Combatant Composition and Peace Durability: A Historical and Empirical Dive into Rebel Group Fragmentation as a Determinant of Conflict Relapse

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I.   Introduction

Nearly all regions of the world have observed repeated cycles of violence involving anti-state militias and domestic or international terrorist groups since the end of World War II. A 2020 UN Human Rights Office report on conflict-related civilian casualties revealed that 5 out of 100,000 civilians are killed every year due to conflict (UN| SDG Indicator 16.1.2, 2020). War is costly, and sustainable war resolution efforts are complicated by the socio-political and economic contexts on which wars' characteristics are contingent. By granularly examining wars in their respective contexts, however, peace-building literature has uncovered rebel group fragmentation, the process by which rebel organizations splinter into distinct armed entities, as an increasingly common characteristic of armed conflict. The number of armed groups in Syria, for instance, has proliferated from eight to several thousand since conflict outbreak in 2011 (UN75, 2020). Myanmar's conflict history, too, is inundated with incidences of fragmentation (UCDP n.d. | Myanmar).

One year after the 1947 signing of the Burma Independence Act, the Karen National Union (KNU), a rebel group pursuing autonomy for Myanmar's Karen ethnic minority, organized an intrastate armed conflict against the Government of Myanmar (Burma). In 1953, the Karen National United Party (KNUP) formed to become the main political body and military wing of the Karen forces and soon after replaced the KNU with a modified agenda of implementing socialist policy. The KNUP, therefore, became not a fragment, but a continuation, or replacement, of the KNU under a new name. While continuations certainly occur, systematically collected data on global armed conflicts accommodate for analysis the possibility that actors need not necessarily remain under one insurgent group throughout the duration of a civil war. In 1957, opposing the Marxist-Leninist political orientation of the KNUP and seeking the creation of a federal union in Myanmar, dissenting members of the KNUP split to form an

armed organization, the Karenni National Progressive Party (KNPP). Pursuing opportunities of military expansion towards the east, in 1966, commander of the eastern regions, Bo Mya, withdrew from the central-Burma stationed KNUP to form the Karen National Liberation Council (KNLC), later renamed KNU. By 1975, this iteration of the KNU had grown in size, territorial control, and had garnered support from Thailand and the United States.

Political and military strategy disputes provoked KNPP and KNU fragmentation. For the Democratic Kayin Buddhist Army (DKBA), a 1992 fragment of the KNU, ethnic discrimination of Buddhist soldiers and rumors of corruption challenged loyalties. Shortly after splintering, the DKBA signed a ceasefire, aided government efforts to capture KNU headquarters and transformed into a government steered border guard force in 2010. Concurrently, the fifth brigade, who disagreed with certain terms of the ceasefire, split from the DKBA to form the DKBA-5 and continued insurgency alongside the KNU.

A similar history of complex, and often overlapping, changes in rebel group composition has sophisticated many government-rebel wars. Rebel infighting, typically provoked by socio-political or economic divergences, often increases the number of incompatibilities necessitating government attention. In the case of Myanmar, fragmentation not only increased the number of rebel groups fought by the government at a given time, but additionally diversified reasons of contention from, for instance, the seeking of an autonomous state to the seeking of a socialist autonomous one.

These effects of fragmentation are certainly evident in Mali's conflict history, too. The Tuareg are a large nomadic pastoralist group that inhabit a vast area of the north African region, including parts of Mali, Algeria, Burkina Faso and Libya. The Tuareg in Mali populate the northern regions of the country collectively and commonly known as Azawad. Conflict between

the Tuareg and the Malian government emerged after Mali's decolonization in 1960 when newly appointed president, Modibo Keita, implemented reform policies that marginalized the Tuareg ethnic minority and brutally suppressed dissent. Symptoms of Tuareg oppression worsened following the severe 1968 Sahel drought and consequent famine that forced a mid-1970s mass displacement. Young Tuaregs emigrated to Algeria and Libya, where they joined and received training from General Muammar Gadaffi's military forces. In the late 1980s, Tuareg immigrants were expelled from Libya due to worsening economic conditions and returned to Mali to form the Mouvement Populaire de Libération de l'Azaouad: Popular Movement for the Liberation of Azawad (MPLA), an insurgent group piloted by an Azawad separatist agenda.

After a short armed struggle, MPLA and the Malian government commenced negotiation talks in 1990. Concerned that negotiation settlements would neglect Arab interests, the Arab sub-group of the MPLA split to form the Front Islamique Arabe de l'Azaouad: Arab Islamic Front of Azawad (FIAA). Negotiation talks dissolved and conflict continued. The following year, the FIAA and MPLA signed the 1991 Tamanrasset Peace Accord, whose terms stipulated the release of Tuareg prisoners and increased Northern autonomy. The MPLA soon after changed its name to MPA, dropping Azawad "liberation" from both its name and agenda, a move which provoked the formation of a northern separatist fragment, Front Populaire de Libération de l'Azawad: Popular Liberation Front of Azawad (FPLA). After one year of separate armed conflicts, the FPLA, FIAA, and MPA formed an umbrella organization to participate in negotiations with the government, resulting in the 1992 National Pact. By 1995, majority members of all rebel groups had agreed to the pact and called for the demilitarization of the North, integration of Tuaregs into national politics, and integration of rebels into the government's armed forces. In 1996, the FPLA leader formally announced his group's

dissolution. The pact ushered in close to 12 years of peace. The war prolonging potential of fragmentation is evident. What remains unclear is the extent to which fragmentation accelerates relapse into armed conflict after the establishment of peace.

