Figure 31: Coefficient Estimates: Formal Alliances (Full Model)



I again run the same set of comparison models in the previous section that excludes the goal distance variable generated via the latent variable model. However, these models now use the formal alliances variable as a dependent variable.[23] I then use these models to compare the out-of-sample predictive power of formal alliances of these models with the full model. Table 8 shows that the full model provides the best predictive model for formal

[23]The coefficient estimates of these models and the k-plot for all the models and the full model are shown in the Appendix.

alliances between rebel groups. This result further demonstrates the usefulness of the goal distance measure I created.

Table 8: Formal Alliance Model Fit Comparison

	ELPD Diff	ELPD Diff SE	ELPD LOO	ELPD LOO SE	P-LOO	P-LOO SE	LOOIC	LOOIC SE
Full Model	0	0	−744.230	28.254	61.190	4.284	1,488.461	56.509
Controls + Binary Ideology	−30.985	9.523	−775.215	27.438	36.530	3.220	1,550.430	54.875
All Controls	−33.621	9.541	−777.852	27.842	34.026	3.023	1,555.704	55.685
Balcell et al (2022)	−33.840	9.834	−778.070	27.114	31.644	3.075	1,556.140	54.229
Controls - Power Variables	−35.185	9.728	−779.415	27.781	31.960	2.978	1,558.831	55.562

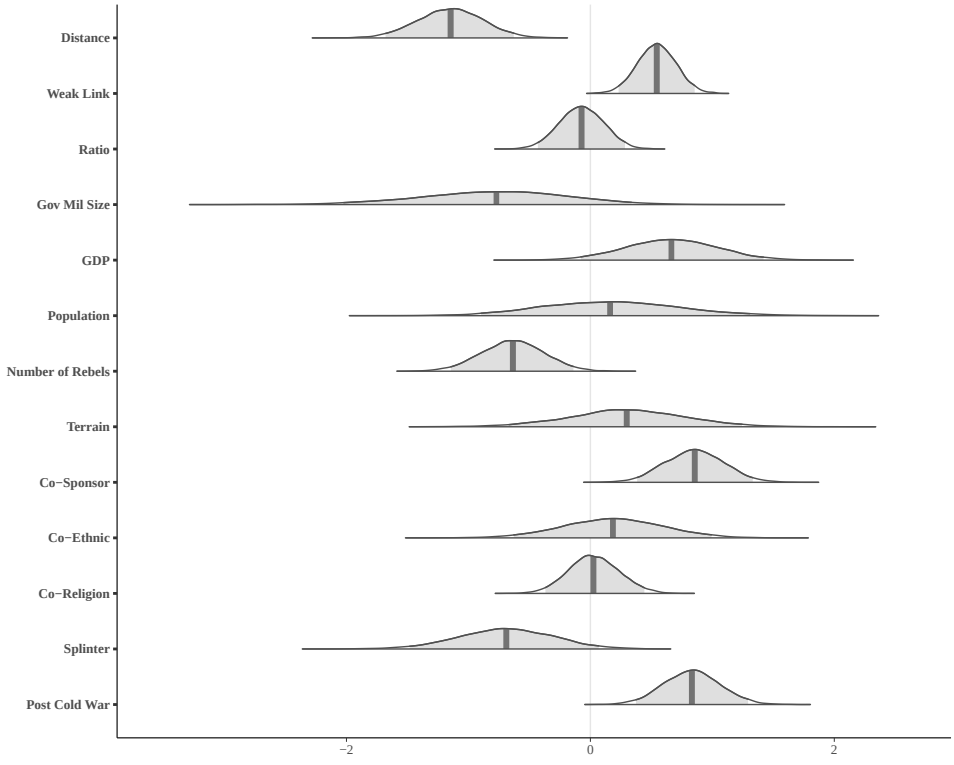
Next, I also conduct the analysis where the dependent variable is informal alliances. The results of this analysis are difficult to interpret as the 0 categories for the dependent variable include no cooperation and formal alliances. More sophisticated modeling, such as using binomial regression would overcome these issues. However, I do not conduct this analysis here because it would entail significant changes in the proposed Bayesian model, and the analysis depicted here can still show that goal distance has a negative and significant effect on predicting non-formal types of cooperation. Figure 32 shows the results of this model. The figure demonstrates, as expected given the proposed framework to explain cooperation in this project, the effect of goal distance is negative, significant, and still large.[24]

Although I caution about interpreting the effect size of the goal distance variable, especially when comparing it with those in the main analysis or the formal alliance model. The point estimate is somewhat smaller at around -1.49. This difference coefficient estimate might be because the goal difference variable is less important when explaining informal alliances. This interpretation makes sense in the context of the ABM as these alliances require smaller compromises in goals. However, it is also very likely caused by including formal alliances in the 0 category dependent variable. Another interesting result is that the Weak Link variable is now positive and significant. This result complements the findings in Figure 31 and can be explained by the ABM. Informal alliances lead to smaller benefits due to lower increases in material capacity to groups as there is less cooperation. Therefore, larger dyads

[24]In the Appendix, the model convergence diagnostics are shown in Figure 39. The figure shows that the effective sample size and the r-hats of some parameters are problematic. There were no divergences in the model, yet the diagnostics statistics should raise concerns about the precision of some parameter estimates. The poor fit is likely caused by the combination of formal alliances and no alliances under the 0 category. The 0 category including opposing outcomes likely creates issues for the model fit.

may be more likely to form these types of alliances as it is less likely to place them over the threshold of power indicated by minimal winning coalition logic.

Figure 32: Coefficient Estimates: Informal Alliances (Full Model)



The observation that goal distance is still in the expected direction and has a comparatively large effect size demonstrates that the results are not drive by formal alliances. As such, these results provide some evidence to my expectations that the role of goals in predicting cooperation is similar regardless of the type (or level) of cooperation and therefore can be analysed jointly. However, they also highlight potential gains to better measuring, and analyzing these different levels of cooperation as different factors may behave differently at different levels of cooperation. This observation is coherent with the theoretical framework presented in this project. Because cooperation is a complex pattern that emerges from the interaction of groups and individuals, not all factors behave linearly and may dependent on other factors such as the level of cooperation.[25]

[25]However, I again raise caution in the interpretation of the results of the strength variables in all models

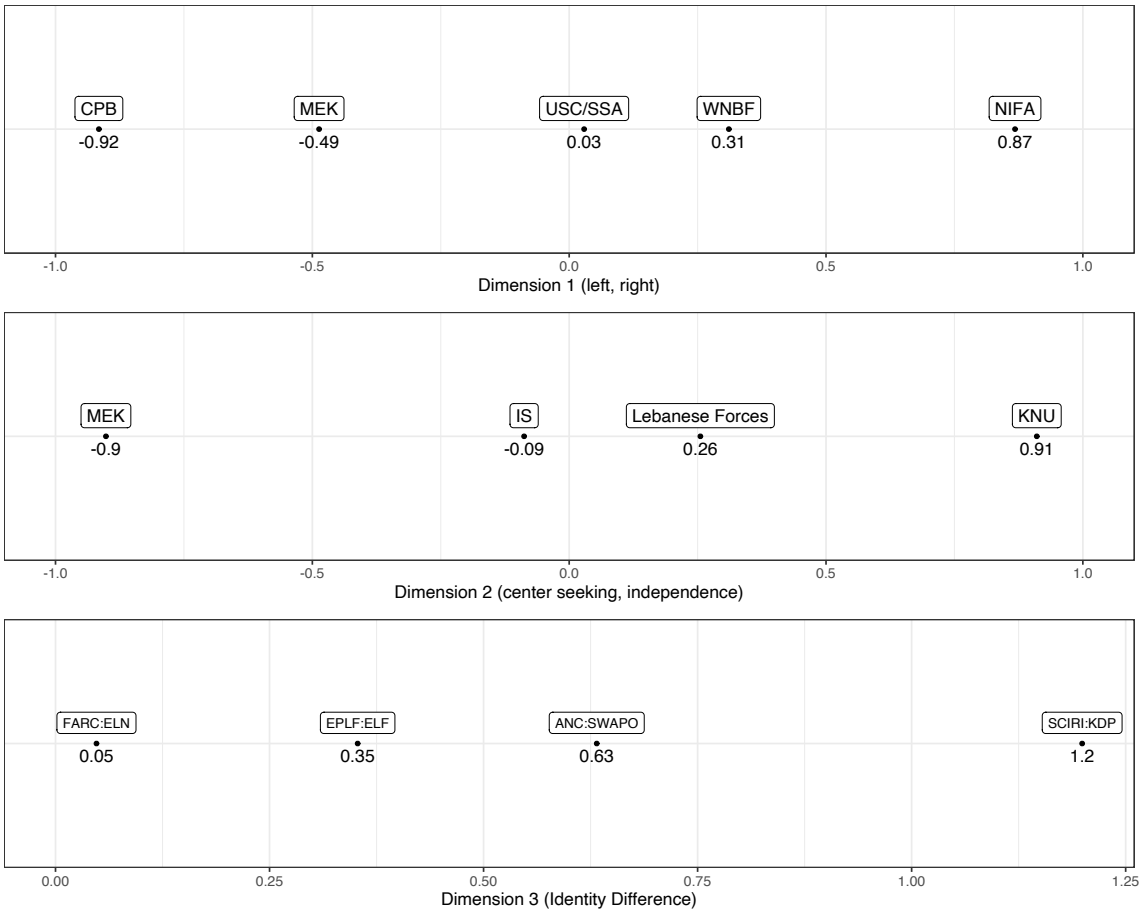
5.4.3 Face Validity of Goal Estimates

Having analyzed the role of goal distance in explaining alliances between rebel groups, it is now important to analyze the rebel group goal measure estimated by the latent variable model. For this analysis I will compare the $\mathbf{\Theta}_{j(i)_d}$ parameter estimated by the full model in the main analysis for different groups whose position was not fixed as a prior. The aim of this analysis is to provide some face validity to the estimates by demonstrating that the model can roughly place groups where qualitative analysis of the groups would suggest they should be located on a given dimension. For the qualitative information on each group used in this analysis, I primarily rely on the UCDP Conflict Encyclopedia (Sundberg, Eck and Kreutz, 2012).

Figure 33 plots the point estimates of the $\mathbf{\Theta}_{j(i)_d}$ for the first two dimensions for selected group-years from the data generated by the latent variable model. These groups were selected to show the range of possible values in each dimension. The figure also shows the difference in $\mathbf{\Theta}_{j(i)_3}$ for select dyads. Again, these groups were selected to cover the range of possible values. Unlike dimensions one and two, the meaning of the the position in dimension three is difficult to interpret given that it is only attempting to differentiate groups with different identities without specifying what those identities are. Thus, rather then plotting the values, I plot the differences so that those differences in identity can be compared to what would be expected from qualitative data.

due to their poor measurement. This is especially true (and applies to all variables) for the informal alliance analysis due to inclusion of both no cooperation and formal alliances in the 0 category in the analysis of informal alliances.

Figure 33: Example of Group Goals from Main Model



The first goal dimension in the latent variable model represents a left-right dimension. For this dimension, starting from the left, the model provides a point estimate for the Communist Party Burma (CPB) in 1948. This group is one of the most negative non-fixed point estimates at a point estimate of -0.92. In this dimension of the model, the more negative the $\mathbf{\Theta}_{j(i)_1}$ is, the more leftist ideology the group has. The CPB was founded in 1939 and joined with a coalition of leftist organizations under the Anti-Fascist People's Freedom League (AFPFL) to fight against the Japanese occupiers. However, following the end of World War II, the CPB broke with the rest of the coalition, which became a central constituency in the Burmese government, due to the CPB's hard-line Marxist views compared with the AFPFL's more moderate leftist views. The CPB then began their insurgency campaign, in the Burmese

countryside. This break with the relatively left AFPFL demonstrates both their extreme leftist position and the importance of these differences for the CPB.

The next group in this dimension is the Mujahideen e Khalq Organization (MEK) in 1979, with a point estimate of -0.49. The MEK was founded in 1960 by socialist-leaning university students to overthrow the monarchical regime of Iran. According to the group People's Mojahedin Organization of Iran (2023), in the 1970's a movement within the group tried to shift the group's ideology to a far-left Marxist interpretation of their struggle rather than a socialist-Islamic ideology. However, the majority of the group rejected the Marxist shift, leading to a splinter group called Peykar. The group's socialist and anti-monarchy ideology places them as a leftist group. Yet, the Islamic leanings of the group and their rejection of far-left ideologies such as Marxism pull their position towards the center.

