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The Geography of Armed Civil Conflict

Doctoral thesis
for the degree of Philosophiae Doctor

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Norwegian University of Science and Technology
Faculty of Social Sciences and
Technology Management
Department of Sociology and Political Science



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Abbreviations

ACD	Armed Conflict Dataset
CIESIN	Center for International Earth Science Information Network
COW	Correlates of War
CSCW	Centre for the Study of Civil War
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GROW-Net	Geographic Representation of War Network
IGCC	Institute of Global Conflict and Cooperation
IICAS	Institute for International, Comparative, and Area Studies
IR	International Relations
KEDS	Kansas Events Data System
LSG	Loss-of-Strength Gradient
MAR	Minorities at Risk
MID	Militarized Interstate Disputes
NTNU	Norwegian University of Science and Technology
OLS	Ordinary Least Squares
PPA	Point Pattern Analysis
PRD	Politically Relevant Dyads
PRIO	International Peace Research Institute, Oslo
RCN	Research Council of Norway
UCDP	Uppsala Conflict Data Program
UCSD	University of California, San Diego
UN	United Nations
UNEP	United Nations Environmental Programme
UNHCR	United Nations High Commissioner for Refugees
3SLS	Three-Stage Least Squares

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1

Introduction

Quite apart from their influence on sources of supply, which constitutes a separate aspect of the matter, geography and the character of the ground bear a close and ever-present relation to warfare. They have a decisive influence on engagement, both as to its course and to its planning and exploitation.

Carl von Clausewitz (1832/1984: 348)

1.1. Purpose of Project

1.1.1. Research questions

This dissertation seeks to increase our general knowledge of the origins and dynamics of civil war by exploring the many possible functions of geography. Each of the five chapters that follow the introduction has its own specific ambition and empirical analysis, but they also serve a more general purpose: to investigate the geography-civil war nexus in more detail and with better data than what has previously been done.

As I started on this project, I soon became aware of certain inconsistencies in the contemporary literature on geography and civil war. One of these is a mismatch in scales between popular theories and applied quantitative measures. Civil conflict, like any significant political event, tends to be studied and understood at the country level. Popular explanations of why and where these conflicts occur, however, refer to such factors as ethnic composition, social and economic inequalities, resource extraction, and rough terrain. The intensity of such factors may vary considerably from one sub-national district to the next; yet, they are almost exclusively being measured at the scale

of the country. A second and related problem concerns the inability of these studies to take account of the possibly important role of relative location, despite the prominence of location (and in particular, the periphery) in theories of insurgency and guerrilla warfare. Moreover, a large majority of empirical studies treat civil wars as a homogenous group, even though the few works that do distinguish between different types of conflict have demonstrated several type-specific characteristics. These flaws inevitably cast doubt on the reliability of reported findings on the subject. Throughout this project, then, a particular emphasis has been put on the development and use of disaggregated conflict data that facilitate analysis on a sub-national scale. These data enable the researcher to consider the spatial association between factors of interest and to assess characteristics of the conflicts (as opposed to the conflict-ridden countries). By disaggregating the study of conflict, we will not only be better able to test prevailing hypotheses but may also develop new theories on the local determinants of civil war. Several broad research questions can be identified:

- How do armed conflicts over self-determination for a limited territory differ from conflicts over access to state power?
- To what extent does the spatial distribution of geographic features such as terrain, population, and natural resources influence the risk, location, and size of armed intrastate conflict?
- To what extent does the location relative to the government's stronghold, the capital city, determine the type and duration of intrastate conflict?
- Is the non-random spatial distribution of intrastate conflicts merely due to a similar clustering of causal factors or does it also reflect contagious behavior?

These research questions serve as a base for the formulation of specific hypotheses that will be tested in the subsequent chapters.

1.1.2. Defining the concepts

This project has a clear quantitative orientation as all chapters of the dissertation include empirical investigations that employ statistical models and numerical data to evaluate

various aspects of the geography-civil war relationship. Before we proceed further, then, it is timely to declare what I mean by the concepts ‘geography’ and ‘civil war’.

Political scientists traditionally have a very narrow view of geography. Empirical international relations (IR) studies rarely go beyond simple indicators of contiguity and proximity, which has led some geographers to criticize the political science literature for being “blinded by an equation of geography and distance” (O’Loughlin 2001a: 131). Conversely, geographers tend to be preoccupied with the concept of ‘place’. Place may refer to contextual aspects of location but is frequently interpreted more widely to include cultural and psychological connotations of the land (see Agnew & Duncan 1989). Although this dissertation certainly resides closer to the first group – in part because the non-tangible aspects of place are hard to quantify – it applies a relatively broad interpretation of geography. ‘Geographic’ factors that are explored in this dissertation include various types of natural resources, extent of mountainous and forested terrain, country area, population size and density, precipitation, the geographic distribution of infrastructure and minority languages, and whether or not the conflict concerns self-determination for a specific piece of territory. In addition, attributes of the conflict zones (conflict area as well as distance to the capital city and neighboring countries) and characteristics of the region (presence of neighboring conflict and democracy) are considered. In general, then, geography is treated as the environment surrounding and shaping the object of prime interest, civil war.