In 2011, integrated rebels began to split from the national army due to discrimination and preferential promotion of southern soldiers. In 2011, too, after the fall of Gaddafi's regime, Malian senior officers in the Libyan army broke ranks and returned to Mali to form a new rebel group, MNLA, with a Northern separatist agenda. Concurrently, another Tuareg rebel group, Ansar Dine: Defenders of the Faith, formed with the distinct objective of spreading and strictly enforcing Sharia law throughout Mali. In a cooperative armed struggle that ended the long-standing period of peace, MNLA and Ansar Dine captured northern main towns Kidal, Gao, and Timbuktu, and successfully ousted from power in Mali the president and government army forces in 2012. The rebels declared the formation of an independent Azawad. Shortly after, however, Ansar Dine and its Algerian jihadist allies, MUJAO and AQIM–who themselves are fragments of Algerian insurgent groups–pushed MNLA out of main towns to create a de facto Islamic state and move further towards central Mali. This joint operation caught international attention, provoking a three-year French-led initiative aimed at stopping the metastasis of Ansar Dine, MUJAO, and AQIM control in Mali, Algeria, and other North African regions. In 2015, former members of all three groups split to form new insurgent group Force de libération du Macina: Machine Liberation Movement (FLM), which became one of the most active and deadly Islamist groups in Mali. The FLM focused efforts on the liberation of Central Mali and largely managed to stay undetected by international counterinsurgency efforts, owing partially to its vast rebel network both in Algeria and Mali, yet apparently exclusive focus on Mali.

These cases of Myanmar and Mali demonstrate both the commonality of fragmentation and its influence on conflict outcome. The aim of this paper is to examine its effect specifically on war recurrence. Peace building literature has identified an increase in "conflict trap," the tendency for countries to become trapped in repeated cycles of violence (Collier & Sambanis, 2002). A current challenge in peace-building, therefore, is not only punctually and effectively preventing new-war onset but intercepting the relapse of old ones. This paper, to that end, will examine the effect of rebel group fragmentation on war recurrence.

II.   Literature Review

Peace building literature takes a multi-pronged approach to the examination of post-war peace durability. One such prong addresses the post-war environments that historically have produced fertile ground for war relapse. Election timing, public goods provisions, quality of democracy, and the financial, organizational, and political strength of central governments are typical independent variables in studies of this end (Brancati and Snyder, 2012; Daly, 2020; Mansfield and Snyder, 2005). Fearon and Laitin (2003) found that peace duration is longest in countries whose central governments have the capacity to build and enforce counterinsurgency policies. Other factors, such as the structure of disarmament, demobilization, and reintegration (DDR) programs and foreign governmental or aid organization intervention, have been implicated in war relapse research (Richards, 2016; Walter, 2014).

A second prong of literature posits that war recurrence depends not only on the post-war environment, but the peri-war and war-ending factors that necessarily influence the structure of the post-war environment. Mason et al. (2011) found post-war peace duration is a function of the extent to which the outcome of the previous civil war led to a victor with a "significant degree of popular support" and the extent to which the post-civil war environment creates incentives for dissident groups to return to violence. The first end is supported by Stedman (1997), whose

research revealed that rebel group infighting may provoke the emergence of negotiation "spoilers," dissident members of a rebel group who undermine negotiation between a state and the group's leadership, thereby causing a cooperation breakdown and risking conflict relapse. Grievances within a group complicate the extent to which negotiations can take place with popular approval, as evident in the cases of Myanmar and Mali. Moreover, the larger the rebel organization, the more difficult it is for the organization's leadership to incorporate varying member preferences into a single political or military agenda (Dalton, 2012). Similarly, an increased number of rebel actors in a civil war decreased the likelihood of a state victory over any actor (Akcinaroglu, 2012). The author postulated this may be due to reduced state capacity that may emerge from the allocation of counterinsurgency resources to an increasing number of rebel groups. Conversely, the "divide and conquer" method may be adopted by states wherein intra-group fighting is provoked, typically during concessions negotiation stages, to prevent cohesive and therefore more powerful anti-state effort (De Luca et al., 2018; Nilsson, 2010). Additionally, using evidence from Liberia and Sierra Leone, Johnston (2008) posited that aside from intragroup political or social grievances, fragmentation may also result from intragroup pay-off or information asymmetry. Johnston presents a hierarchical view of rebel group power structures in which individuals on the higher end typically receive a higher pay-off relative to mid- or low-level fighters. The asymmetry is theorized to assert pressure on inherent power imbalances that then are overwhelmed during negotiation stages in which group leaders are made offers by the government, leading to the possible fragmentation of mid- or low-level fighters.

Other studies have examined cohesion building strategies which may counterintuitively yield fragmentation, including sexual violence. Nagel and Doctor (2020) found that rebel groups whose rank-and-file members engage in sexual violence are more prone to fragmentation, as this

activity leads to cohesion and trust between them and their immediate superior. The authors posited that leaders decide to fragment when they believe their own fighters are loyal to the unit. Finally, Schubiger (2023) found that state violence against the civilian constituency of rebel groups increases fragmentation risk by disrupting "intra-organizational coordination, strategic unity, and…ideological cohesion."

Directly relating fragmentation and war recurrence, Findley and Rudloff (2016) found that fragmentation decreased peace durability for wars which occurred between 1946-2002. The present study will expand on this research by increasing the scope of analysis to reach conflicts between 1946 and 2020, providing a dyad-level analysis to disaggregate trends in both fragmentation and civil war outcome that may be masked in conflict-level data, and adding a number of control variables unexplored in Findley and Rudloff (2016). In the context of these and the aforementioned findings, the present study hypothesizes that fragmentation will increase the likelihood of war recurrence.