The model then estimates the position of the United Somali Congress/Somali Salvation Alliance (USC/SSA) in 2001 at the center of the left-right dimension with a point estimate of 0.03. The USC/SSA formed as a splinter group of the USC in 1993 and by 2001 the group had suffered a series of leadership changes. Placing the ideological position of the USC/SSA and other USC splinter groups is challenging. Broadly, the USC and its splinter groups aimed at ending the dictatorship of Siad Barre. They achieved this goal in 1991 by establishing a decentralized democracy. The stated aims of the USC/SSA are neither leftist nor right-wing, nor is this dimension a relevant issue in the conflict as clan identity seemed to be the main driving factor behind the complex network of armed groups in Somalia at the time.

Moving to the right on this dimension, the model places the West Nile Bank Front (WNBF) in 1996 at a point estimate of 0.31. The WNBF was founded around 1996 by former Ugandan Army officers from Idi Amin's regime. The group's leader Juma Oris, for example, was a colonel in the army and Amin's Minister of Foreign Affairs. The stated aim of the group was to topple Yoweri Museveni as President of Uganda, and some argued to re-establish the Amin regime.[26] The group's origin in the military class of the Nationalist Amin regime, while having no explicit traditionalist or conservative goals, is compatible with

[26]This claim holds some truth as in 1999, Taban Amin, a son of Idi Amin, became the leader of the movement.

the value of the left-right dimension estimated by the model.

The last group in the first dimension with a point estimate of 0.97 is Jabha-yi Nijat-i Milli-yi Afghanistan (NIFA) in 1986.[27] The group was founded in the 1970s and was supported by conservative and religious constituents to establish a parliamentary regime within a traditional Islamic state. This support base included many members of Sufi religious orders from South Afghanistan and aristocratic families from the old royal regime. However, the group distanced itself from fundamentalist Islamic groups, especially those with Wahabist groups. Placing it at the right end of the left-right dimension is consistent with its traditionalist and aristocratic base. While the group is often considered moderate due to its anti-Wahabist religious beliefs, this moderation is better captured in the identity dimension.

Next, I turn to the center-seeking independence dimension shown in the second plot in Figure 33. In the negative end of the dimension, the plot shows MEK as an example with a point estimate of -0.9. The MEK's goals to end the Iranian monarchical regime and later the Islamic Republic place it in the center-seeking end of the spectrum. Next in the dimension is the Islamic State (IS) in Iraq in 2008, with a value of -0.09. IS's territorial demands were broad and not aimed at capturing the Iraqi state but rather to establish a Caliphate across the Islamic world. While the full extent of these goals was not fully clear in 2008, it seems that this Islamic extremism has always been a core feature of the group. Thus, by placing the group in the center-seeking direction of the dimension but very close to the center, the model signals that this dimension was not a central goal of the group. This placement makes sense in the context of the group's territorial demands. IS did not seek to capture a state or to gain independence from one. Their goals were to create a new supernational actor across a large region.

Moving to the independence side of the dimension, the model then estimates the Lebanese Forces group in 1989 at a point estimate of 0.28. The Lebanese Forces was created in August 1976 by merging several Christian militias that had been expanding and cooperating for some time in Lebanon. By the early 1980s, it became the only representation of the Christian Maronite society in Lebanon. The group had no goals for independence from Lebanon. However, it did fight for greater rights and autonomy for the Lebanese Christian population.

[27]The abbreviation used matches the group's name in English, National Islamic Front of Afghanistan.

These goals push it toward the independence end of the dimension. However, there was no intent to gain independence or establish an autonomous territory, thus lowering the value. Next, the model estimates the Karen National United Party (KNUP) in 1972 to have a value of 0.97, placing it at the end of the independence spectrum. This placement is consistent with qualitative descriptions of the KNUP's goals. The KNUP was a communist group created by the Karen ethnic minority in Myanmar(Burma) in 1952. The principle goal stated by the group was to create an independent socialist Karen state. Thus with its primary goal of independence, the model's estimate of their position in the center seeking-independence dimension is accurate.

Last, I turn to the identity dimension in the bottom plot in Figure 33. For this dimension, I plot the difference in position between two groups in the same conflict year, as the position by themselves are difficult to interpret across cases. Further, the relevant aspect of the model for this dimension is that the model can distinguish between groups with significantly different identities. Therefore the validity of this dimension is more dependent on the model's ability to place different groups far away from each other and place those with more similar identities close to each other. The first shows the dyad between The Revolutionary Armed Forces of Colombia (FARC), which originated from peasant self-defense groups in 1966, and the National Liberation Army of Colombia (ELN), founded by university students in 1964. The model estimates the difference between these groups in this dimension to be 0.05. This difference is coherent with observations about the two groups and the conflict. The two groups recruited from Colombians, which compared to other countries have relatively homogeneous identities. Further, ethnic, religious, or other similar identities were not important components of either group's goals or played a role in the conflict more broadly. However, there were still some differences as the FARC originated mainly from peasants while the ELN had a more urban base.

The next dyad of groups with a slightly larger identity difference is the Eritrean People's Liberation Front (EPLF) and Eritrean Liberation Front (ELF) in 1978. The ELF was founded in 1960 by Eritrean exiles in Cairo to establish an independent Eritrea. In contrast, the EPLF splintered from the ELF in 1970 over a series of disputes.[28] The model estimates

[28]Both groups are briefly described in more detail in Section 2.2.2.

the difference between the identity position of both groups to be 0.35. This value demonstrates significant differences in the identities of both groups but also some similarities. This value is coherent with the goals of the two groups as they both explicitly claimed to represent an Eritrean identity defined by their colonial experience under Italian and Ethiopian rule. Both groups also rejected explicitly ethnic definitions of this identity. However, there were still significant differences between them. The EPLF splintered from the ELF in part over the ELF's more Pan-Arabic worldview as a majority of the membership of the ELF was recruited from paternalist Muslims and planned a closer integration with the Arabic world. In contrast, the EPLF formed around a core of Christian highlanders and rejected the Arabic leaning of the ELF. In short, both groups claimed to represent a multi-ethnic Eritrean. However, there were still significant differences between what that identity was.

To the right of the EPLF: ELF dyad, the plot shows the dyad of the African National Congress (ANC) and South West African People's Organisation (SWAPO) with a distance in their identity positions of 0.6. Both SWAPO and the ANC share many similarities including their leftist and African nationalist ideologies, which led to relatively warm relations between the two groups for much of their struggle against the South African Apartheid regime that also ruled Namibia at the time. However, there is little overlap in the identities of both groups. SWAPO originated in the 1960s and began its armed struggle in 1966 for the full independence of Namibia. The group's membership is primarily of the Ovambo ethnic group, which makes up about half of Namibia's population. In contrast, the ANC emerged in the 1920s to represent black South Africans. In the 1960s the group began its armed struggle against the Apartheid regime in response to growing repression by the South African government. The identities of the two groups differ first in their national identity, SWAPO represented Namibians, while the ANC represented South Africans. Given their divergent colonial histories, both regions had distinct national identities which had little to do with each other aside from a common Pan-African ideology common in African social movements at the time. Further, SWAPO was primarily dominated by one ethnic group while the ANC was more conscious of creating a black South African identity.[29]

In the far end of the spectrum is the Supreme Council of the Islamic Revolution in Iraq

[29]However, many of the founders and leaders of the ANC were of Xhosa origin.

(SCIRI) and the Kurdistan Democratic Party (KDP) dyad in 1982 with a difference of the identity point estimate of 1.2. This difference suggests that the identity of the two groups is not only different but also a relevant component of both groups' goals. The KDP was formed in Iraq in 1946 to represent the interest of the Kurdish population living in the country. Its membership was primarily composed of members of the Kurdish Barzani tribe. In contrast, the SCIRI was founded in 1982 by exiled Shia clerics and other anti-Baathist religious groups with the explicit aim to establish a theocratic Iranian-style regime in Iraq. The large identity difference between these groups makes sense given the different backgrounds of the groups. The KDP is explicitly a Kurdish organization aimed at representing ethnic Kurds, and the group is secular in its religious approach, but because its membership primarily comes from the Barzani tribe, the group consists mostly of Sunni Muslims, with Yazidi and Christian minorities. This identity clashes with the overtly religious and Shia SCIRI, who are also mostly ethnic Iraqi-Arabs whose vision for the region of Iraqi-Kurdistan is not noticeably different from those of the Baathist regime.

The purpose of this analysis is not to demonstrate that the model perfectly predicts the position of each group in the three relevant dimensions. Rather, I aim to show that the point estimates provided by the model are consistent with expectations about the goals of the different groups in the data. Overall, the examples provided here demonstrate that the model for the most part can distinguish between different group goals and correctly place them in relation to each other according to the mapping described in Sections 5.2 and 5.4. By demonstrating this consistency, I show that the dimensions and the associated values are valid measures of group goals. I also show that these values can be interpreted in context with each other. This interpretability facilitates any improvements to the model and opens up the possibility of different uses of the results.

5.5 SUMMARY

In this chapter, I created a measure of the difference in the goals of rebel groups using a Bayesian multidimensional ideal point model. This measure is theoretically grounded in

the theory and Agent-Based model I outlined throughout this project. More specifically, it posits the differences between these groups as the distance in the preferences across a multidimensional space. The model builds on a large body of work I outlined in this chapter that uses ideal point models to estimate positions across multiple dimensions and demonstrates a further application of the approach. To fit the model, I compiled data related to the preferences, identities, and aims of rebel groups from multiple data sets that serve as items in the ideal point modeling framework.

The model's results show the role that differences in group goals play in explaining alliances between rebel groups. In summary, the goal distance measure has a large and statistically significant effect that matches the expectation about the effects of goals in alliance decisions developed in previous chapters. Further, in the chapter I have demonstrated that this added consideration of goal distance as I have modeled it significantly increases the out-of-sample predictive capacity of logistic models of rebel group alliances, even compared to other commonly used binary measures of shared ideologies, and that these effects are consistent even in informal alliances. Lastly, I demonstrate the validity of the estimates of the goal of different rebel groups, which further increases the validity of the results.

Besides the benefits of predicting alliances, the ideal point modeling framework I outline in the chapter can analyze other interactions between rebel groups such as rivalries, and predictions of violence between groups. Further, this framework has several routes for potential improvement in both the data and modeling components. With more complete and specific data on group characteristics, preferences, and identities the framework can explore the addition of new dimensions, for example, the rural versus urban divides common in different conflicts such as the Ethiopian Civil War. Further, additional and purpose-built data will likely produce better ideal point estimates and thus provide better predictive capacity. In addition, changes to model specification such as a more explicit accounting of how different groups weigh different dimensions, can also be explored to improve the model.

6.0 CONCLUSION

In this project, I aim to understand when rebel groups ally in civil wars. Given its benefits, rebel groups have strong incentives to cooperate. Why, then, do some rebel groups fail to unite against a common competitor? To answer this question, I start with the observation that civil wars are complex systems. In complex systems, the behaviors of actors are difficult to understand by focusing only on their characteristics. Rather, to better understand these behaviors, it is necessary to account for the system as a whole. In this context, civil wars consist of individuals who cooperate to form groups who then cooperate to form alliances. Thus, both group-level and individual-level actors produce behaviors only usefully explained in the context of both levels.

I then argue that rebel group goals play a pivotal role in shaping the cooperation decisions of rebel groups. These goals emerge from the dynamics of group formation which aggregate the macro-level distribution of individual preferences into group-level goals. At the same time, these goals serve as excludable, jointly-produced goods that increase the benefits for some individuals of joining the group while pushing others away. Because of this feature, goals are essential to maintain group cohesion, and any behavior that encourages deviation from these goals runs the risk of creating discontent among group members. This discontent may lead to desertion of the group and even its disintegration. Different forms of cooperation, such as alliance formation, entail changes in at least the perception of group goals to enable coordination between partners. Thus, groups must account for changes in their goals when making alliance decisions. Specifically, I argue that we should expect groups to avoid cooperating with groups with dissimilar goals.

6.1 MODELING FRAMEWORK OF COOPERATION

In Chapter 2, I recount the formation of the TPLF and other groups during the Ethiopian Civil War 1974-1991. This case study highlights how individual preferences, based on the macro-level social structure of pre-conflict Ethiopia, influenced the goals of groups that emerged from the conflict and how these goals shaped the cooperation decisions of groups in the conflict. This case also highlights how the existence of multiple groups with sufficiently similar goals presents a second puzzle about rebel group alliances. Why do different groups that share similar goals exist in civil wars? Why do individuals sometimes fail to form one united front against a common threat? Existing works such as Gade et al. (2019) and Blair et al. (2022) consider the role of ideological similarities in explaining rebel cooperation. However, they take the existence of multiple groups as exogenous. This assumption is problematic considering the complex interactions between individuals and groups that influence cooperative behavior during conflict.