The second central concept in this dissertation is, of course, civil war. Here, the discrepancies in interpretation between different academic fields are less significant. The most apparent variations within the quantitative tradition relate to fatality thresholds and whether or not civilian casualties should be counted. Most empirical work use derivatives of the Correlates of War (COW) project’s data, where civil war is defined as fighting between a state and a non-state actor in which at least 1,000 people were killed in total. Others include less severe conflicts, too, but typically reserve the term ‘civil war’ to those conflicts that comply with the COW definition. The analyses presented in this dissertation are based on Uppsala/PRIO’s sample of intrastate conflicts, which includes all armed conflicts between a state government and an organized opposition group with a clearly stated aim (governmental changes or territorial secession) that generated at least 25 battle-related deaths (civilians not included) per calendar year (see Gleditsch et al. 2002). Less than half of these conflicts reach the stricter 1,000 fatalities threshold. Nonetheless, the terms ‘conflict’ and ‘war’

will be used interchangeably throughout this dissertation, unless specified otherwise. For a more comprehensive conceptual discussion of civil war, see Sambanis (2004a).

1.2. *Geography and Armed Conflict: A Review*

The traditional geopolitical literature focuses exclusively on interstate war (see Diehl 1991 for a review). Although this dissertation explores another set of violent conflicts – those that occur *within* the boundaries of nation-states – much of contemporary theorizing about civil war actually, if implicitly, draws on thoughts of international relations and conflicts between states. Therefore, a brief summary of how geography is associated with interstate war is appropriate.

1.2.1. Contiguity, distance, and territoriality

Geography has always maintained a central position among IR studies. In fact, one of the most successful of all models of international relations – the gravity model of trade – has distance as one of its core elements (Zipf 1949; Tinbergen 1962; Linnemann 1966). Initially developed to estimate population flows between cities, the gravity model states that the amount of transaction between two entities is proportional to the product of their size and inversely proportional to the distance between them. In its most simple, linear (logarithmic) form, the model is given by

$$\ln T_{ij} = \alpha \ln Y_{ij} + \beta \ln D_{ij} + R,$$

where T is some measure of transaction (trade, migration) between units *i* and *j*, Y is the combined size of the two units (typically GDP or population size), D is the distance between them, while R represents other factors that might affect the bilateral relationship. Since geographic distance is generally a significant impediment to interaction (see Gleditsch 1995), the sign of the distance coefficient β in the above equation is expected to be negative.

A number of theoretical formulations pertain more specifically to the geography-war relationship. The first resembles the gravity model by stressing the impeding impact of geographical distance on power projection. Kennan (1962: 261) argues that “the effectiveness of the power radiated from any national center decreases in proportion to

the distance involved.” This is incorporated into a formal model of conflict proposed by Boulding (1962). In this framework, two factors are essential for projecting force. One is a nation’s power at the point of origin. The other is the rate at which this power diminishes over distance because of transportation costs, the ‘loss-of-strength gradient’ (LSG). In its deterministic form, this model cannot account for war, only for conquest. Where the weaker party realizes that it has less power at home than the projected power of the opponent, it should yield to invasion rather than resist. However, if we introduce uncertainty about the aggressor’s power preponderance or about the LSG, war becomes possible because both parties may see themselves as likely winners.

The notion of ‘environmental possibilism’ (Sprout & Sprout 1965) constitutes a slightly different view. Here, emphasis is placed on the possibilistic (as opposed to a deterministic) nature of the environment. This means that neither geography nor any other feature of the environment determines specific actions; they merely shape the range of possible strategies to the decision-maker, some of which will be more probable than others. It is the decision-maker’s “percepts and reactions thereto [...] that determines what is to be undertaken” (p. 207).