III.   Theory

This section motivates the variables which, in addition to fragmentation, will be included in the empirical model.

a. *"Bread and Water Without Dictatorship:" The Case for Global Food Prices*

Tunisians and much of the Arab world chanted this slogan in the 2010-2012 series of uprisings collectively known as the Arab Spring. Increased food prices played a catalytic role in conflict escalation and outspread: prices increased 32% in the second half of 2010 and reached a historical high in 2011 as worldwide wheat and grain production declined (Ansani & Daniele, 2012; Soffiantini, 2020; FAO|World Hunger Report, 2011). Egypt, Morocco, and Jordan addressed these grievances by increasing staple food subsidies and public sector salaries and

pensions. In countries whose governments did not have the capacity to provide social safety nets, such as Libya, Yemen, and Syria, food and poverty related grievances outlasted the official end of the Arab Spring (Rosenberg, 2011).

Increased food prices that result in food insecurity are positively correlated with the risk of democratic breakdown, civil conflict and protest (Brinkman and Hendrix, 2011). Surveying Sierra Leonean ex-combatants, Humphreys and Weinstein (2008) reported food insecurity to be one of the primary motivators of joining a rebel group, and Reno (2012) with Liberian ex-combatants. Additionally, Hirshleifer (1995) posits increased food prices reduce the opportunity costs of insurgency, thereby increasing labor supply to rebel groups or strengthening other forms of civilian-rebel group support. It is worth noting, too, that there exists the likelihood of conflict itself yielding food insecurity (Akande & Gillard, 2019; Gibson et al., 2012; Xia et al., 2022).

Due to these findings, global food prices will be included in the present study's empirical model. Increased food prices are expected to accelerate civil war relapse.

b. *Annual Population Growth Rate*

Strands of research examining the impact of population pressure on conflict often cite a resource scarcity pathway wherein competition for scarce supplies increases the risk of conflict. This impact is worsened in states with reduced capacity to provide countervailing social safety policies or manage insurgency. Homer and Dixon (1994) present population growth as a generator of environmental scarcity which may result in mass emigration from countries unable to support this growth. The consequent decreased economic productivity, the authors postulate, creates a weakening effect on the governments' counterinsurgency capacity, in turn increasing the risk of coup d'états and deprivation conflicts. Moreover, Hauge & Ellingsen (1998) found

high population density that results in environmental scarcity increased the risk of domestic armed conflict for the period 1980-1982. Disease outbreak resulting from overcrowding is additionally cited to increase the risk of health systems breakdowns, population displacement, and ultimately, conflict (Fabiani et al., 2005; Liotta & Miskel, 2004). Lastly, Raleigh and Hegre (2009) offer a pathway of preference heterogeneity: divergent opinions that may result in conflict are more likely to emerge in more populous countries relative to smaller, more ethnically and religiously homogeneous ones.

Population composition is a related variable studied for its impact on population pressure. Countries with "youth bulges," a rapid increase in young adult populations aged 15-24, suffer an increased risk of conflict when the population growth rate exceeds economic growth. Urdal (2006) discovered an increased risk of terrorism when youth bulges interacted with negative long-term per capita growth and rapid higher education expansion for the period 1950-2000: a lack of labor market accommodation of educated youths increased their likelihood of militarization and susceptibility to rebel recruitment. The youth bulge in Egypt is often implicated in the intra-state proliferation of conflict during the Arab Spring. LaGraffe (2012) notes that not only was Cairo one of the most populous cities in Africa during conflict outbreak, but that a large percentage of the population consisted of college-educated and unemployed youth with a median age of 24. The effects of demographic stressors, such as youth bulges, environmental scarcity, and state capacity on conflict emerge in the examination of population growth rate. Hence, annual population growth rate will be included in this empirical study and is expected to accelerate war relapse.

c. *Per Capita Government Military Size*

Predictions of conflict outcome often implicate government military size as a determining variable. Mason et al., (1999) found a positive correlation between government military size and government victory in intra-state conflicts and further presented a dissent management theory: large militaries are better able to manage dissent before it develops into an armed insurgency. Raleigh and Hegre (2009) supportively postulated large militaries to have the capacity to instill fear in civilians, discouraging rebel recruitment and eliminating the labor supply for existing rebel groups. Moreover, Fearon and Laitin (2003) found governments with large armies to have an increased dissent management capacity by leaving fewer "safe havens" for rebel groups to elude government military or political action.

Conversely, a large government military size may provoke insurgency if its full capacity is used to squash rebel grievances. DeRouen & Sobek (2004) and Mukherjee (2006) argue full army use may inadvertently push civilian support to the rebel movement. DeRouen and Sobek (2004) additionally found a large government military size did not significantly predict government victory for the period 1994-1997. Rebels who fight a government with a large army, the authors theorized, are often powerful themselves and possess winning capabilities. In the present study, per capita government military size is expected to reduce the likelihood of war relapse.

d. Outcome

Rebel-government interactions critically impact conflict outcome. This section will discuss the outcomes considered in the present study's empirical model to have a potential impact on civil war recurrence.

1. Ceasefire agreement

A ceasefire is a temporary agreement to end hostilities, typically to a specific end such as humanitarian aid facilitation, information exchange, or withdrawal of forces to prevent conflict escalation. Parties involved, the duration of cessation, geographic scope and compliance monitoring mechanisms are identified in a ceasefire agreement (PA-X|Ceasefire Arrangements). Successful and sustainable agreements are those whose drafts are comprehensive, perceived as impartial by all involved parties, and leave little room for misunderstanding (Haysom & Hottinger, 2010). The 2004 Darfur Humanitarian Ceasefire Agreement signed by the Sudanese government and Sudan People's Liberation Movement/Army (SPLM/A) is exemplary.