To address this puzzle, Chapter 3 focuses on the role of goals and individual preferences in the process of group formation. I argue that individuals have preferences across relevant policy dimensions in a given society. Preferences are composed of positions, indicating preferred policies, and weights, indicating the importance of each dimension to the individual. In civil wars, aggrieved individuals join groups to move the status quo toward their preferences. Thus, the goals of the groups—or, the stated set of policy positions that rebel groups would implement (or maintain) after a conflict if they had no constraints—serve as excludable, jointly-produced goods. In part, these goals shape the payoff of being a member of a given group.

Based on these observations, I constructed an agent-based modeling (ABM) framework. Using this framework, I demonstrated that models based only on group strength are only capable of creating two-sided conflicts. However, accounting for individual preferences is sufficient to generate multi-party conflicts. The model can further create groups with similar goals, thus explaining one of the dissertation's central puzzles. Specifically, the model reveals that groups can form around similar clusters of individual preferences when they are sufficiently powerless, such that they cannot recruit individuals with even small differences

in preferences.

In Chapter 4, I integrate group alliance decisions into the framework of group formation discussed in Chapter 3 and demonstrate the interdependence between group formation and alliance behaviors. I argue that alliances mirror individual-level cooperation at the group level by conceptualizing alliances as an agreement between two groups that define the goals that would be implemented if the two groups win the conflict.[1] I then implement this intuition into the agent-based model and systematically analyze the implications of this framework concerning alliance decisions. The analysis shows that it is essential to account for goals in order to generate data consistent with actual data on the number of armed groups across conflicts. I then analyze the data generated from this modeling framework to show similarities between the ABM and existing models predicting rebel group alliances. Overall, the analysis in this chapter shows that the mechanisms connecting individual preferences to group formation and alliances are consistent with real-world patterns and are therefore a coherent explanation for cooperative behavior in civil wars.

The ABM framework developed in Chapters 3 and 4 provides a useful tool for analyzing cooperative dynamics in civil wars and a starting point for modeling other conflict processes. These two chapters further outline a series of assumptions about the model made for theoretical reasons, simplicity, and computational efficiency. One strength of agent-based modeling approaches is the formalization of all modeling choices, which provides a transparent and precise way to engage with the model. A complete rehashing of these assumptions is unwarranted here. There is an almost infinite number of changes, additions, and parameter tuning options that the framework is capable of accommodating. For instance, the model could additionally account for fighting behavior between group agents and provide a physical and/or network space for agent interactions. Another fruitful path of study would look at agent behavior in terms of group goal aggregation and the role of leaders. These additions could further explore how groups behave through agent contest experiments similar to those presented in Laver and Sergenti (2011).

In the next three subsections, I discuss in more detail three specific assumptions that

[1]This conceptualization aligns with the definition of alliances in the context of civil wars (Leeds, 2003; Keohane, 2005; Balcells, Chen and Pischedda, 2022; Blair et al., 2022).

reveal both the scope conditions of the model and some opportunities for further applications and refinements of the model. These applications could generate insight into cooperation in conflict in the form of alliances and group formation. They could also provide information about other conflict dynamics, such as civil war onset and termination. The first assumption that I discuss relates to the role of positions and weights in defining goals and preferences. The second assumption touches on the conceptualization of governments in the model. Last, I discuss the role of group leader in the model

6.1.1 Goals and Radicalism

Research related to group ideology often focuses on the radical, or non-radical nature of their goal.[2] No conventional definition of radicalism exists, but one standard definition denotes it as an attitude based on the presence of non-moderate ideologies. However, others have defined it as readiness to engage in radical behavior (Della Porta, 2018). The modeling framework I have presented takes a middle ground where extremism depends on both attitudes and how much those attitudes influence behavior. In the model, two attributes define the goals and preferences of individuals :the ideal position and dimensional weights. The set of the product of these two attributes creates individual preferences and group-level goals.

The model thus defines radicalism as the product of position and weights with values distant from zero. In this approach, radicalism is a dimensional quality with two partially interconnected ways to achieve it based on attitudes. A preference is at its most extreme (or radical) when (1) the position is at the furthest possible value from 0 in a given dimension and (2) the weight—which represents the importance of the position in influencing behavior—is at the highest possible level. This definition implies that, for any level of radicalism that is not the highest possible level, there are infinite ways to reach it based on the values of the positions and weights. For example, to achieve a preference with a value of 0.25, an actor can have a position of 0.25 and a weight of 1, 0.5 and 0.5, 0.3334 and 0.75, and so forth. As such, the model provides a clear and useful definition of radicalism and extremism.

Nevertheless, the model does not focus on some of the processes that are theoretically

[2]See e.g., Chenoweth (2010); Bosi and Porta (2012); Vogt, Gleditsch and Cederman (2021).

valuable to the radicalism literature. At the individual level, radical preferences are parameters in the model through the creation of the prototypes, which create the preference clusters for a given society. Therefore, there is no process of individual-level radicalization. Researchers have argued that radicalization emerges from complex and contingent interactions between individuals and organized actors (Bosi and Porta, 2012; Alimi, Bosi and Demetriou, 2015). These interactions can create opportunities for radicalism, for example, through violent repression by the state, which may encourage radical attitudes and excuse radical behavior (Tilly, 1985; McAdam, Tarrow and Tilly, 2003; Tarrow, 2011). Further organizations such as social networks, rebel groups, and governments can radicalize individuals through framing goals and grievances (Tilly, 1985; Weinstein, 2005; Cederman, Weidmann and Gleditsch, 2011). This research thus reveals some of the limitations of the assumptions made by the model. The model takes individual preferences as exogenous, implying no radicalization process at the individual level. However, the model framework can easily accommodate individual-level preference changes through the interactions of agents in the model in a manner coherent with individual-level radicalization.

The radicalism literature also offers some useful extensions for the model at the group level. At this level, researchers have focused on outbidding between groups as a driver for extremism (Kydd and Walter, 2006; Chenoweth, 2010; Conrad and Greene, 2015; Vogt, Gleditsch and Cederman, 2021). Outbidding happens when multiple violent actors compete for support and increase their radicalism in attitude and behavior to differentiate themselves from other groups. However, groups do not use outbidding as a strategy in the current formulation of the model. Rather, group goals emerge directly from the preferences of group members. As such, group goals change only through recruitment of new members, not as a result of planned changes by the leader or members of the group. In other words, any movement to extreme positions is an emergent property of the model and not a strategy of the actors. The outbidding literature often relies on a signaling mechanism where more radical demands make groups appear more committed to bargaining with the state to connect a benefit to extremism (Vogt, Gleditsch and Cederman, 2021). This mechanism would suggest a value of extreme goals, possibly through weights, such that there is a benefit to extreme goals regardless of individual preferences. While outside the scope of this project, such an

extension could provide useful insight into the role of goals in group formation and alliances. It might allow researchers to specify clearer mechanisms and design better-fitting predictive models for cooperation and group formation in civil wars.

6.1.2 The Government

The model begins with no existing groups. In the ABM, groups emerge from the interaction of individual agents. This process is a simplification as most conflicts begin with existing actors such as the government, militias, and possibly political and social movements that take up arms and develop into rebel organizations. However, given the gains in computational efficiency and analytical simplicity, this is a useful simplifying assumption. Further, the analysis conducted in Chapters 3 and 4 commits to initial iterations of the model or focus on end outcomes, creating a type of "warm-up" period in the model where groups develop, but this development is not analyzed. Nevertheless, a consequence of this assumption is that state actors are treated the same as non-state rebel actors. Given the focus of this project on rebel group behavior and the theoretical expectation that the state acts under a similar set of incentives during civil wars, this simplification is warranted.

However, a more detailed and coherent implementation of the state as an actor could produce insights into the role of goals and power dynamics in actor behavior during civil wars. At the most basic level, the most noticeable difference between states and non-state actors in most civil conflicts, at least at the onset, is their ability to project power within the territory. This observation provides a starting point to understand the role of the state in the complex system of interactions created by the ABM by initiating the model with a powerful actor, which includes up to the whole population of individual agents. How might agent behavior change under this implementation? What patterns of group formation would be more likely to emerge? Would such an implementation of the framework create outcomes closer to observable patterns of group formation?

The primary advantage of unpacking the government in this framework would be to broaden the applicability of the ABM I have presented. One of the primary aims of the

civil war literature has been to understand and explain conflict onset[3] and termination.[4] As demonstrated by the results in Chapters 3 and 4, under some parameter specifications, the ABM never produces conflict, while other specifications lead to conflict only with some probability.[5] It is possible to exploit this feature to analyze how different sets of parameters affect the probability of conflict onset. For example, the model can analyze the impact of different societal structures, like the opportunity costs of individuals joining a group and the distribution of preferences on conflict onset. However, for such an analysis to have any validity, it is first necessary to unpack the role of the government in the model.

It is also possible to explore conflict termination through the same framework. Signing a peace agreement with the state can be interpreted as a form of cooperation. In essence, the state and the rebel group(s) agree to cooperate in not fighting to implement some agreed-upon set of goals, which end the fighting, in a similar way to how cooperation is defined in Chapter 4. Thus, the ABM results concerning the mechanisms linking group-level cooperation with goal differences might imply a similar dynamic about the role of goals in conflict termination. This has some validity given existing works such as that of (Keels and Wiegand, 2020), which implies that the ideological positions of governments and rebel groups complicate peace negotiations. If rebel groups have ideological positions that have higher levels of contrast with those of the government, it generates more indivisible disputes which prevent conflict termination. While the model results are suggestive of these dynamics, further refinement of the model, especially regarding the role of the government, is necessary as the assumption about equal incentives for rebel groups and states is less defensible for this application.

6.1.3 Rebel Leaders

The scholarship analyzing the role of rebel leaders in group behavior and conflict processes has flourished in recent years (see, e.g., Tamm (2016); Cunningham and Sawyer (2019);

[3]See, e.g., Fearon and Laitin (2003); Collier and Hoeffler (2004); Chadefaux (2014); Hegre et al. (2019).

[4]See, e.g., Fearon (2004); Regan and Aydin (2006); Cunningham (2006); Keels and Wiegand (2020); Joshi (2023).

[5]In the model, conflict occurs when there are two or more groups, in which one group is assumed to be the government.

Doctor (2020); Thaler (2022)). These studies demonstrate the crucial role that a rebel leader or a small core of leaders play in shaping rebel movements. Further,they highlight the variation in rebel group leadership structure and leadership behavior. However, the ABM presented in this work simplifies much of this variation and assumes specific behaviors for leaders. Given the model's complexity, I simplified the role of leaders for parsimony. Yet, this does not mean that leaders do not play an important role in group behavior. In the ABM, leaders provide a critical role by making final decisions to increase membership, build alliances, and merge with other groups. In other words, it is the group leader's preferences, when compared to the group's goal and possible goal change caused by different behaviors, that serves as a base for major group-level events.

The framework presented in this dissertation also lays the foundation for the exploration of different assumptions about group organization, leader selection, and the ways in which leaders influence group behavior. One particular simplification in the ABM related to leaders and group structure pertains to the process of group goal formation. I assume that leaders and members have an equal say in the group's goal. However, this assumption can be relaxed by weighting the averages such that $n \in L_{gt}$ has more weight in deciding the value of the elements in P_{gt} and W_{gt}. One way to accomplish this is by adding a group-level parameter that establishes the weight for the leader, or a group of leaders, and average members.

The framework can easily incorporate other additions to the process of leader selection. For example, in the model, I assume that leaders are the first agent in the group. However, groups can be encoded to assign leaders through different behaviors and frequencies, for example, by a random selection, popularity conquests, or a skill-based selection.[6] There are also many possible avenues to study how leader behavior influences emergent patterns in the model. It is possible to create different types of leader behavior in recruiting, alliance strategies, and assimilation capacity.[7]

The suggested additions to the model would explore how different assumptions about rebel group structures influence group-level behavior and macro-level emergent patterns. Equally of interest is the possibility of conducting competition model experiments by as-

[6] One possibility is by including a skill or capability parameter for individual-level agents.

[7] By giving rebel leaders the capacity to assimilate group members to have more similar preferences, the model would also relax assumptions about stable individual-level preferences.

signing different combinations of behaviors and structures to analyze which types of groups are more likely to survive. These competition-style models are particularly useful for exploring the plausibility of different assumptions. In short, while the ABM framework I have presented simplifies the role of leaders in the group, it provides fruitful avenues to analyze different sets of assumptions about rebel leaders in future research.

6.2 MEASURING GOALS

Chapter 5 applies insights from the ABM developed in Chapters 3 and 4 on the role of differences in rebel group goals to create a statistical model that analyzes the relationship between goal distance and the likelihood of cooperation. The model builds on a large body of work that uses ideal point models to estimate positions across multiple dimensions. More specifically, the model uses the Bayesian multidimensional ideal point model to estimate the goals of different groups in three policy dimensions: left-right, secessionist-center seeking, and identity. These dimensions are derived based on qualitative and statistical analyses of a series of data sets related to rebel group characteristics that were combined to provide the items for the model.