The joint insights from the works of Boulding and the Sprouts led Starr (1978) to develop the widely recognized typology of ‘opportunity’ and ‘willingness’. Opportunity is here understood as the possibility of interaction between units, whereas willingness refers to the desire to pursue a particular goal. From this follows that both opportunity and willingness are necessary conditions for going to war. The most obvious factor determining the set of interaction opportunities, and hence the probability of conflict, is geographic proximity. States are less constrained when their counterpart is geographically nearby, as most states are unable to reach distant states by military means. Besides, proximate states interact more with each other overall, which increases the likelihood of finding issues of disagreement. Willingness (or lack thereof) to engage in interstate conflict may be shaped by such factors as alliance ties, regime similarity, and relative capability, but also by geographic factors that affect the anticipated probability of success. In that respect, willingness is shaped partly by the opportunity structures.

More recent theories on geography and war have broadened the interpretation of the geography concept to also include physical and psychological values of the territory itself. Accordingly, geography is not only viewed as a ‘facilitating condition’ for conflict but also as a ‘source of conflict’ (Diehl 1991). Vasquez (1993, 1995) points out that proximity and interstate distance are in most cases constant features over time and therefore cannot explain temporal variations in the outbreak of war. The interaction

argument – that neighbor states fight more often because they interact more overall – is also flawed because it does not explain why greater interaction results in more cooperation in some cases and more conflict in others. Rather, the explanation for the proximity-war relationship, according to Vasquez, lies in the issues of disagreement, where territoriality plays a major role. To use Starr's framework, proximity provides the opportunity for war whereas territorial disputes generate the willingness to go to war. Accordingly, the states most at risk of conflict are neighbors with unresolved territorial disputes. But what makes territory more salient than other political issues? Hensel (1999) offers several reasons: because of what the territory contains in terms of natural resources, because it might offer security advantages, because it might be attached to a cultural or historical identity or in other ways constitute a symbolic value, because of the population that inhabits the land, and lastly because of reputation.

1.2.2. Empirical findings of the geography-interstate war nexus

Perhaps the earliest empirical study to recognize a link between geography and armed conflict, Richardson (1960) noted that there is a tendency for states to be involved in wars in proportion to their number of borders. This is consistent with Herz' (1959) claim that borders invoke uncertainty and create security dilemmas; the higher the number of borders, the higher the number of potential adversaries (whose true intentions are unknown to the other actors). Later studies have suggested that the number of colonial borders has a particularly large impact on the propensity for war (Starr & Most 1976). These authors have also demonstrated the hazardous effect of neighboring wars (e.g. Most & Starr 1980).

The empirical link between geography and armed conflict is even stronger at the dyadic, or bilateral, level. Gleditsch & Singer (1975) found that the average distance between the capitals of warring dyads is considerably shorter than the average distance between all pairs of states in the system. Likewise, Gochman (1990) reported that roughly two-thirds of all militarized disputes between 1816 and 1976 involved proximate states (land contiguous or separated by maximum 150 miles of water). The power of contiguity has since been verified by a host of quantitative investigations, including Bremer (1992) and Buhaug (2005a). This has led some to argue that quantitative studies of conflict should exclude 'irrelevant' pairs of states; that is, states that rarely if ever interact with each other. Maoz & Russett (1993) define politically relevant dyads (PRDs) as pairs of states that are either contiguous or include at least one

major power (according to the Correlates of War project, there are seven major powers at present: China, France, Germany, Japan, Russia, the United Kingdom, and the United States). These states comprise less than 10 percent of all dyads since 1816 but account for approximately 75 percent of all militarized disputes in the period.ⁱⁱ See Lemke & Reed (2001) for a critical discussion of the PRD approach.

Additionally, there is ample evidence that territorial issues are indeed more salient than other issues. Hensel's (1999) empirical investigation shows that territorial disputes are generally more severe, more likely to escalate, and more likely to recur (and within a shorter period of time) than disputes over other issues. Therefore, it seems that the strong empirical association between contiguity and risk of conflict is partly a function of opportunity, partly a function of interaction patterns, and partly a result of territorial characteristics. See Huth (1996) and Senese (2005) for further contributions on this subject.

Finally, a small number of studies explore the spatial association between conflicts. For example, Anselin & O'Loughlin (1992) find strong evidence of clustering patterns of conflict as well as cooperation, trade, and economic development in Africa. In fact, the conflict and cooperation clusters were partly overlapping, which supports the seeming paradox that states with more positive interaction are also more likely to engage in negative forms of interaction. In a more recent study, Ward & Gleditsch (2002) demonstrate that the conflict proneness of a state is affected by the recent conflict history of proximate states, which may reflect regional characteristics but also suggests contagious behavior. Figure 1-1 suggests a similar clustering pattern. Latin America, Europe, East Africa, and Central Asia have seen few militarized interstate disputes (MIDs) since 1946 whereas the major powers and countries in the Middle East and South Asia have been particularly disposed to conflict.