2. Peace Agreement

Peace agreements aim to permanently terminate conflict and establish peace. Successful and sustainable peace agreements address underlying issues in a manner satisfactory to all involved parties. Moreover, relapse-avoiding implementation of the proposed terms requires strong state capacity, or in its absence, a third-party enforcer such as the UN (DeRouen, 2010). The 1992 Chapultepec Peace Accords, mediated by the UN, successfully implemented peace between the El Salvadoran government and rebel group Farabundo Marti National Liberation Front (FMLN) by disarming and demobilizing FMLN combatants, transitioning FMLN into a legitimate political party and reintegrating combatants into society, among other feats (Studemeister, 2001).

Although reluctant signatories certainly are not uncommon, peace agreements convey a particular commitment by all involved parties to terminate violence or a belief that military victory is nonviable or outweighed by the proposed benefits of a peace agreement.

3. Decisive victory

A government or rebel decisive victory is achieved by the defeat or complete elimination of one by the other. If won by defeat and underlying reasons of conflict are left unaddressed, Mason et al., (1999) theorized, the winner risks an underground "simmering of grievances" that may coax relapse after a period of peace, as had been the case during the 2000 government of Tajikistan brief defeat of rebel group Forces of Mullo Abdullo, whose leader fled to Afghanistan after defeat then returned in 2009 to continue an armed insurgency with a much larger army.

Rebel victories commonly lead to central government captures, like the Sierra Leonean 1979 Armed Forces Revolutionary Council successful coup d'état, or secessions, amongst other outcomes.

4. *Actor ceases to exist*

A conflict may end because one of two actors ceases to exist, for instance, due to annexations or mergers. The annexation of Hyderabad by India ended a history of armed conflict between the two states. The 1976 Zimbabwe African National Union (ZANU) and Zimbabwe African People's Union (ZAPU) merger that created the Patriotic Front removed individual "actor" status from ZANU and ZAPU.

It is not uncommon for mergers to fail. An actor who ceased to exist due to a merger may resurface and continue insurgency. The Syrian Islamic Front, the Colombian Revolutionary Armed Forces of Colombia and the Philippine Moro National Liberation Front are some examples of merged organizations whose member groups would dismantle to continue insurgency under a previous name.

5. *Low activity*

Lastly, a conflict may end as a result of low activity without a settled ceasefire or peace agreement or clear one-sided victory.

e. *Intensity level*

The intensity level of a conflict refers to the number of battle-related deaths caused throughout conflict duration. There exists consensus in the literature regarding the effect of intensive fighting on peri and post war conditions: intense wars lead to longer recovery times and increase the risk of conflict recurrence (Gates et al., 2016; Mason, 2007; Mason et al., 2011; Toft, 2009). A commonly cited pathway is the increase of hostilities that emerge between warring sides as the death toll on either side climbs.

IV. Research Design

Data

1. Conflict

Dyad-level conflict data were sourced from the Uppsala Conflict Data Program (UCDP) Conflict Termination Dataset (v.21.3) and Actor Dataset (v.22.1). The UCDP assigns a unique identifier consistent across all UCDP datasets for each conflict and associated dyad. A dyad belongs to one conflict and constitutes armed dispute between two primary parties, one of which is the government of a state. For instance, four rebel groups opposed the Myanmar government intermittently *over the same incompatibility* between 1949 and 2011, signifying one conflict with four dyads. Figure 1 illustrates the Myanmar conflict as found in the UCDP dataset.
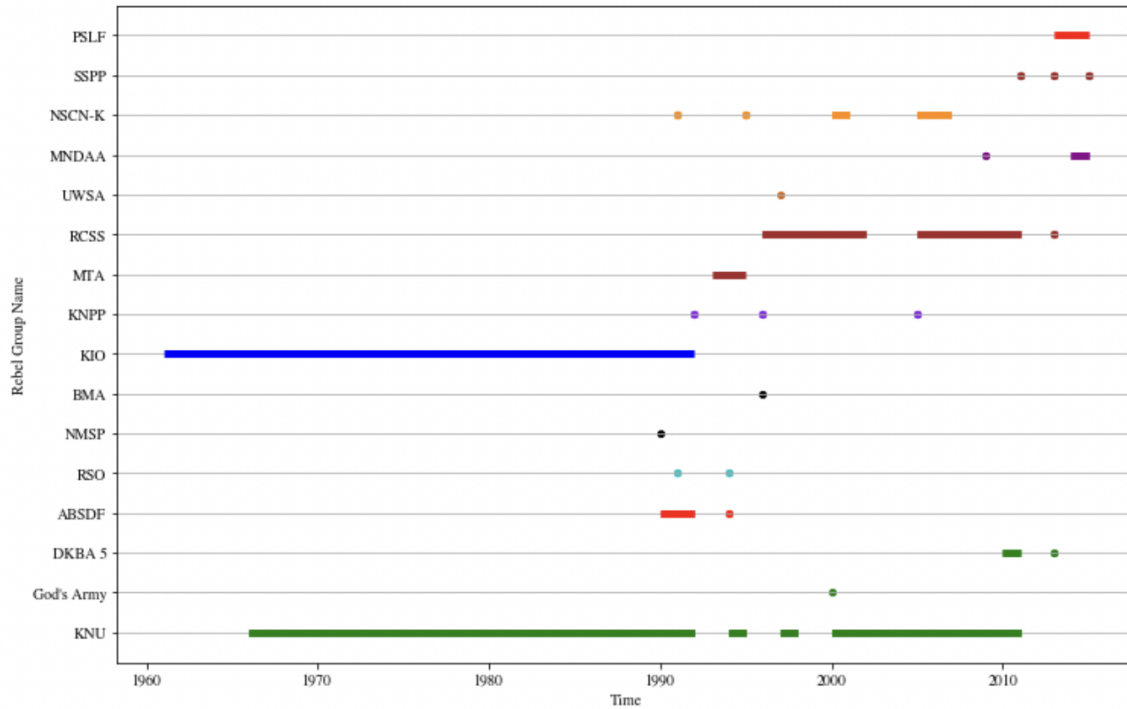
Figure 1. Myanmar conflict history.
Note: Color codes group episodes belonging to the same conflict, bar length identifies conflict duration