Next, the model calculates the average distance between the goals of two groups in three dimensions and uses this value in a logistic model. The Bayesian perspective of the logistic model allows for the joint estimation of the ideal point model and logistic model. This estimation considers uncertainty in both components by utilizing the full posterior distribution of parameter estimates. As a result, the estimated ideal points are improved by incorporating cooperation data, leading to a better model fit. Moreover, the logistic component of the model fully incorporates the uncertainty in position estimates by utilizing the coefficients for the cooperation model, which are informed by the complete posterior distribution of ideal points.

Nevertheless, there are potential avenues for enhancing the data and modeling aspects of the model. Acquiring more comprehensive and specific data on group characteristics, preferences, and identities tailored for the model can enable the integration of new dimensions

into the framework, thereby bolstering its predictive capabilities. This improved data can facilitate an analysis of which policy dimensions demonstrate strong predictive capacity across all cases or specific subsets of cases. Such analysis could provide researchers with a deeper understanding of the interplay between goals and conflict. Additionally, future endeavors could explore model specifications that explicitly account for the varying weights assigned to different dimensions by different groups or in different conflict scenarios.

Regardless, the model's findings demonstrate the significance of the distance in group goals in explaining rebel group alliances. Specifically, the goal distance measure exhibits a substantial and statistically significant effect, aligning with expectations developed in previous chapters. Moreover, the leave-one-out (Loo) analysis demonstrates that incorporating the goal distance measure significantly enhances the out-of-sample predictive capacity of logistic models for rebel group alliances, surpassing commonly used binary measures of shared ideologies. This out-of-sample performance suggests that the measure captures relevant features of the underlying relationship between dependent and independent variables.

6.3 SUMMARY

In summary, this dissertation provides an innovative approach to study rebel group goals, formation, and cooperation. By considering civil conflict as a complex system in which individuals and groups interact repeatedly, the dissertation generates novel insight into numerous aspects of conflict processes. The multi-method research integrates insights from an in-depth case study of the Ethiopian conflict, an original ABM, and Bayesian analysis to further researchers' understanding of civil wars. As a whole, the dissertation provides a cohesive framework for future studies on civil wars to expand.

APPENDIX

A.1 TWO-DIMENSIONAL GOAL REPRESENTATION

Some dimensions, such as ethnicity, authoritarianism, and religion are hard to capture in a one-dimensional space. For example, imagine two very religious individuals. If both individuals share the same religion then they would have similar preferences, however, if both have different religions then their equal level of religious devotion would make their preferences more distinct. To tackle this issue, an accompanying angle $\theta_d \in E_n | 0 \leq \theta_d \leq 180\}$ is given to each element in P_n when the researcher cannot model the preference in a one-dimensional Where E_n is a sequence of those values people agents and E_{gt} for group agents.[1] Further, the position is now constrained to $-0.5 < P_{n_d} < 0.5$. The positions that need this extra θ_d are always added to the end of the sequence P_n, and the starting location of these cases is given by the value $\hat{D}$. The angle represents the category of that dimension, in this example the religious denomination of the individual. Thus, for example, two religions with similar beliefs and practices, or with historical ties can be given similar angles demonstrating their similarities, while those with more divergent beliefs can be given more distant angles. The position P_n represents the magnitude of the preference, as in the one-dimensional cases. With both an angle and magnitude, a point can be calculated in a two-dimensional Euclidean space for each individual. With the two points, a distance can be calculated. Instead of using the formula $|W_n * P_n - W_{gt} * P_{gt}|$ to calculate the distance as in the one-dimensional case, it is calculated by:

[1] Sequences E are of size D, but elements 1 through D are empty and not involved in the calculations.

$$Distance(D, W_n, P_n, E_nP_g, W_{gt}, E_{gt}) =$$

$$\sum_{d=\hat{D}}^{D} \sqrt{((W_{n_d} * P_{n_d} * cosE_{n_d}) - (W_{gt_d} * P_{gt_d} * cosE_{g_d}))^2 + ((W_{n_d} * P_{n_d} * sinE_{n_d}) - (W_{gt_d} * P_{gt_d} * sinE_{n_d}))^2}$$

Thus the full function R is given by

$$R(N_{gt}, N, D, P_n, W_n, E_n, P_{gt}, W_{gt}, E_{gt}) =$$

$$B(N_{gt}, N) - \frac{(\sum_{d=1}^{\hat{D}-1} |P_{gt_d} * W_{gt_d} - P_{n_d} * W_{n_d}|) + Distance(D, W_n, P_n, E_nP_g, W_{gt}, E_{gt})}{D}$$

Given the constraint that P_n, which still holds for the two-dimensional cases, the maximum absolute distance between the two points is still 1. This distance increases as the angles became more different and as the magnitude increases.[2] Thus to continue with the religion example, imagine two individuals that are not very religious but come from very different religious backgrounds. In this case, they would receive a low magnitude and two different angles (for example 0 and 180). Because neither individual is religious, the difference between them in the religious dimension is very small. However, if they were to become more religious this distance would increase. If instead the two individuals are of the same group (same angle), and they both became equally more religious then the distance would not change. Like individual agents, groups also have two-dimensional positions. As with one-dimensional positions, these are the average of all individuals in a group. Each group gets an average calculated for all its members for the position and for the angle. These averages represent the group's goals, as depicted in the main text. In this way, the two-dimensional positions are still mapped onto one measure of preference difference which is a key parameter for the model. The addition of a two-dimensional preference does not impact model outcomes in any way. However, it allows researchers to more clearly define and represent the dimensions they wish to input into the model.

[2]The largest difference would be between 0 and 180.

A.2 CALIBRATING THE PARAMETERS OF THE RANDOM SOCIETIES

In this section, I plot the distribution of key actual world variables that are the basis for the parameters to create data using the ABM that approaches actual world data of rebel group cooperation in conflict. This data comes from UCDP conflicts between 1946-2010, which is the dates usually utilized for these types of analysis.[3] Looking at this data, there are 169 conflicts in this time range, which I round up to 170 for the purpose of generating data. Next, Figure 34 plots the density of the number of identity groups in each conflict. The distribution approaches a normal distribution with a mean of 4.5 and a standard deviation of 3.7, but with a fat right tail and truncated at 0. Thus, setting the number of O to be drawn from a normal truncated distribution with a mean of 5 and a standard deviation of 3 provides a similar distribution of this variable. Next, Figure 35 plots the density or the duration of each conflict in the UCDP data from 1946-2010. The density approaches a normal distribution truncated at 1 with a mean of 2.5 and a standard deviation of 12 with a significant right tail. To approximate this distribution I again use a normal distribution truncated at 1, but with a mean of 2 and a standard deviation of 3. The reduction of the standard deviation serves to prevent many conflicts with very large duration as they are relatively uncommon but also to preserve computing resources to run large numbers of iterations of the ABM.

[3]See Bapat and Bond (2012), Popovic (2018), Balcells, Chen and Pischedda (2022), and Blair et al. (2022).

Figure 34: Number of Identity Groups by Conflict 1946-2010

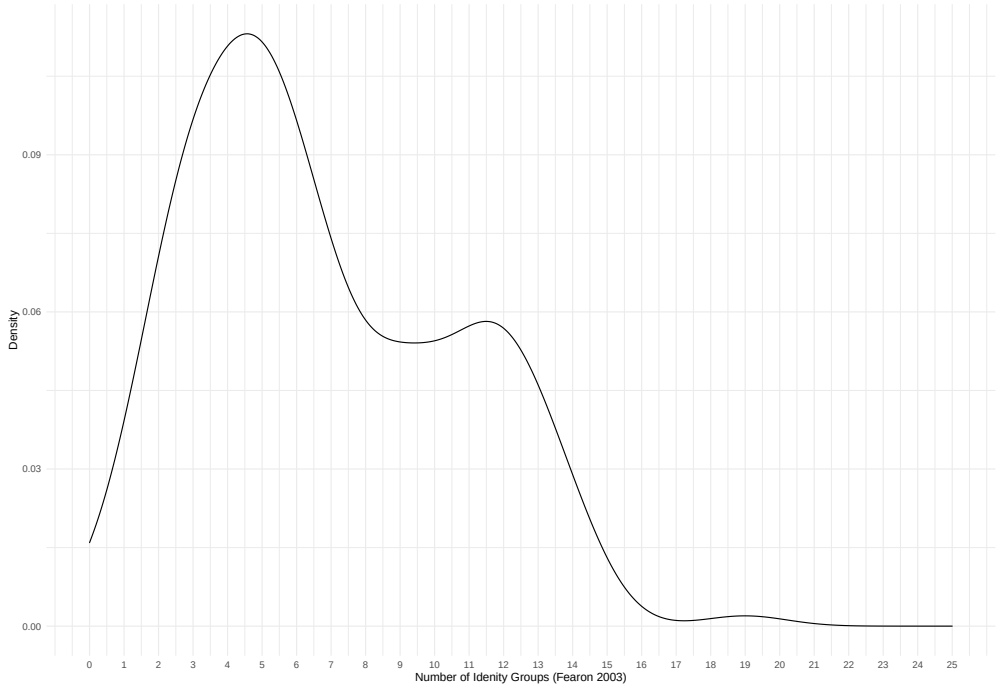
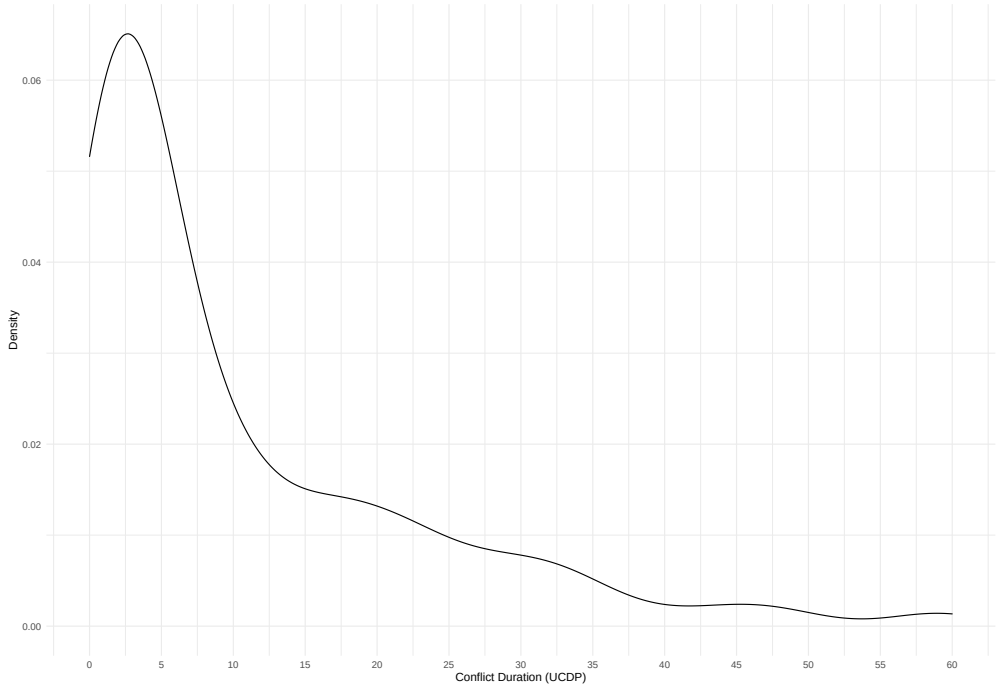


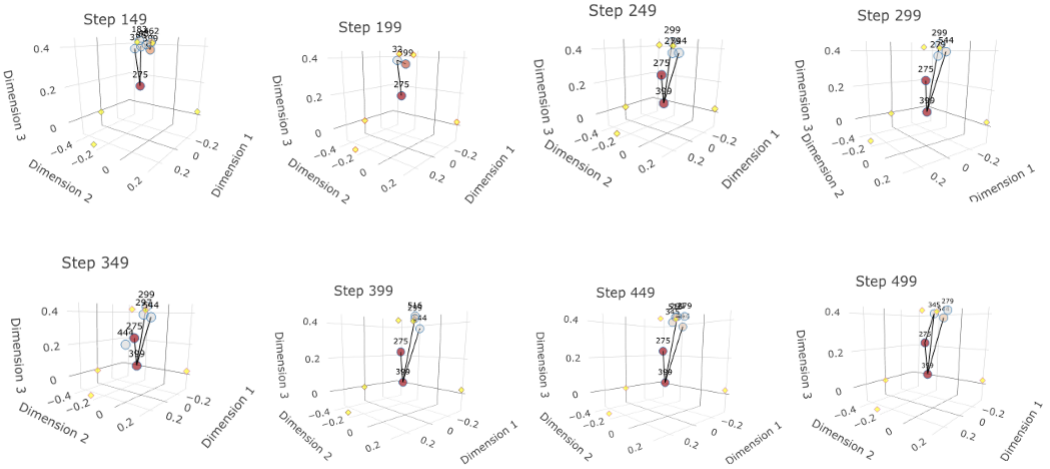
Figure 35: Density of Conflict Duration 1946-2010



A.3 FULL GENERALIZED LOGISTIC MODELS BOOTSTRAP RESULTS FOR CHAPTER 5.3

A.4 MORE VISUALIZATIONS OF EXAMPLE NETWORKS

Figure 36: Goals, Alliances Example 1



Notes: Each dot represents a group in the model run, while the number is the ID of the group. The light yellow diamond shapes are the average position of the prototypes in this model run. Darker reds for the dot indicate that the size of the group is larger, while the black lines indicate an alliance relationship.