A more precise measure of actual spatial association is Moran's *I* correlation coefficient (Moran 1950). This is given by

$$I = \frac{n}{\sum_i \sum_j \tilde{w}_{ij}} \sum_i \sum_j \tilde{w}_{ij} \frac{(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2},$$

where \tilde{w}_{ij} represents a row-standardized connectivity matrix between unit *i* and all units *j* and *x* denotes the variable of interest. The statistic is basically analogous to Pearson's correlation coefficient and gives the linear association between a value for one unit and the weighted average of the corresponding value for the other units in the sample. Figure 1-2 illustrates the spatial correlation of MID involvement in the post-World War

II period, based on a simple spatial lag where only first-order neighbors of each country are considered. The scatterplot and the map both show clear evidence of negative as well as positive spatial association at the local level. The plots in the upper right and lower left quadrants denote positive correlation, and the countries with a statistically significant (95% level of confidence) positive covariance with their neighbors are highlighted in red in the map. Countries that differ considerably from their neighbors are found in the upper left and lower right quadrants, and significant negative clusters are found among the blue countries. Note that islands that lack contiguous neighbors are compared to the global average dispute involvement. On the global (or systemic) level, militarized dispute involvement shows a distinct positive correlation pattern ($I=0.3$), as visualized by the solid blue line in the scatterplot. This means that neighbors of peaceful states are likely to have a low conflict involvement rate while neighbors of belligerent countries are themselves often engaged in militarized disputes.ⁱⁱⁱ

Figure 1–1. Density of Militarized Interstate Disputes, 1946–98

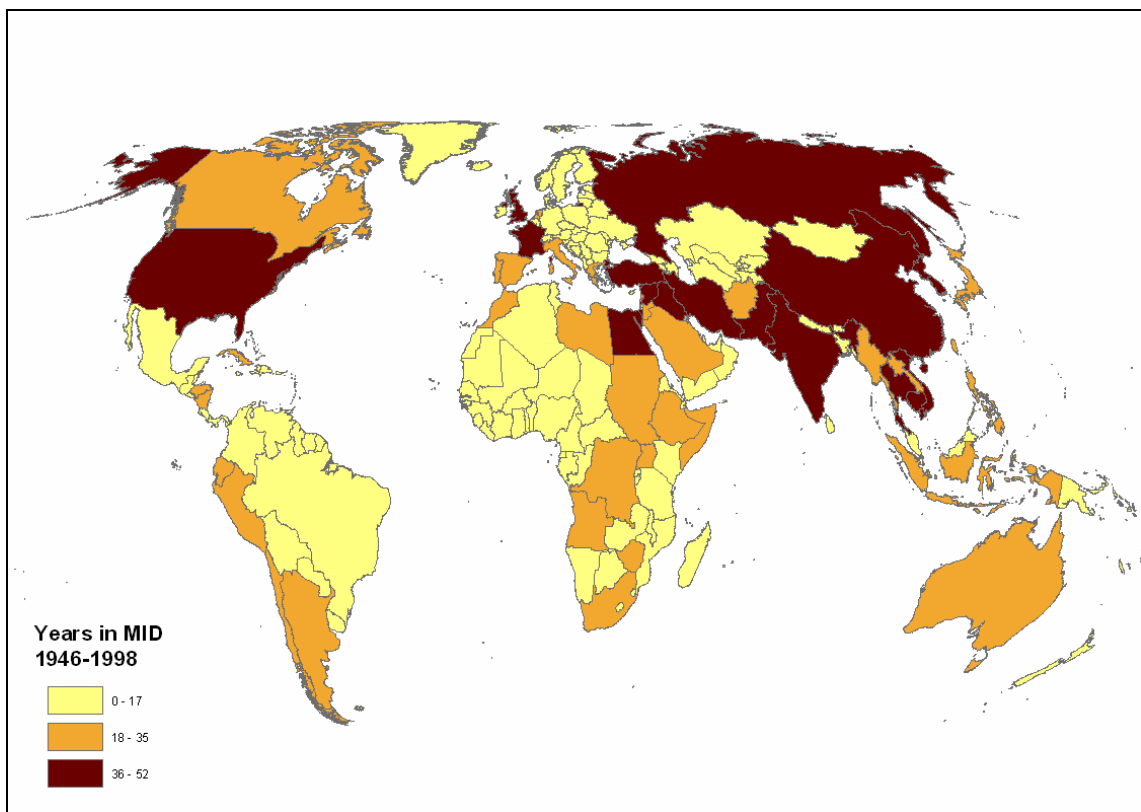
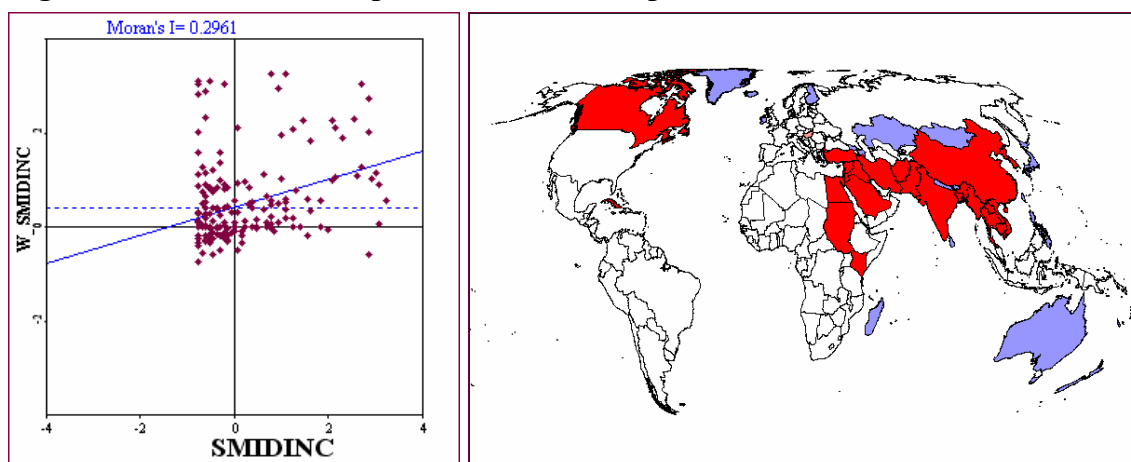