All dyad episodes in both datasets have reached the inclusion threshold of 25 battle-related deaths in the given year. From the termination dataset, conflict start and end dates, outcome, conflict intensity differentiated by *minor* (25-999 battle-related deaths) and *war* (1,000 or more battle-related deaths), location, and names of involved parties were extracted for the period 1946-2020. A dyad episode was considered terminated when an active year was followed by a year in which the battle-related death count was less than 25. Distribution of outcomes and intensity levels are provided in Tables 1 and 2.

Outcome	Freq.	Percent
Peace Agreement	106	12.49
Ceasefire Agreement	95	11.19
Government Victory	142	16.73
Rebel Victory	69	8.13
Low Activity	353	41.58
Actor Ceases to Exist	84	9.89
Total	849	100

Table 1. Distribution of outcome variable.
Note: 67 missing values for ongoing conflicts

Intensity Level	Freq	Percent
Minor	799	87.23
War	117	12.77
Total	916	100

Table 2. Distribution of intensity level variable

From the actor dataset, a binary variable indicating whether an actor formed via fragmentation was extracted for the period 1946-2020 and appended to the termination dataset via a conflict and dyad ID number-matching process. Next, a binary variable identifying recurring episodes was constructed: if armed activity over the same incompatibility and involving the same warring sides occurred again, all episodes before the last were set to 1, indicating recurrence. For instance, the 1992-1996 armed conflict between KNU and the government of Myanmar was followed by another spell of violence between 1994-1995, and another between 1997-1998, and the last between 2000-2011. All except the last were coded to show future recurrence (Figure 1). Lastly, dyad peace duration was coded as the number of days

elapsed between the end date of a dyad episode and the start date of the following one. For wars with only one dyad episode (wars that did not recur), dyad peace duration was set as the number of days elapsed between the start date of the dyad episode and 2023, the year of the present study's analysis.

There are 916 dyads in the dataset. Approximately 28% recurred, of which approximately 26% experienced fragmentation (Table 1). The total number of active rebel groups per year and the proportion composed by groups formed by fragmentation is shown in Figure 2.

	Will Recur	Non-Recur	Total
Fragmented	67	124	191
Not Fragmented	195	530	725
Total	262	654	916

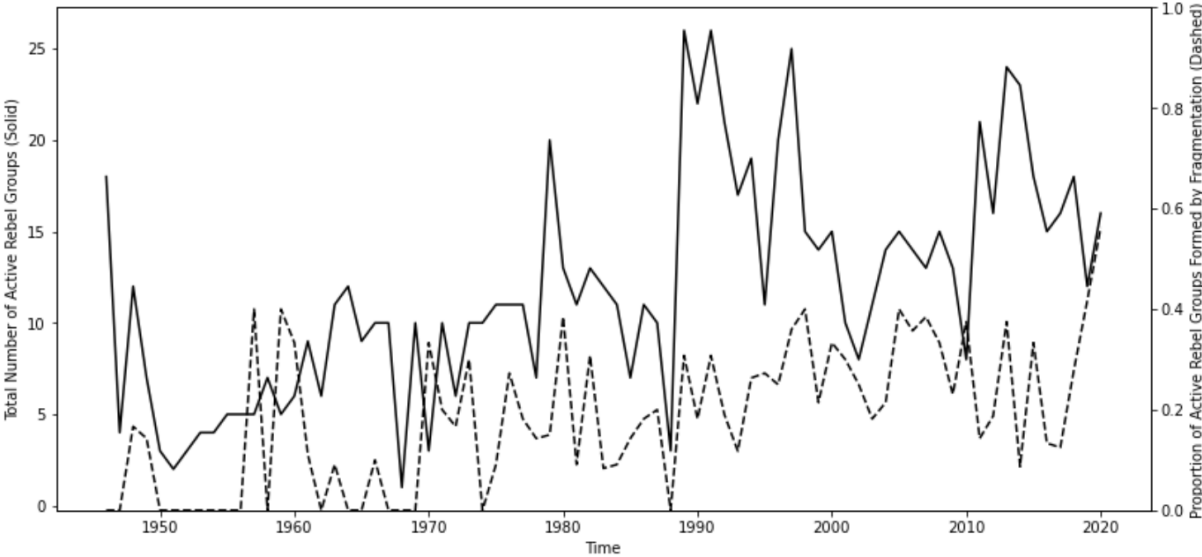Table 3. Conditional distribution of recurrence and splintering

Figure 2. Trends in the total number of active rebel groups (solid line) and the proportion formed by fragmentation (dashed line) for period 1946-2020

2. Global Food Prices

The Food and Agriculture Organization (FAO) Food Price Index (FFPI) is a measure of international prices for a basket of agricultural commodities in real U.S. dollars. The food groups included are meat, dairy products, cereals, oils and fats, and sugar, and indices are weighted by the average export shares of each group over base years 2014-2016. The FFPI at the end date of each dyad episode was added to the conflict dataset. Publicly available FFPI data only dates to 1990, so the variable is considered in the empirical model only for dyad episodes terminated in or after 1990, leaving 484 episodes for analysis with a mean index of 89.15 (Table 4).