Table 9: Full Models for Varying Goal Weights

W = 0			
	Estimate	2.5 %	97.5 %
Weak Link	−0.009	−4.283	5.998
Ratio	2.690	−110.130	80.889
Group Alliance Count	−1.432	−51.932	43.394
Other Alliance Count	5.775	−131.500	100.371
Society Fixed Effects	YES		

W = 0.1			
	Estimate	2.5 %	97.5 %
Goal Distance	9.888	−38.565	31.314
Weak Link	2.391	0.379	3.751
Ratio	3.001	0.844	5.379
Group Alliance Count	3.251	1.065	4.146
Other Alliance Count	2.644	−0.146	3.815
Society Fixed Effects	YES		

W = 0.2			
	Estimate	2.5 %	97.5 %
Goal Distance	−6.619	−8.335	−4.518
Weak Link	1.109	−1.245	2.713
Ratio	1.412	0.845	1.755
Group Alliance Count	0.377	0.090	0.773
Other Alliance Count	0.510	0.383	0.652
Society Fixed Effects	YES		

W = 0.3			
	Estimate	2.5 %	97.5 %
Goal Distance	−2.645	−3.333	−1.884
Weak Link	3.116	2.463	3.572
Ratio	1.893	1.641	2.070
Group Alliance Count	−0.526	−0.759	−0.262
Other Alliance Count	0.452	0.394	0.507
Society Fixed Effects	YES		

W = 0.4			
	Estimate	2.5 %	97.5 %
Goal Distance	−1.259	−1.460	−1.055
Weak Link	3.121	1.856	4.358
Ratio	1.310	1.145	1.459
Group Alliance Count	−1.310	−1.444	−1.171
Other Alliance Count	0.272	0.224	0.317
Society Fixed Effects	YES		

W = 0.5			
	Estimate	2.5 %	97.5 %
Goal Distance	−1.625	−1.774	−1.469
Weak Link	3.261	2.173	4.269
Ratio	1.338	1.193	1.461
Group Alliance Count	−1.295	−1.405	−1.182
Other Alliance Count	0.182	0.143	0.222
Society Fixed Effects	YES		

W = 0.6			
	Estimate	2.5 %	97.5 %
Goal Distance	−1.415	−1.502	−1.322
Weak Link	4.542	3.218	5.733
Ratio	1.070	0.987	1.146
Group Alliance Count	−1.549	−1.617	−1.473
Other Alliance Count	−0.349	−0.438	−0.256
Society Fixed Effects	YES		

W = 0.7			
	Estimate	2.5 %	97.5 %
Goal Distance	−1.176	−1.247	−1.099
Weak Link	4.758	3.382	6.050
Ratio	0.956	0.867	1.039
Group Alliance Count	−1.465	−1.534	−1.390
Other Alliance Count	−0.554	−0.635	−0.462
Society Fixed Effects	YES		

W = 0.8			
	Estimate	2.5 %	97.5 %
Distance	−1.010	−1.077	−0.941
Weak Link	4.501	3.778	5.153
Ratio	1.173	1.093	1.239
Group Alliance Count	−1.586	−1.655	−1.515
Other Alliance Count	−0.494	−0.579	−0.406
Society Fixed Effects	YES		

W = 0.9			
	Estimate	2.5 %	97.5 %
Distance	−0.944	−0.996	−0.888
Weak Link	5.118	3.880	6.195
Ratio	1.034	0.951	1.108
Group Alliance Count	−1.513	−1.579	−1.442
Other Alliance Count	−0.771	−0.850	−0.682
Society Fixed Effects	YES		

W = 1			
	Estimate	2.5 %	97.5 %
Distance	−0.839	−0.879	−0.796
Weak Link	5.520	4.653	6.309
Ratio	0.828	0.773	0.879
Group Alliance Count	−1.541	−1.595	−1.485
Other Alliance Count	−0.796	−0.856	−0.732
Society Fixed Effects	YES		

Table 10: No Goal Distance Models for Varying Goal Weights

W = 0			
	Estimate	2.5 %	97.5 %
Weak Link	−0.009	−4.283	5.998
Ratio	2.690	−110.130	80.889
Group Alliance Count	−1.432	−51.932	43.394
Other Alliance Count	5.775	−131.500	100.371
Society Fixed Effects	YES		

W = 0.1			
	Estimate	2.5 %	97.5 %
Weak Link	2.149	1.633	2.272
Ratio	2.898	1.138	4.707
Group Alliance Count	3.186	0.437	3.677
Other Alliance Count	2.543	0.431	3.335
Society Fixed Effects	YES		

W = 0.2			
	Estimate	2.5 %	97.5 %
Weak Link	1.049	−1.104	2.537
Ratio	1.460	0.904	1.807
Group Alliance Count	0.537	0.282	0.850
Other Alliance Count	0.563	0.427	0.695
Society Fixed Effects	YES		

W = 0.3			
	Estimate	2.5 %	97.5 %
Weak Link	3.155	2.505	3.610
Ratio	1.917	1.665	2.095
Group Alliance Count	−0.370	−0.599	−0.101
Other Alliance Count	0.474	0.411	0.530
Society Fixed Effects	YES		

W = 0.4			
	Estimate	2.5 %	97.5 %
Weak Link	3.056	1.846	4.248
Ratio	1.327	1.168	1.470
Group Alliance Count	−1.174	−1.296	−1.041
Other Alliance Count	0.296	0.250	0.340
Society Fixed Effects	YES		

W = 0.5			
	Estimate	2.5 %	97.5 %
Weak Link	3.251	2.171	4.277
Ratio	1.338	1.196	1.458
Group Alliance Count	−1.084	−1.185	−0.975
Other Alliance Count	0.212	0.174	0.250
Society Fixed Effects	YES		

W = 0.6			
	Estimate	2.5 %	97.5 %
Weak Link	4.438	3.096	5.658
Ratio	1.063	0.983	1.136
Group Alliance Count	−1.394	−1.462	−1.318
Other Alliance Count	−0.232	−0.314	−0.145
Society Fixed Effects	YES		

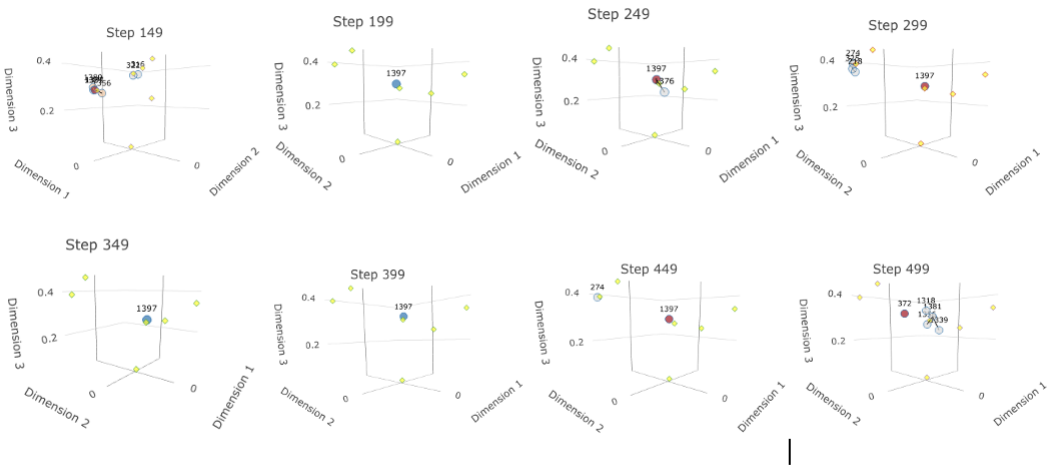
W = 0.7			
	Estimate	2.5 %	97.5 %
Weak Link	4.806	3.500	6.129
Ratio	0.947	0.866	1.027
Group Alliance Count	−1.322	−1.391	−1.251
Other Alliance Count	−0.454	−0.537	−0.365
Society Fixed Effects	YES		

W = 0.8			
	Estimate	2.5 %	97.5 %
Weak Link	4.414	3.726	5.062
Ratio	1.171	1.094	1.237
Group Alliance Count	−1.441	−1.515	−1.365
Other Alliance Count	−0.384	−0.465	−0.301
Society Fixed Effects	YES		

W = 0.9			
	Estimate	2.5 %	97.5 %
Weak Link	5.094	3.813	6.164
Ratio	1.006	0.925	1.080
Group Alliance Count	−1.368	−1.433	−1.300
Other Alliance Count	−0.658	−0.740	−0.577
Society Fixed Effects	YES		

W = 1			
	Estimate	2.5 %	97.5 %
Weak Link	5.518	4.708	6.265
Ratio	0.788	0.735	0.838
Group Alliance Count	−1.401	−1.452	−1.346
Other Alliance Count	−0.689	−0.746	−0.631
Society Fixed Effects	YES		

Figure 37: Goals, Alliances Example 2



Notes: Each dot represents a group in the model run, while the number is the ID of the group. The light yellow diamond shapes are the average position of the prototypes in this model run. Darker reds for the dot indicate that the size of the group is larger, while the black lines indicate an alliance relationship. Blue dots indicate large groups when there is no other group.

A.5 DATA DESCRIPTION

Table 11: Item Information

Item Name	Source	Question Description
Ideology	Forge	was the rebel group founded with a specific political ideology?
Ideolcom	Forge	did the group proclaim an explicitly Communist ideology (Maoist, Marxist, Marxist-Leninist, or other)?
Ideolleft	Forge	did proclaim some left-leaning political ideology not specifically Communist?
Ideolright	Forge	did the group proclaim a right-leaning political ideology?
Ideolnat	Forge	did the group proclaim a nationalist ideology?
Ideolanti	Forge	did the group proclaim an anti-system political ideology?
Ideolrel	Forge	did the group proclaim a religiously-oriented political ideology?
Ideoloth	Forge	did the group proclaim a political ideology not listed above?
Religious	Forge	was the rebel group explicitly founded around a religious identity?
Ethnic	Forge	was the rebel group explicitly founded around an ethnic identity?
Goalrights	Forge	was the group's initial goal the pursuit of increased/improved group rights (e.g. language, education)?
Goalrep	Forge	was the group's initial goal the pursuit of increased/improved political representation and/or participation?
Goaldem	Forge	was the group's initial goal to democratize the political system?
Goalindep	Forge	was the group's initial goal the pursuit of an independent state?
Goalauto	Forge	was the group's initial goal the pursuit of (increased) autonomy for their region within the existing state?
Goalchange	Forge	was the group's initial goal to remove the current leader(s) of government? (not democratization)
Anticommunist	Forge	Forge's ideolnotes variable includes anti-communism description
NAGID_1	NAG	Identity of group is not coded in NAG
NAGID_2	NAG	Identity of group is Ethno-nationalist
NAGID_3	NAG	Identity of group is religious
NAGID_4	NAG	Identity of group is leftist
NAGID_5	NAG	Identity of group is other
Left	NAG	Group is a leftist revolutionary group