Figure 1–2. Moran Scatterplot and Cluster Map of MID Incidence, 1946–98

Note: The scatterplot shows the spatial association between a country's involvement rate in militarized interstate disputes (horizontal axis) and the average dispute involvement for contiguous countries (vertical axis) for the 1946–98 period. Axis values denote standard deviations from the sample mean. The rising blue line indicates substantial positive clustering at the global level. The map illustrates statistically significant ($p < .05$) negative (blue) and positive (red) local clustering of militarized disputes in the same period.

1.2.3. Does the relationship still hold?

The globalization debate has revitalized the position that distance and location are less important than they used to be, and that the integrity of territorial units – notably the nation-state – is being undermined. These are not new ideas. Wright (1942: 1241, n. 4) noted that geographical distance had declined in importance for cultural contact between groups “in relative importance with the invention of new means of transport and communication.” A major characteristic of globalization is technological innovation. Technological innovation reduces the cost of interaction, increases its speed, and increases the range of the vehicles of interaction. The exchange of goods, money, or information can be achieved at lower cost, but so can the exchange of ‘bads’ such as bombs or invading soldiers. A particular feature of recent developments is the crucial role of electronic infrastructure. Defense strategy is now as much about information technology and computer skills as about building better bombs. Hence, even states that do not possess long-range ballistic weapons may overcome the tyranny of distance by investing in jamming, propaganda, and electronic strike capabilities.

Figure 1–3 below offers a simple evaluation of the relationship between distance and international conflict over time. The dotted line shows that the average distance between all pairs of states increased from approximately 6,500 km in 1875 to nearly 8,000 km in 1998. This reflects the increasing number of independent states in the

world. The mean distance for conflicting dyads (solid line) assumes a third degree polynomial shape. The average disputing distance reached its maximum value in the mid 20th century – at the time of the Second World War and the Korean War – and has since declined to the level of the initial period. At no time, of course, did the average distance between the conflict dyads approach even close to the average dyadic distance, as would be expected by the death-of-distance argument of the globalization literature (see Cairncross 2000).