3. Annual Population Growth Rate

The Correlates of War National Material Capabilities (v.6) dataset, which includes estimates for the period 1816-2016, provided civilian population data. To calculate annual population growth rate, the log of the population counts at the end date divided by that of the start date was divided by the time elapsed between the start and end date. Missing values were extracted, and 395 dyad episodes remained between the years 1946-2012 with a mean annual growth rate of 1.67% (Table 4).

4. Per Capita Military Size

The Correlates of War National Material Capabilities (v.6) dataset provided military personnel size data. The variable spans the period 1816-2016 and defines military personnel as "troops under the command of a national government intended for use against foreign adversaries, and held ready for combat as of January 1 of the referent year." This includes land, naval, and air unit personnel. For the purposes of the present study, military personnel counts were divided by the total population count, sourced from the same dataset, to obtain per capita military size. Per capita military size at the end date of each dyad episode was appended to the

conflict dataset after missing values extraction. 775 dyad episodes remained with a mean per capita size of 0.00697, or 0.697% (Table 4).

Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FFPI	484	89.15	14.94	67.06	118.83
Annual Population Growth Rate[+]	395	1.67%	6.11%	-82.88%[·]	26.02%
Per Capita Military Size	775	0.00697	0.00870	0.00018	0.05781

Table 4. summary statistics
[+] Annual population growth rate * 100
• Approximate 82% decline in annual population growth rate occurred in the 1991-1992 Government of Serbia (Yugoslavia) v. Republic of Croatia conflict wherein Croatia and Slovenia declared sovereignty from the Federal People's Republic of Yugoslavia, resulting in a drastic population reduction.

Methods

Peace duration served as the dependent variable in a Cox proportional hazards model. Independent variables included fragmentation, outcome, intensity level, annual population growth rate, per capita military size, and global food prices. Two models were run. The first included only fragmentation, outcome, and intensity level, and the second included the latter three control variables. The inclusion of annual population growth rate, per capita military size, and global food prices reduced the number of observations to 204 and the scope to conflicts occurring only between 1990-2016. Conditional distributions of the main variables of interest, recurrence and fragmentation, are presented in Table 5 for the 204 observations.

	Will Recur	Non-Recur	Total
Fragmented	21	24	45
Not Fragmented	61	98	159
Total	82	122	204

Table 5. Conditional distribution of recurrence and splintering; n = 204, model 2

V.   Results

Kaplan-Meier (KM) survival estimates for binary predictors fragmentation, outcome, and intensity level are presented in Figures 3-5. The vertical axis indicates estimated probability of survival, and the horizontal axis indicates peace duration, or the time elapsed between conflict termination and conflict recurrence, in weeks.

Dyad episodes in which fragmentation did not occur had higher survival rates, or a lower hazard of recurrence, than those in which fragmentation did occur, lending support to the present study's hypothesis. For instance, at 1000 weeks past conflict termination, approximately 72% of fragmentation-free conflict episodes survived conflict recurrence compared to only 60% in episodes in which fragmentation occurred. In other words, the hazard of recurrence increased due to the presence of fragmentation at all peace duration markers (Figure 3). KM survival estimates for outcome and intensity level are interpreted in a similar manner. Dyad episodes terminated due to low activity had the lowest survival rate, or highest recurrence hazard, followed by ceasefire agreements, peace agreements, government victory, rebel victory, then most conducive to durable peace, the actor ceasing to exist (Figure 4). Lastly and surprisingly, episodes with 25-999 deaths yielded an increased recurrence hazard relative to those with 1000+ deaths (Figure 5).
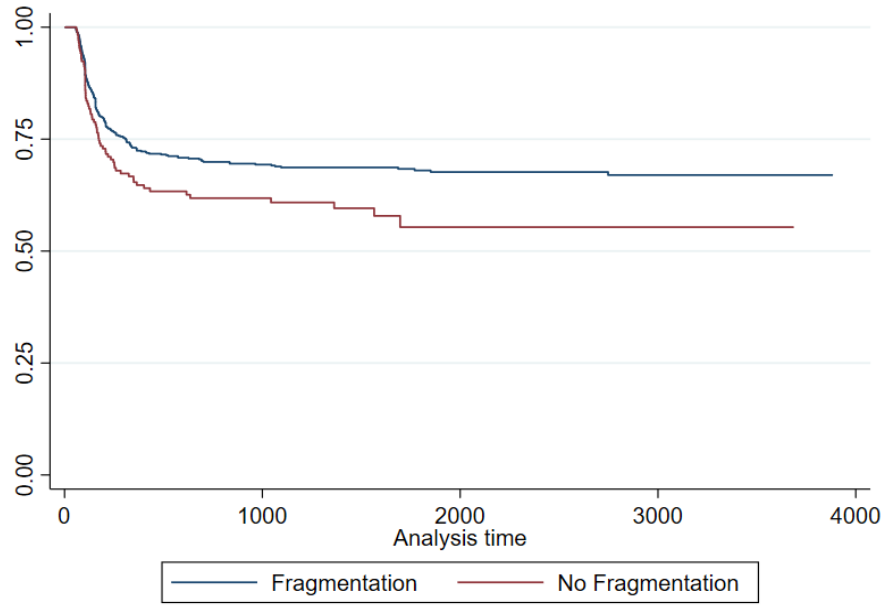
Figure 3. KM survival estimates; wars in which fragmentation did not occur, wars in which fragmentation did occur
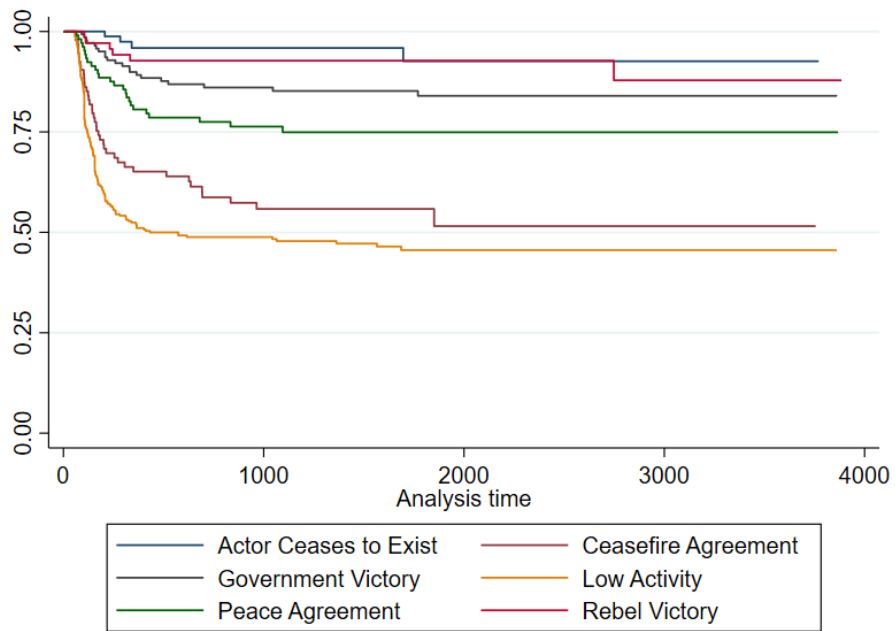