Item Name	Source	Question Description
Right	NAG	Group is a right-wing group (fascist or conservative or other)
Dem	NAG	Group has democratic aspirations
Theo	NAG	Group aspires to establish a theocratic regime
NAGObj_1	NAG	Objective of group is to topple an existing leadership
NAGObj_2	NAG	Objective of group is to change of regime type (transition from autocracy to democracy or the reverse regime change)
NAGObj_3	NAG	Objective of group is to gain autonomy
NAGObj_4	NAG	Objective of group has secession/ territorial demands
NAGObj_5	NAG	Objective of group has demands for policy change
NAGObj_6	NAG	Objective of group is other
AuthRight	NAG	Group aspires to establish an authoritarian regime, supports a dictatorial or military regime (Combines NAGAuth, NAGDic and NAGMil variables)
LocalGov	QSI	Rebel group sets up a governing administration body at the local level without a national level government. This is only coded if the local/village government is not part of a larger national government created by the rebels.
NationalGov	QSI	Rebel group sets up a national level government with control over at least a portion of their civilian population.
Elections	QSI	This variable captures when rebels hold elections for civilian government positions. These elections can be local, for village-level governing positions, or national, like elections for a President or Prime Minister. The elections must be forcivilian governing positions and allow at least some non-rebel civilians to vote. It does not include elections for civilian representation within the rebel group, or elections exclusively for rebel members for rebel leadership positions.
Justice	QSI	This variable captures rebel justice systems, which includes courts, prisons, and enforcement of judicial decisions. It must be a civilian service
ConstituencyPolitics	QSI	This variable captures when rebels hear civilian complaints or issues with the current government administration and lobby on behalf of the civilians to the state bureaucracy
IllegalNet	QSI	This variable captures when rebels engage in illicit trade, smuggling or black market sales. Common examples include drug trafficking; however, this variable does not require that the item being traded or sold be contraband (illegal or illicit).
Embassy	QSI	This variable captures when rebels send representatives abroad to engage with foreign government officials or politicians. It can include embassies and consulates; however, offices opened to engage solely with diaspora members are not counted.
JoinIO	QSI	This variable captures the years when a rebel group is a member of an international organization. An

Item Name	Source	Question Description
		international organization can be comprised of other entities that are not formally recognized as independent states.
Pol_Other	QSI	This variable captures the years when the rebels had any political institutions that are not captured by the other institution variables.
Soc_Other	QSI	This variable captures the years when the rebels had any social institutions that are not captured by the other institution variables.
Econ_Other	QSI	This variable captures the years when the rebels had any economic institutions that are not captured by the other institution variables.
Services	QSI	The group is coded as providing either education, infrastructure, transportation, health care, or housing according to the QSI data.
Polwing	AGD	armed group has an organized and organizationally distinct political wing in addition to the group's principal armed wing.
Left	AGD	the group ascribes to a left-wing ideological goal.
Center	AGD	the group ascribes to a centrist or moderate ideological goal.
Right	AGD	the group ascribes to a right-wing ideological goal.
Religious	AGD	the group ascribes to a religious ideological goal.
Islam	AGD	the group ascribes to an Islamic ideological goal.
Ethnonational	AGD	the group ascribes to an ethno-nationalist ideological goal.
Center_Seeking	AGD	the armed group's initial political motivation to start using violence against the state was Center-Seeking (Based on aim1 variable)
Autonomy_Seeking	AGD	the armed group's initial political motivation to start using violence against the state was Territory/Autonomy-Seeking.(Based on aim1 variable)
Mixed_Ambiguous_1	AGD	the armed group's initial political motivation to start using violence against the state was Mixed/Ambiguous. (Based on aim1 variable)
Regime	AGD	the armed group's initial political motivation to start using violent against the state was regime change (Based on aim1 variable)
Territory	AGD	the armed group's initial political motivation to start using violent against the state was territorial demands(Based on aim1 variable)
Mixed_Ambiguous_2	AGD	the armed group's initial political motivation to start using violent against the state was MixedAm/Abiguous(Based on aim1 variable)
Christian	AGD	the armed group's idological philosophy is described as Christian (based on ideodescrip variable)
Islamic Other	AGD	the armed group's idological philosophy is described as Islamic (not Sunni or Shia) (based on ideodescrip variable)
Islamic Sunni	AGD	the armed group's idological philosophy is described as Islamic Sunni (based on ideodescrip variable)
Islamic Shia	AGD	the armed group's idological philosophy is described as Islamic Shia (based on ideodescrip variable)

Item Name	Source	Question Description
Leftist Democratic	AGD	the armed group's idological philosophy is described as lefitis democratic (based on ideodescrip variable)
Leftist Maoist	AGD	the armed group's idological philosophy is described as Maoist (based on ideodescrip variable)
Leftist Marxist	AGD	the armed group's idological philosophy is described as Marxist (based on ideodescrip variable)
Leftist	AGD	the armed group's idological philosophy is described as Leftist (based on ideodescrip variable)
Leftist Socialist	AGD	the armed group's idological philosophyis described as leftist-socialist (based on ideodescrip variable)
Sikh	AGD	the armed group's idological philosophy is described as Sikh (based on ideodescrip variable)
Ex Militant/Military	AGD	the background of the group's founding or initial set of members is described as ex-military (military or police) or from militant groups(militias, rebels ect)
Foreign Fighters	AGD	background of the group's founding or initial set of members is described as foreign fighters
Labor	AGD	background of the group's founding or initial set of members is described as laborers, blue collar workers, peasants, or farmworkers, etc.
Other	AGD	background of the group's founding or initial set of members is described as Criminals, Prisoners, Mafias, Families, Unusual Social Organizations (e.g. Mental, Hospitals), Other, Etc.
Political Party Org	AGD	background of the group's founding or initial set of members is described as Political, Movements Political Organizations, Political Parties, Etc.
Refugee Exiles	AGD	background of the group's founding or initial set of members is described as Refugees, Migrants, Political Exiles, Etc.
Relig Community	AGD	background of the group's founding or initial set of members is described as Religious communities, religious organizations, clerics, church members, mosque members, synagogue members, etc.
Student	AGD	background of the group's founding or initial set of members is described as Undefined youth, youth groups, university students, high school students, madrassa students, etc.
Unknown	AGD	The group's membership background is unknown
Abkhazians	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Acholi	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Afar	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Arab	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Arakan	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Aringa	Forge	was the group coded as this ethnicity in the

Item Name	Source	Question Description
		ethnicity variable in Forge
Armenian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Assamese	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Baganda	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Bakongo	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Baloch	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Baluchi	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Bangala	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Bangsamoro	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Banyankole	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Bodo	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Croatian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Estonian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Habr-Gedir	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Hadjaraï	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Hawiye	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Hazara	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Hutu	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Irianese	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Issaq	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Iteso	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Kachin	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Karen	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Karenni	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Kurdish	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Lahu	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Latvian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge

Item Name	Source	Question Description
Lithuanian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Luba	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Majeerteen	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Meitei	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Minahasa	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Mizo	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Mon	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Naga	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Niboleks	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Ogaden	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Oromian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Ovimbundu	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Pa-O	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Palestinian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Pashtun	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Rakhine	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Rohingya	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Serbian	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Shan	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Sinhalese	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Somali	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Tamil	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Tcheks	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Tigray	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Tripuri	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Tutsi	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Ukranian	Forge	was the group coded as this ethnicity in the

Item Name	Source	Question Description
		ethnicity variable in Forge
Zaghawa	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Fur	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Masaleet	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Kobe	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Lunda	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Bayeke	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Touraeg	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Sahelian Arabs	Forge	was the group coded as this ethnicity the ethnicity variable in Forge
Banyamulenge	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Amhara	Forge	was the group coded as this ethnicity in the ethnicity variable in Forge
Buddhist	Forge	was the group coded as this religion in the religion variable in Forge
Catholic	Forge	was the group coded as this religion in the religion variable in Forge
Christian	Forge	was the group coded as this religion in the religion variable in Forge
Christian Orthodox	Forge	was the group coded as this religion in the religion variable in Forge
Muslim	Forge	was the group coded as this religion in the religion variable in Forge
No Religion	Forge	was the group coded as this religion in the religion variable in Forge
Shia	Forge	was the group coded as this religion in the religion variable in Forge
Sunni	Forge	was the group coded as this religion in the religion variable in Forge
End of Table		

In the table below, I plot the percentage of missing data for a series of variables used in this analysis. The table, does however include more variables than are used in the main analysis presented. These variables are mostly different measures of rebel group strengths such as the lower and upper estimates, the parity dummy and the mobilization capacity dummies. These variables are included when creating the multiple imputation in the hope of increasing the quality of the imputed data by providing more information to the imputation models. This is necessary given the high percentage of missing data for the rebel group size estimates. The variables used to create the Weak Link and Ratio variables were RBL_A_rebestimate and RBL_B_rebestimate.

Table 12: Percentage of Missing Data

RBL_A_rebestimate 16.256	RBL_A_rebstrength2 9.315	RBL_B_rebestimate 30.094	RBL_B_rebstrength2 13.480	RBL_B_rebestlow 30.094
RBL_A_rebestlow 16.256	RBL_B_rebesthigh 30.094	RBL_A_rebesthigh 16.256	FormalAlliance 0	InformalAlliance 0
state_cosponsor_dummy 26.332	state_cosponsor_count 26.332	rugg_prop 0	splinter 0.448	splinter_indirect2 0.448
intensity_level 10.837	rebels_count 0	milper 0	gdppc_log 0	pop_log 0
post_cold 0	RBL_forge_coethnicity 0	RBL_forge_coreligion 0	strenparity_dummy 16.928	RBL_A_mobcap 9.449
RBL_B_mobcap 15.137	co_ideology 0	co_constituent 0		

A.6 CONSTRAINTS ON ALPHA AND THETA PARAMETERS FOR ANALYSIS OF REAL DATA

$$\mathbf{\Theta_{g(i)_{t=1}d}} \sim N(0,1)$$

$$\mathbf{\Theta_{g(i)_{t}d}} \sim N(\mathbf{\Theta_{g(i)_{t-1}d}}, 0.25)$$

$\mathbf{\Theta_{j(i)=Taliban,d=1}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=Taliban,d=2}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=Taliban,d=3}} \sim N(-1, 0.01)$
$\mathbf{\Theta_{j(i)=TPLF,d=1}} \sim N(-0.5, 0.01)$	$\mathbf{\Theta_{j(i)=TPLF,d=2}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=TPLF,d=3}} \sim N(0.5, 0.01)$
$\mathbf{\Theta_{j(i)=EDU,d=1}} \sim N(0.5, 0.01)$	$\mathbf{\Theta_{j(i)=EDU,d=2}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=EDU,d=3}} \sim N(1, 0.01)$
$\mathbf{\Theta_{j(i)=ALF,d=1}} \sim N(0.5, 0.01)$	$\mathbf{\Theta_{j(i)=ALF,d=2}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=ALF,d=3}} \sim N(-0.5, 0.01)$
$\mathbf{\Theta_{j(i)=CPI-Maoist,d=1}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=CPI-Maoist,d=2}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=CPI-Maoist,d=3}} \sim N(1, 0.01)$
$\mathbf{\Theta_{j(i)=PLA,d=1}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=PLA,d=2}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=PLA,d=3}} \sim N(0, 0.01)$
$\mathbf{\Theta_{j(i)=Hamas,d=1}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=Hamas,d=2}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=Hamas,d=3}} \sim N(-1, 0.01)$
$\mathbf{\Theta_{j(i)=Fatah,d=1}} \sim N(-0.5, 0.01)$	$\mathbf{\Theta_{j(i)=Fatah,d=2}} \sim N(-, 0.01)$	$\mathbf{\Theta_{j(i)=Fatah,d=3}} \sim N(1, 0.01)$
$\mathbf{\Theta_{j(i)=KNUP,d=1}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=KNUP,d=2}} \sim N(0.5, 0.01)$	$\mathbf{\Theta_{j(i)=KNUP,d=3}} \sim N(-1, 0.01)$
$\mathbf{\Theta_{j(i)=CPB,d=1}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=CPB,d=2}} \sim N(-1, 0.01)$	$\mathbf{\Theta_{j(i)=CPB,d=3}} \sim N(-1, 0.01)$
$\mathbf{\Theta_{j(i)=SRBH,d=1}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=SRBH,d=2}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=SRBH,d=3}} \sim N(1, 0.01)$
$\mathbf{\Theta_{j(i)=CRBH,d=1}} \sim N(0, 0.01)$	$\mathbf{\Theta_{j(i)=CRBH,d=2}} \sim N(1, 0.01)$	$\mathbf{\Theta_{j(i)=CRBH,d=3}} \sim N(-1, 0.01)$

$$\mathbf{A}_{\mathbf{k(i)},\mathbf{1}} \sim N(0,1)$$

$\mathbf{A}_{\mathbf{k(i)=NAGAuthRight,d=1}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=rightagd,d=1}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgeanticommunis,d=1}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGTheo,d=1}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=LeftistMarxistagd,d=1}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=leftagd,d=1}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgegoalindep,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=CenterSeekingagd.A,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=AutonomySeekingagd,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGObj4,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGObj1,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgeethnic,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgegoalchange,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=ChristianOrthodox,d=1}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Serbian,d=1}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Amhara,d=1}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Tigray,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Sunni,d=1}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Pashtun,d=1}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Afar,d=1}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Croatian,d=1}} \sim N(0, 1)$

$\mathbf{A}_{\mathbf{k(i)=NAGAuthRight,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=rightagd,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgeanticommunis,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGTheo,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=LeftistMarxistagd,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=leftagd,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgegoalindep,d=2}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=CenterSeekingagd.A,d=2}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=AutonomySeekingagd,d=2}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGObj4,d=2}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGObj1,d=2}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgeethnic,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=forgegoalchange,d=2}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=ChristianOrthodox,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Serbian,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Amhara,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Tigray,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Sunni,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Pashtun,d=2}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Afar,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=Croatian,d=2}} \sim N(0, 1)$