Figure 1–3. Mean Interstate Distance by Year, 1875–1998

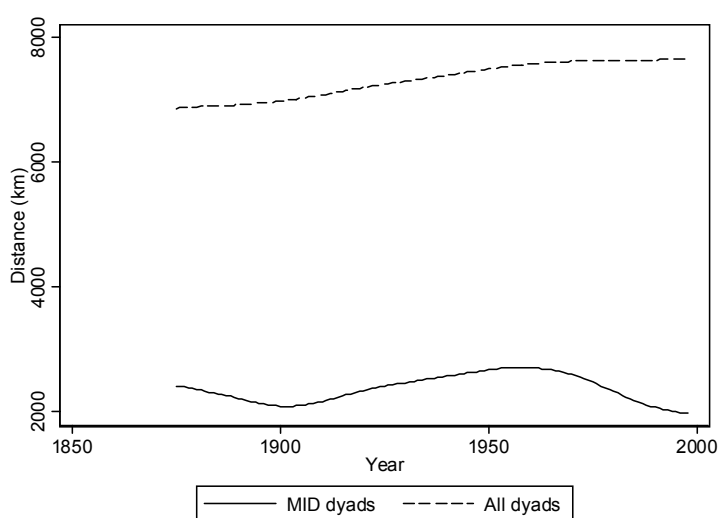


Table 1–1 presents a more rigorous test of the distance-conflict relationship. Here, the (logged) interstate distance variable is interacted with a proxy for globalization. The globalization variable gives the lowest ratio of trade to population in the dyad and is presumably highly correlated with other, less measurable aspects of globalization, including level and quality of the infrastructure and access to advanced military technology. Again, we see no effect of globalization on the association between relative geographic location and conflict propensity. Proximate and land contiguous states are significantly and substantially more likely to be involved in any kind of armed conflict than distant countries, and the impeding impact of distance is not affected by the extent of globalization.^{iv} A similar investigation by Gochman (1990), which looks at temporal trends rather than globalization per se, actually finds that geographic proximity has become *more* important with respect to the distribution of adversaries over time. This is true regardless of the level of hostility of the dispute.

Table 1–1. Geography, Globalization, and Interstate Conflict Incidence, 1875–1998

	MID		War	
	(1)	(2)	(3)	(4)
Interstate distance	-.284 ** (.018)		-.207 ** (.039)	
Interstate distance × globalization	-.047 (.026)		-.013 (.064)	
Land contiguity		2.460 ** (.055)		1.867 ** (.148)
Land contiguity × globalization		.075 (.235)		.234 (.600)
<i>N</i>	423,397	423,609	423,397	423,609

Note: Robust standard errors are in parentheses. Estimates for control variables and smoothing splines not shown. For a complete table output, see Buhaug & Gleditsch (2006). * $p < .05$; ** $p < .01$.

How can we explain this counterintuitive finding? The primary explanation lies in the fact that much of the globalization literature confuses absolute cost of interaction with relative cost. Absolute cost may decline with little or no impact on relative cost. If relative cost is what matters to interaction, the distance-interaction relationship should continue to hold up. Indeed, one of the big puzzles of macroeconomics is that there *is no* evidence of a decline in the distance coefficient over time (Obstfeld & Rogoff 2001). States continue to select their trading partners on the basis of geographic proximity. There is little reason to believe that negative interaction, such as disputes and armed conflict, should follow a dramatically different pattern.

A complementary explanation is that the aforementioned developments in technology are often not available to combatants. Modern weapons are extremely expensive and this has resulted in an increasing technological gap between the haves and the have-nots. Besides, while state-of-the-art equipment, such as stealthy aircraft, satellite navigation, night capability, and precision-guided munitions are undoubtedly progressive from a military point of view, it does not necessarily follow that armies equipped with such weapons are capable of fighting at longer distances than less advanced ones. Modern armies will, however, have a larger probability of winning the battle, and are likely to do so with fewer casualties (Lacina & Gleditsch 2005).

Geography is a persistent determinant of international relations. I have found no evidence that this relationship is about to fade, at least not with respect to interstate armed conflict. But there is another trend that has made the geography-interstate conflict nexus less interesting from an academic point of view: Whereas the dominant form of conflict in the first half of the 20th century was international war, conflicts are now increasingly internal in nature, being either armed challenges to state control by non-state actors or separatist insurgencies by minority groups. Since 1989, there has

never been more than two active interstate conflicts in any single year; the corresponding annual average figure for internal conflicts is 39 (Eriksson & Wallensteen 2004: 626, Table II). Our traditional understanding of geography and war is fast becoming obsolete, simply because international war is such a rare phenomenon, even among the sample of armed conflicts. The remaining parts of the dissertation concentrate exclusively on the association between geography and intrastate conflict, a topic that is more germane but less understood.

1.2.4. Geography and civil war

While theories of geography and interstate war focus on relative location and issues of territoriality, studies of civil war – to the extent that they consider geography at all – typically refer to such features as population size, rough terrain, and natural resources. There are few explicit links between the two literatures, largely because the two phenomena, interstate and intrastate conflict, are usually understood as being distinctly dissimilar, but perhaps also because few scholars adhere to both disciplines. The theoretical rationale behind the ‘geographic’ factors in studies of civil war is nonetheless quite similar to those that form the theories of geography and interstate war. This will be elaborated further in the next sections. First, however, I briefly review the theorized causes of civil war and how they relate to geography.