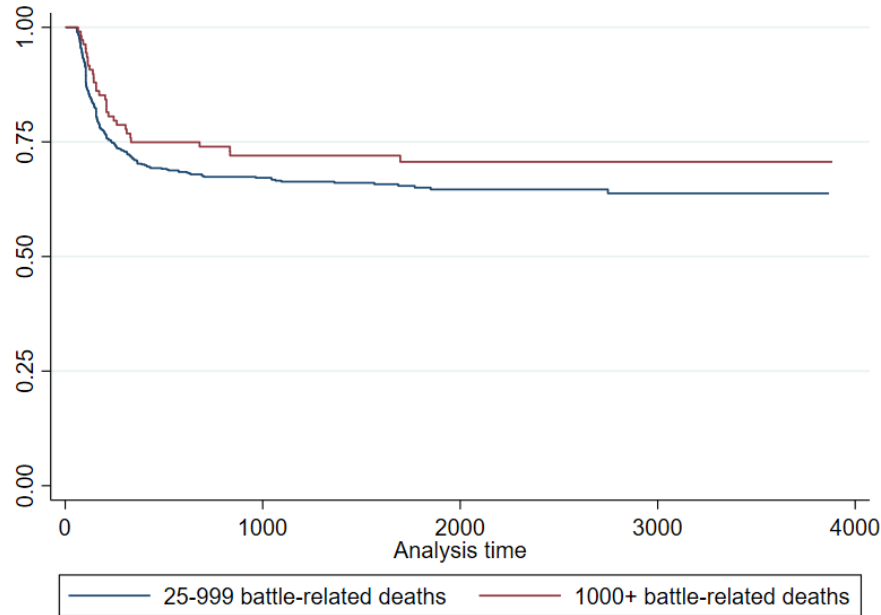Figure 4. KM survival estimates; conflict episode outcome

Figure 5. KM survival estimates; "minor" conflict episodes (25-999 deaths), "war" (1000+ deaths)

Findings from the Cox proportional hazards models are presented in Tables 6 and 7. A hazard ratio (HR) of 1 indicates no change in the likelihood of recurrence due to the presence of the associated independent variable. An HR smaller than 1 indicates reduced likelihood, and an HR greater than indicates 1 indicates increased likelihood. HRs will be interpreted in 100 x (HR-1)% format. Table 6 reports HRs for fragmentation, outcome, and intensity level. After extraction of ongoing dyad episodes, 848 out of 916 observations remained.

The fragmentation HR indicates a 20.8% increase in the likelihood of recurrence as a result of rebel group fragmentation ($p = 0.184$). Contrary to KM survival estimates, the intensity level HR indicates a lower likelihood of recurrence for "minor" conflict episodes relative to those that meet the UCDP criteria for "war:" the likelihood of recurrence increased by 24.2% in dyad episodes with a battle-related death count which exceeds 999 persons ($p = 0.274$). Both HRs, however, lacked statistical significance. Conversely, all war outcomes were significant to varying alpha levels: relative to peace agreements, ceasefires increased recurrence likelihood by

approximately 109.8% ($p = 0.004$) and low activity by 194.3% ($p = 0.000$). As predicted by KM

survival estimates, low activity yielded the highest recurrence hazard followed by ceasefires.

Government victory decreased recurrence likelihood by 42.5% ($p = 0.061$), rebel victory by

68.9% ($p = 0.011$), and rebel group ceasing to exist by 81.1% ($p = 0.002$), an order supportive of

KM survival estimate findings.