$\mathbf{A}_{\mathbf{k(i)=NAGAuthRight,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=rightagd,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgeanticommunis,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGTheo,d=2}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=LeftistMarxistagd,d=3}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=leftagd,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgegoalindep,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=CenterSeekingagd,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=AutonomySeekingagd,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGObj4,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=NAGObj1,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=forgeethnic,d=3}} \sim N(0, 1)$
$\mathbf{A}_{\mathbf{k(i)=forgegoalchange,d=3}} \sim N(0, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=ChristianOrthodox,d=3}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Serbian,d=3}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Amhara,d=3}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Tigray,d=3}} \sim N(4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Sunni,d=3}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Pashtun,d=3}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Afar,d=3}} \sim N(-4, 0.01)$
$\mathbf{A}_{\mathbf{k(i)=Croatian,d=3}} \sim N(-4, 0.01)$

A.7 EXTRA INFORMATION ON MODELS OF COOPERATION

Table 13: Coefficient Estimates: Full Model

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Distance	−1.721	0.005	0.250	−2.224	−1.885	−1.716	−1.546	−1.252	2,706.916	1.000
Weak Link	0.022	0.001	0.127	−0.226	−0.064	0.021	0.109	0.270	8,975.263	1.000
Ratio	0.109	0.001	0.118	−0.126	0.031	0.112	0.188	0.334	10,012.220	1.001
Gov Mil Size	−0.782	0.006	0.476	−1.729	−1.098	−0.773	−0.454	0.120	6,021.522	1.000
GDP	0.200	0.004	0.245	−0.277	0.034	0.200	0.360	0.680	4,486.730	1.000
Population	−0.013	0.006	0.415	−0.822	−0.299	−0.015	0.262	0.805	4,920.980	1.000
Number of Rebels	−0.644	0.002	0.179	−0.993	−0.765	−0.645	−0.522	−0.300	8,041.845	1.000
Terrain	−0.074	0.007	0.361	−0.809	−0.308	−0.068	0.166	0.633	2,931.710	1.001
Co-Sponsor	1.059	0.002	0.193	0.675	0.929	1.060	1.188	1.437	8,971.876	1.000
Co-Ethnic	−0.223	0.003	0.243	−0.701	−0.385	−0.222	−0.060	0.247	7,783.232	1.000
Co-Religion	−0.473	0.002	0.135	−0.737	−0.563	−0.472	−0.383	−0.209	6,064.202	1.000
Splinter	0.362	0.003	0.251	−0.144	0.197	0.367	0.527	0.858	8,280.745	1.000
Post Cold War	0.333	0.002	0.159	0.016	0.227	0.334	0.440	0.641	7,718.839	1.000

Table 14: Coefficient Estimates: All Control

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Weak Link	−0.040	0.001	0.120	−0.279	−0.121	−0.038	0.038	0.193	10,241.440	1.000
Ratio	0.149	0.001	0.116	−0.076	0.071	0.149	0.228	0.377	11,448.190	1.000
Gov Mil Size	−0.973	0.006	0.494	−1.961	−1.292	−0.961	−0.639	−0.028	7,114.597	1.000
GDP	−0.038	0.003	0.237	−0.507	−0.195	−0.039	0.118	0.419	6,045.930	1.000
Population	0.199	0.005	0.414	−0.603	−0.085	0.197	0.474	1.013	5,711.289	1.001
Number of Rebels	−0.740	0.002	0.172	−1.076	−0.856	−0.743	−0.623	−0.402	10,924.970	1.000
Terrain	−0.223	0.007	0.390	−1.014	−0.474	−0.212	0.039	0.513	2,929.141	1.000
Co-Sponsor	1.062	0.002	0.191	0.696	0.931	1.062	1.188	1.437	11,051.900	1.000
Co-Ethnic	−0.019	0.002	0.240	−0.495	−0.181	−0.018	0.145	0.444	10,253.450	1.000
Co-Religion	−0.037	0.001	0.121	−0.268	−0.118	−0.036	0.044	0.201	11,984.750	1.000
Splinter	0.665	0.002	0.235	0.206	0.508	0.664	0.825	1.126	11,352.170	1.000
Post Cold War	0.443	0.002	0.156	0.135	0.339	0.442	0.547	0.749	10,465.950	1.000

Table 15: Coefficient Estimates: Control + Binary Ideology

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Co-Ideology	0.917	0.004	0.157	0.596	0.813	0.918	1.024	1.215	1,847.374	1.000
Weak Link	0.059	0.003	0.126	−0.186	−0.029	0.061	0.143	0.304	2,368.861	1.000
Ratio	0.065	0.003	0.119	−0.180	−0.018	0.065	0.148	0.293	1,923.933	1.000
Gov Mil Size	−0.683	0.013	0.503	−1.681	−1.016	−0.685	−0.336	0.293	1,500.937	1.000
GDP	−0.196	0.006	0.243	−0.670	−0.361	−0.199	−0.032	0.303	1,543.618	1.001
Population	0.006	0.013	0.428	−0.829	−0.283	−0.004	0.283	0.891	1,124.557	1.000
Number of Rebels	−0.913	0.004	0.185	−1.270	−1.038	−0.917	−0.789	−0.544	2,592.118	0.999
Terrain	−0.287	0.012	0.377	−1.070	−0.526	−0.275	−0.052	0.404	1,003.310	1.000
Co-Sponsor	0.990	0.004	0.189	0.632	0.860	0.986	1.120	1.367	2,136.229	1.000
Co-Ethnic	0.073	0.005	0.238	−0.390	−0.087	0.075	0.229	0.543	2,290.350	1.000
Co-Religion	−0.206	0.003	0.123	−0.451	−0.287	−0.207	−0.121	0.025	2,086.817	1.000
Splinter	0.540	0.006	0.236	0.091	0.382	0.531	0.697	1.009	1,799.806	1.000
Post Cold War	0.467	0.003	0.157	0.151	0.362	0.465	0.573	0.775	2,009.843	1.000

Table 16: Coefficient Estimates: Control - Power Variables

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Gov Mil Size	−1.003	0.006	0.494	−1.993	−1.329	−0.997	−0.662	−0.070	6,023.050	1.000
GDP	−0.011	0.003	0.235	−0.463	−0.171	−0.014	0.150	0.448	5,237.002	1.000
Population	0.207	0.006	0.408	−0.599	−0.066	0.203	0.479	1.013	5,401.787	1.001
Number of Rebels	−0.743	0.002	0.169	−1.075	−0.858	−0.741	−0.628	−0.416	9,469.948	1.000
Terrain	−0.234	0.007	0.393	−1.034	−0.494	−0.226	0.035	0.510	3,515.323	1.000
Co-Sponsor	1.099	0.002	0.185	0.734	0.974	1.102	1.224	1.452	8,808.847	1.000
Co-Ethnic	−0.029	0.003	0.238	−0.494	−0.190	−0.030	0.131	0.434	8,814.033	1.000
Co-Religion	−0.037	0.001	0.120	−0.272	−0.117	−0.039	0.045	0.197	10,485.550	1.000
Splinter	0.666	0.002	0.241	0.190	0.503	0.667	0.829	1.139	11,656.100	1.000
Post Cold War	0.452	0.002	0.155	0.149	0.346	0.452	0.559	0.751	9,743.060	1.000

Table 17: Coefficient Estimates: Balcell et al 2022

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Co-ideology	0.948	0.002	0.149	0.655	0.846	0.948	1.048	1.236	9,681.302	1.000
Gov Mil Size	−0.770	0.006	0.483	−1.751	−1.087	−0.756	−0.440	0.142	7,393.703	1.000
GDP	−0.135	0.003	0.238	−0.611	−0.296	−0.134	0.025	0.322	6,071.851	1.000
Population	0.230	0.006	0.419	−0.588	−0.051	0.223	0.515	1.039	5,789.035	1.000
Number of Rebels	−0.900	0.002	0.172	−1.239	−1.014	−0.898	−0.785	−0.561	9,271.180	1.000
Terrain	−0.337	0.006	0.396	−1.150	−0.584	−0.326	−0.075	0.415	3,894.211	1.001
Co-Ethnic	0.084	0.002	0.231	−0.370	−0.069	0.082	0.241	0.539	9,497.036	1.000
Splinter	0.561	0.002	0.234	0.103	0.403	0.561	0.720	1.011	9,917.212	1.000
Post Cold War	0.367	0.002	0.153	0.062	0.266	0.365	0.471	0.663	9,531.250	1.000

Figure 38: Convergence Diagnostics of Model (Formal Alliances)

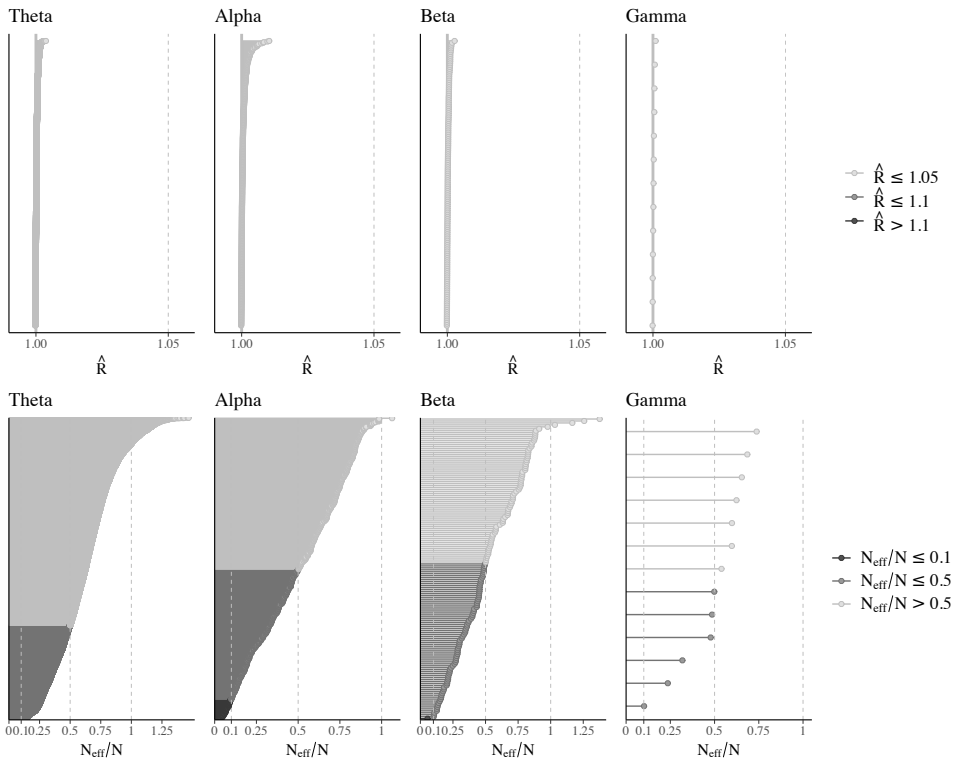


Table 18: Coefficient Estimates: Full Model (Formal Alliances)

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Distance	−2.367	0.015	0.492	−3.351	−2.692	−2.360	−2.030	−1.445	1,015.044	1.001
Weak Link	−0.386	0.002	0.175	−0.747	−0.499	−0.378	−0.267	−0.057	7,377.460	1.000
Ratio	0.060	0.002	0.143	−0.229	−0.037	0.061	0.156	0.339	5,391.948	1.001
Gov Mil Size	−0.205	0.009	0.591	−1.380	−0.611	−0.195	0.201	0.913	4,780.660	1.000
GDP	−0.042	0.004	0.304	−0.628	−0.248	−0.044	0.163	0.563	4,859.263	1.000
Population	−0.149	0.007	0.486	−1.111	−0.479	−0.151	0.182	0.789	4,983.760	1.000
Number of Rebels	−0.680	0.003	0.220	−1.111	−0.824	−0.680	−0.534	−0.249	6,852.348	1.000
Terrain	−0.743	0.012	0.584	−1.937	−1.122	−0.731	−0.346	0.363	2,356.199	1.000
Co-Sponsor	0.816	0.003	0.266	0.300	0.632	0.813	0.996	1.338	5,983.225	1.001
Co-Ethnic	−0.420	0.003	0.282	−0.987	−0.604	−0.421	−0.228	0.114	6,540.194	1.000
Co-Religion	−0.754	0.003	0.177	−1.107	−0.870	−0.753	−0.635	−0.406	3,182.524	1.001
Splinter	0.788	0.004	0.283	0.236	0.596	0.787	0.977	1.350	6,238.907	1.000
Post Cold War	−0.127	0.003	0.202	−0.520	−0.265	−0.124	0.011	0.263	5,975.669	1.000