Armed uprisings by an organized opposition group against the government of a state – what usually precedes an all-out civil war – are assumed to be shaped by three necessary but individually insufficient factors: motivation, opportunity, and identity (Gurr 1970; Ellingsen 2000). Motivation (or frustration) is analogous to Starr’s (1978) willingness concept and typically refers to the growing gap between expected and actual need satisfaction (Davies 1962). What explains rebellion, then, is not as much absolute levels of poverty or inequality but the dynamics that exaggerate the (perceived) unfavorable conditions of a particular group. This traditional focus on relative deprivation has more recently been challenged by economic theories of civil war, which tend to emphasize personal ambitions, or ‘greed’, as the prime motivation for dissent, and where the rebellion is likened to criminal activity (Berdal & Malone 2000; Collier 2000; Collier & Hoeffler 1998, 2004; Grossman 1991).

Opportunity refers to the degree to which rebellion is a feasible means to redress the grievance (or to achieve personal profit). In the same manner as minor powers cannot fight each other by military means unless they are geographically proximate – no

matter the intensity of their motives – frustrated groups of society are unable to mount a serious challenge to the government if they lack the opportunity to do so. While various forms of opportunity exist, opportunities for financing a rebellion have received the most attention in the literature (Collier & Hoeffler 2004; Le Billon 2001b; Ross 2004a, b; Weinstein 2005). Possible sources of finance include the extortion of valuable natural resources, donations from diasporas, and subventions from foreign governments. A weak or failed state is a second important aspect that provides a window of opportunity to altering the status quo. Other relevant opportunity factors that have been considered include rough terrain, which might offer vital protection from government forces; access to foreign soil, which in addition to providing safe havens facilitates trade and smuggling; and specific contextual events, such as a neighboring conflict or a regime change, that alter the ease of rebel recruitment and the perceived probability of success.

The final prerequisite for rebellion is a common identity. Identity is the glue that maintains the coherence of the rebel group. Whenever the perception of having a common origin or fighting for a common cause is seriously weakened, the rebellion is likely to collapse (see Gates 2002a). Since states are assumed to constitute the natural source of identity for interstate interactions, this part is omitted from Starr's opportunity/willingness framework. A considerable civil conflict literature focuses on ethnic groups and ethnic conflict (e.g. Ellingsen 2000; Regan 2002; Reynal-Querol 2002; Sambanis 2001; as well as Gurr's (1993) Minorities at Risk project). These conflicts, which often take the form of separatism (hence the confusion in the literature between ethnic and separatist conflict), may start as intercommunal violence but can also be the product of deliberate actions by the government to change settlement patterns and exploit goods of the land of ethnic minorities (so-called sons-of-the-soil conflicts). However, a group's identity need not have a long history or be attached to any particular piece of land. A common desire (economical, political, or ideological) to change the dominant system may be sufficient. This is perhaps best exemplified by international terrorist groups, such as the Bader-Meinhof gang and al Qaeda, but is also descriptive of most coup d'états.

The mutual dependence between these factors means that increasing opportunities may contribute to reinforcing the feelings of a common identity by raising the awareness of the group's misfortune. For example, the discovery of oil off the coast of Biafra in the mid-1960s generated a mutual sense of relative deprivation and thus created a feeling of common identity among several smaller ethnic groups belonging to the Ibo tribe (in part due to an alliance between the two other dominant tribes in Nigeria to enforce the sharing of oil revenues). After the war, in which the Biafra rebellion was

crushed, several of these groups conveniently re-defined themselves as non-Ibo (Collier & Hoeffler 2002). The correspondence between increased British oil wealth (located in the North Sea) and a growing awareness of a unique Scottish nationality during the 1970s suggests a similar pattern. In that sense, geography may influence both the desire to alter the status quo, the opportunities and motives for support and sustained opposition, and the sense of a common identity.

1.2.5. Empirical findings of the geography-civil war nexus

With the exception of the economic literature on resource wealth and conflict, most empirical work treat geography merely as an opportunity factor; that is, it facilitates (or inhibits) the viability of rebellion. Three aspects, or geographic attributes of states, have received particular attention in this regard: country size, rough terrain, and natural resources. Larger countries – usually operationalized as populous countries – are considered to be more prone to internal conflict because larger populations are harder to monitor and control by a central government and because these countries contain a higher number of potential rebel recruits. This proposition has received massive support by several quantitative investigations. In fact, in Sambanis' (2004a) rigorous test of determinants of civil war since 1945, population size is one of only two covariates (the other is income per capita) that always come out with a significant estimate. Empirical evidence also suggests that population is positively associated with the duration of conflict (Collier et al. 2004; Fearon 2004), although this is a finding in search a proper theoretical explanation. One plausible reason is that population size captures the effect of country area, and thus indirectly the distance from the conflict to the government's stronghold: the capital city. In fact, much of the theorizing presented by Fearon & Laitin (2003) and Collier & Hoeffler (2004) draws on insurgency and guerrilla theories, which stress the importance of taking advantage of the rural countryside. Along this line of reasoning, conflicts in populous countries last longer because larger countries contain larger peripheral areas that favor guerrilla tactics. The link between population and duration may also partly be an artifact of selection bias and crude measurements. Since larger countries are more likely to have multiple overlapping conflicts, they are in conflict for longer periods at a time, which may create the (false) impression that conflicts in these countries last longer on average. Besides, the most widely used civil war datasets only include records of conflicts that generated at least 1,000 deaths, a figure that is less likely to be reached in conflicts in small countries (Sambanis 2004a).