Cox proportional hazards model: n = 848				
Variable	Haz. ratio	Std. err.	z	P> |z|
Fragmentation	1.208	0.1722	1.33	0.184
Outcome				
Ceasefire agreement	2.098	0.535	2.90	0.004***
Government Victory	0.575	0.170	-1.87	0.061*
Rebel Victory	0.311	0.142	-2.56	0.011**
Low Activity	2.943	0.639	4.97	0.000***
Actor Ceases to Exist	0.189	0.102	-3.09	0.002***
Intensity level	1.242	0.246	1.09	0.274

Table 6. Cox proportional hazards model with variables fragmentation, outcome, and intensity level.
p-values: *<0.1, **<0.05, ***<0.01

Table 7 reports HRs for fragmentation, outcome, intensity level, annual population

growth rate, per capita military size, and global food prices. With addition of the latter three

controls, the fragmentation HR indicated a *decrease* in the likelihood of recurrence as a result of

rebel group fragmentation ($p = 0.826$). Relative to a peace agreement, a government victory

reduced the likelihood of recurrence by 25.8% ($p = 0.742$), an actor ceasing to exist by 55.1% ($p

= 0.310$), and a rebel victory by 64.8% ($p = 0.329$). Ceasefires increased recurrence likelihood by

209.5% ($p = 0.007$) and low activity by 335.2% ($p = 0.000$). Moreover, a 69.4% increase in

recurrence likelihood is observed for high intensity conflict episodes ($p = 0.230$). Additional

variable inclusion impacted the statistical significance of all conflict outcome HRs, except those

of ceasefire and low activity, relative to the previous model and the direction of the fragmentation HR. Intensity level insignificance remained unchanged in this model; however, the HR increased from 24.2% to 69.4%. Similarly, although both still significant, ceasefire and low activity HRs increased from 109.8% in the previous model to 209.5% and 194.3% to 335.2%, respectively. Lastly, a 1% increase in per capita military size and annual population growth rate yielded a 14.1% and 10.2% increase in recurrence likelihood, respectively ($p = 0.316$; $p = 0.093$), and a 1-point increase in FFPI increased recurrence likelihood by 1.3% ($p = 0.083$).

Cox proportional hazards model: n = 204				
Variable	Haz. ratio	Std. err.	z	P> |z|
Fragmentation	0.945	0.245	-0.22	0.826
Outcome				
Ceasefire agreement	3.095	1.299	2.69	0.007***
Government Victory	0.742	0.582	-0.38	0.704
Rebel Victory	0.352	0.377	-0.98	0.329
Low Activity	4.352	1.608	3.98	0.000***
Actor Ceases to Exist	0.449	0.354	-1.02	0.310
Intensity level	1.694	0.743	1.20	0.230
Annual Pop. Growth Rate	1.102	0.064	1.68	0.093*
Per Capita Military Size	1.141	0.150	1.00	0.316
Global Food Price Index	1.013	0.008	1.73	0.083*

Table 7. Cox proportional hazards model with all variables. *p*-values:*<0.1, **<0.05, ***<0.01
Note: Units of annual population growth rate and per capita military size are percentage points, and the unit of the global food price index is points. See Section IV parts 2, 3, and 4 for detailed description of the variables.

V. Discussion

The hypothesis that rebel group fragmentation increases the likelihood of civil war recurrence, although observed in KM survival estimates, did not receive empirical support in the Cox proportional hazards model. This may owe to several limitations of the study design.

The country, time-period, and variables under examination impact the reliability of global conflict data. For instance, states may have an incentive to over- or under-report military size, rebels may have incentive to conceal or exaggerate infighting, conflict itself may prevent data completeness via necessitating the discontinuation of census data collection and battle-related death data, on which the precise determination of conflict start- and end-dates is contingent, may go unreported or often is subject to estimation. In a study whose scope of analysis spans 1946-2020, therefore, the use of a broader range of combatant composition variables than those included in the present study is especially crucial to unmask the highly context-dependent features of conflict that may impact its recurrence. Some suggested variables include reasons for and timing of fragmentation, course of action employed by rebel groups post-fragmentation, such as continued insurgency or settlement-signing, relative strength of the emerging group, including vastness of its rebel network and reliability of its recruitment sources, and the presence and type of foreign aid. Lastly, endogeneity is a notorious limitation of conflict studies. Fragmentation, outcome, intensity level, per capita military size, annual population growth rate and global food prices were expected to impact post-war peace durability, however, it can be easily postulated that the post-war conditions themselves drive trends in these variables. Moreover, limitations to the present study's findings emerge from the near 76% reduction in the number of observations resulting from the addition of the latter three control variables in Model 2. A low sample size is researched to affect Cox model estimation efficiency (Jia & Lynn, 2015; Xu, 2017; Xu et al.,

2018). Future iterations of this study may increase the number of observations by using alternative sources of data.

Although findings did not lend evidence to the hypothesis, insights emerge from the significant HRs of ceasefire and low activity outcomes, annual population growth rate, and the global food index. Ceasefire and low activity outcomes increased the likelihood of recurrence by more than 100% relative to peace agreements in both models. Ceasefires establish an impermanent end to hostilities. There are cases, such as the 2004 Darfur Humanitarian Ceasefire Agreement, where a ceasefire may directly lead to a peace agreement; however, ceasefires are typically declared to facilitate a specific end, such as humanitarian aid. Upon completion of this outcome, warring sides commonly resume battle. Findings regarding the low activity outcome would be made more tenable with information regarding courses of action taken by the warring sides during that time. It may be that the low activity was induced not by a desire to end hostilities, but by a necessity to replenish ammunition, recruit personnel, strengthen existing agenda or reach consensus on a new one, among several other possibilities. Findings may additionally be impacted by nearly 42% of dyad episodes in the dataset ending due to low activity, a proportion higher than that of any other outcome. The significant annual population growth rate and global food index findings offer a springboard for future studies assessing determinants of conflict relapse.

The complex nature of conflict examination should not deter interest. I hope to have emphasized the role of fragmentation as a war dynamic shifting event which warrants both interest and exploration.

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