Table 19: Coefficient Estimates: All Control (Formal Alliances)

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Weak Link	−0.408	0.002	0.170	−0.757	−0.519	−0.402	−0.290	−0.095	11,692.770	1.000
Ratio	0.188	0.001	0.138	−0.085	0.095	0.189	0.285	0.458	14,551.250	1.000
Gov Mil Size	−0.301	0.006	0.597	−1.497	−0.693	−0.291	0.110	0.852	9,109.023	1.000
GDP	−0.342	0.003	0.286	−0.903	−0.535	−0.342	−0.150	0.225	8,589.448	1.000
Population	0.052	0.005	0.466	−0.853	−0.268	0.049	0.365	0.955	7,715.018	1.000
Number of Rebels	−0.704	0.002	0.217	−1.127	−0.851	−0.701	−0.558	−0.277	11,529.830	1.000
Terrain	−0.856	0.010	0.597	−2.065	−1.247	−0.841	−0.446	0.289	3,885.328	1.000
Co-Sponsor	0.742	0.002	0.254	0.249	0.574	0.744	0.913	1.231	12,242.440	1.000
Co-Ethnic	−0.145	0.002	0.269	−0.677	−0.324	−0.143	0.040	0.381	15,173.870	1.000
Co-Religion	−0.268	0.001	0.147	−0.551	−0.367	−0.269	−0.170	0.023	14,958.260	1.000
Splinter	1.134	0.002	0.263	0.617	0.963	1.134	1.309	1.652	13,020.920	1.000
Post Cold War	0.042	0.002	0.198	−0.338	−0.090	0.042	0.174	0.431	11,792.130	1.000

Table 20: Coefficient Estimates: Control + Binary Ideology (Formal Alliances)

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Co-Ideology	0.761	0.005	0.217	0.325	0.617	0.765	0.911	1.171	1,705.069	1.000
Weak Link	−0.323	0.003	0.169	−0.673	−0.436	−0.314	−0.208	−0.019	2,352.991	1.000
Ratio	0.110	0.003	0.135	−0.163	0.022	0.109	0.201	0.374	2,006.595	1.000
Gov Mil Size	−0.147	0.016	0.602	−1.348	−0.564	−0.138	0.260	1.005	1,404.690	0.999
GDP	−0.430	0.008	0.302	−1.023	−0.628	−0.430	−0.223	0.145	1,289.401	1.001
Population	−0.013	0.013	0.469	−0.934	−0.318	−0.017	0.292	0.915	1,365.303	1.000
Number of Rebels	−0.839	0.005	0.222	−1.274	−0.995	−0.835	−0.685	−0.417	1,661.924	1.001
Terrain	−0.935	0.021	0.582	−2.129	−1.311	−0.902	−0.543	0.154	748.384	1.008
Co-Sponsor	0.607	0.006	0.273	0.053	0.421	0.614	0.793	1.114	2,066.707	1.000
Co-Ethnic	−0.082	0.005	0.262	−0.606	−0.260	−0.074	0.103	0.408	2,325.680	1.000
Co-Religion	−0.392	0.003	0.151	−0.684	−0.490	−0.389	−0.297	−0.090	2,127.308	0.999
Splinter	1.015	0.006	0.275	0.468	0.834	1.013	1.197	1.565	2,190.044	0.999
Post Cold War	0.060	0.005	0.201	−0.328	−0.075	0.059	0.193	0.475	1,676.086	0.999

Table 21: Coefficient Estimates: Control - Power Variables (Formal Alliances)

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Gov Mil Size	−0.334	0.007	0.601	−1.548	−0.726	−0.315	0.069	0.800	7,032.181	1.000
GDP	−0.209	0.003	0.288	−0.778	−0.399	−0.209	−0.016	0.345	7,255.326	1.000
Population	0.137	0.005	0.462	−0.756	−0.178	0.136	0.442	1.049	7,335.443	1.000
Number of Rebels	−0.619	0.002	0.213	−1.039	−0.763	−0.616	−0.477	−0.206	10,545.000	1.000
Terrain	−0.868	0.011	0.608	−2.117	−1.266	−0.852	−0.448	0.279	3,071.395	1.000
Co-Sponsor	0.876	0.002	0.250	0.387	0.708	0.878	1.044	1.363	10,296.370	1.000
Co-Ethnic	−0.119	0.002	0.269	−0.657	−0.300	−0.116	0.063	0.403	13,242.470	1.000
Co-Religion	−0.270	0.001	0.145	−0.553	−0.369	−0.270	−0.173	0.016	14,163.190	1.000
Splinter	1.106	0.002	0.269	0.576	0.927	1.109	1.288	1.635	12,044.770	1.000
Post Cold War	−0.018	0.002	0.195	−0.398	−0.151	−0.016	0.113	0.363	10,866.960	1.000

Table 22: Coefficient Estimates: Balcell et al 2022 (Formal Alliances)

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Co-ideology	0.803	0.002	0.195	0.414	0.672	0.802	0.937	1.181	7,872.016	1.000
Gov Mil Size	−0.176	0.008	0.591	−1.380	−0.566	−0.162	0.219	0.972	5,164.306	1.001
GDP	−0.281	0.004	0.292	−0.863	−0.474	−0.280	−0.086	0.286	4,816.888	1.000
Population	0.188	0.006	0.461	−0.714	−0.125	0.192	0.501	1.088	6,066.694	1.000
Number of Rebels	−0.775	0.003	0.219	−1.201	−0.921	−0.776	−0.631	−0.336	7,526.806	1.000
Terrain	−0.911	0.011	0.607	−2.132	−1.302	−0.897	−0.490	0.220	2,790.153	1.000
Co-Ethnic	−0.146	0.003	0.262	−0.665	−0.321	−0.147	0.027	0.369	9,286.079	1.000
Splinter	0.957	0.003	0.266	0.434	0.778	0.960	1.137	1.481	8,610.495	1.000
Post Cold War	−0.060	0.002	0.193	−0.440	−0.187	−0.061	0.065	0.327	8,344.096	1.000

Figure 39: Convergence Diagnostics of Model (Informal Alliances)

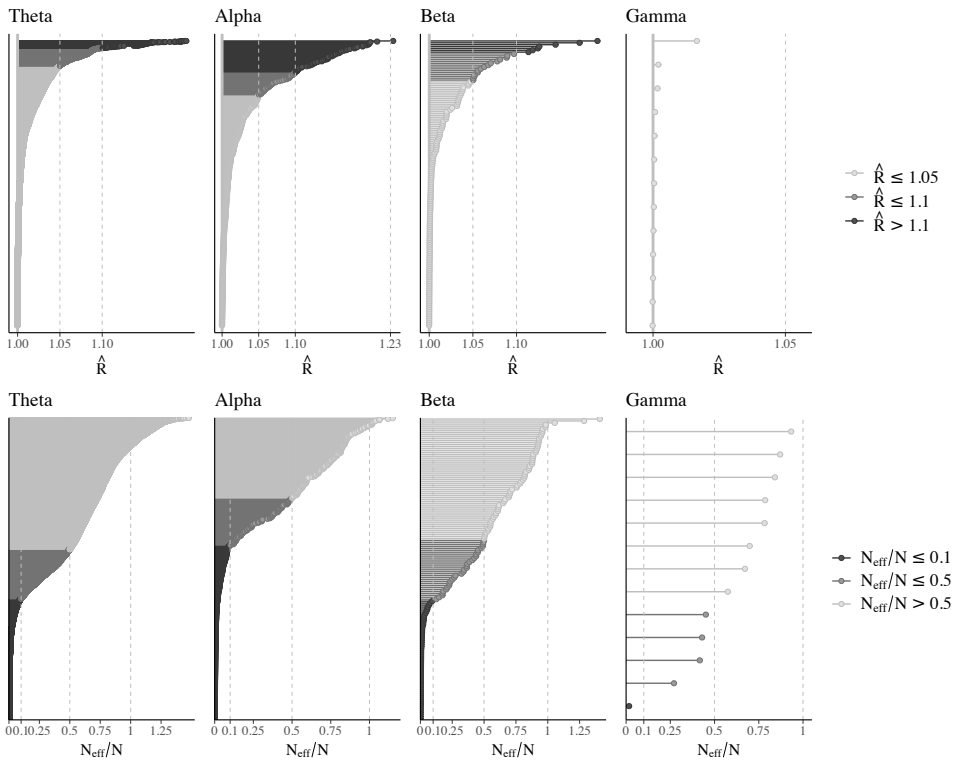
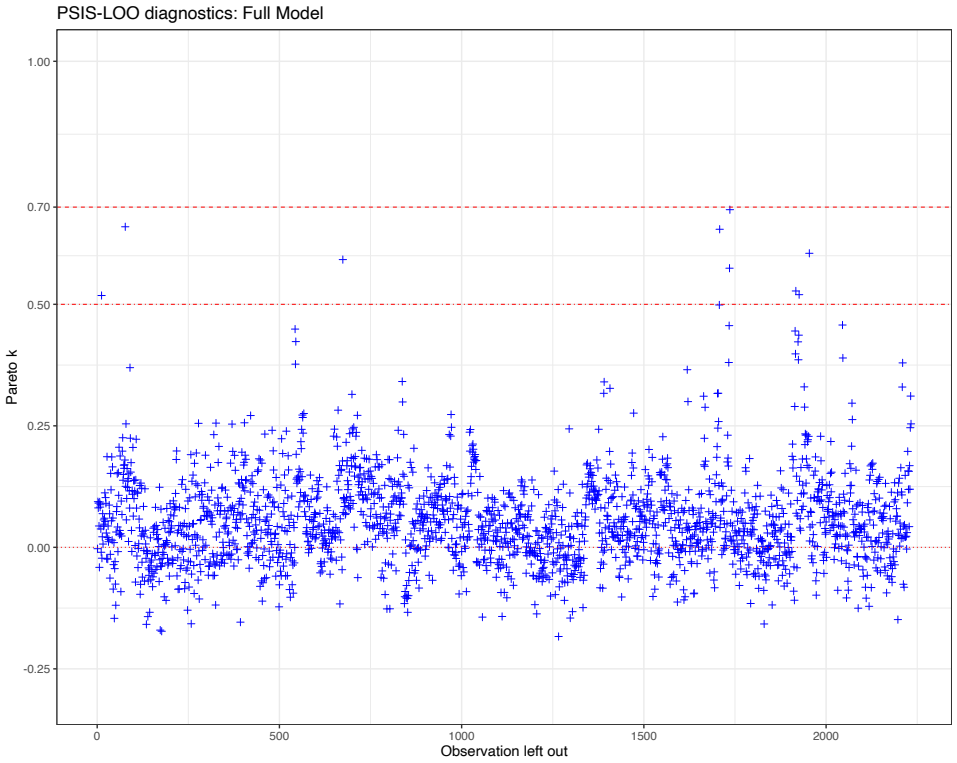


Table 23: Coefficient Estimates: Full Model (Informal Alliances)

	mean	se_mean	sd	2.5%	25%	50%	75%	97.5%	n_eff	Rhat
Distance	−1.149	0.021	0.270	−1.679	−1.327	−1.146	−0.966	−0.628	168.439	1.017
Weak Link	0.544	0.002	0.159	0.231	0.436	0.544	0.652	0.855	7,860.006	1.000
Ratio	−0.072	0.002	0.183	−0.430	−0.195	−0.072	0.053	0.284	8,410.202	1.000
Gov Mil Size	−0.792	0.008	0.608	−2.023	−1.191	−0.770	−0.371	0.336	5,751.348	1.001
GDP	0.665	0.006	0.381	−0.078	0.406	0.665	0.922	1.420	4,164.947	1.001
Population	0.168	0.009	0.566	−0.896	−0.226	0.163	0.545	1.308	4,292.885	1.002
Number of Rebels	−0.637	0.003	0.258	−1.144	−0.809	−0.636	−0.464	−0.139	7,824.596	1.000
Terrain	0.299	0.009	0.484	−0.668	−0.005	0.298	0.622	1.244	2,706.860	1.000
Co-Sponsor	0.854	0.003	0.243	0.383	0.690	0.856	1.020	1.331	9,327.721	1.000
Co-Ethnic	0.183	0.005	0.413	−0.628	−0.094	0.185	0.464	0.993	6,982.094	1.000
Co-Religion	0.030	0.003	0.208	−0.369	−0.110	0.024	0.169	0.443	4,507.209	1.002
Splinter	−0.692	0.004	0.393	−1.482	−0.954	−0.689	−0.424	0.068	8,706.687	1.000
Post Cold War	0.833	0.003	0.233	0.374	0.674	0.833	0.988	1.293	6,718.061	1.000

Figure 40: PSIS Model Comparison (Informal Alliances)



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