The second geographic aspect that is thought to affect the general opportunities for rebellion is rough and inaccessible terrain. Dense forests provide cover from aerial detection and also hinder the movement of mechanized troops. Mountains, too, inhibit conventional warfare and offer vital hide-outs, as demonstrated by the unsuccessful US-led hunt for Osama Bin Laden in the Afghan mountains in late 2001. This, as well as numerous other cases, illustrates how military inferiority can be counterbalanced by taking advantage of the opportunities offered by the terrain. It may come as a surprise, then, that large-N empirical studies have generally failed to demonstrate a systematic relationship between the extent of rough terrain and the risk or duration of civil war (see e.g. Collier & Hoeffler 2004; Collier et al. 2004; Sambanis 2004a). Fearon & Laitin (2003) do actually find a positive and significant effect of mountainous terrain on the risk of civil war, but this analysis differs from the others by using a logged mountain variable. Whether this procedure is superior to using the raw terrain data is open to debate, but there are other and more fundamental problems with all of these measures that might explain the lack of empirical support (see next section).

Arguably the most controversial part of the geography-civil war nexus is the assumed links between natural resources and risk of armed conflict. A major divide runs between those who claim a causal relationship between resource scarcity and conflict and those that stress the hazardous effect of resource abundance. The former group, which is often referred to as the neomalthusians, focuses mostly on renewable resources (water, soil), is usually occupied with future scenarios, and tends to apply selected case studies to demonstrate their case (see e.g. Homer-Dixon 1999). In contrast, the abundance literature more often uses quantitative investigations to explore how abundance of certain valuable, non-renewable resources (in particular minerals and fuels) makes conflict more likely (see Ross 2004a for a review). The two theoretical stands are actually less incompatible than it might seem as they speak of different types of resources and at different scales. It is quite possible to imagine that local abundance of a globally scarce resource is particularly likely to be associated with looting and general domestic instability. Indeed, it is largely the relative scarcity (the ratio between demand and supply) at the global level that determines the value of a given commodity. Nonetheless, in the following, as well as in subsequent chapters, I limit the discussion of natural resources to the role of highly valuable commodities, such as gems, fuels, minerals, and drugs.

For at least two reasons, precious commodities are expected to increase the risk of domestic instability; they tend to be associated with ineffective and corrupt regimes (part of the grievance argument) and they may provide a source of finance for emerging

rebel groups (which is usually referred to as opportunity or greed, see Collier & Hoeffler 2004). Several recent conflicts, in particular those in Western and Central Africa where alluvial diamonds play a central role, seem to validate these expectations. The results from quantitative investigations are less conclusive, though. For example, Collier & Hoeffler (2004) find strong and consistent evidence of a positive but parabolic association between a country's dependence on primary commodities and its likelihood of experiencing a civil war. Other studies, using the same resource proxy but different research designs, have generally failed to reproduce this finding (Elbadawi & Sambanis 2002; Fearon 2005; Fearon & Laitin 2003). Studies that differentiate between resource types are more supportive of the resource curse argument, where oil wealth in particular appears to have a harmful effect (de Soysa 2002; de Soysa & Neumayer 2004; Fearon & Laitin 2003; Lujala et al. 2005). The influence of natural resources on the duration of conflict is also inconclusive. Collier et al. (2004) find no individual effect of their resource dependence proxy. In contrast, Humphreys (2005) concludes that natural resources are associated with shorter wars whereas Fearon (2004) and Buhaug et al. (2005) report that conflicts where the rebel group exploits contrabands last considerably longer.

1.2.6. Shortcomings of previous work

As the preceding section has shown, the link between geography and civil war appears to be quite weak, and geography, as it is usually defined, certainly plays a less prominent role in explaining internal conflict than interstate war. Be that as it may, two significant shortcomings in contemporary empirical work render most conclusions regarding the geography-civil war relationship premature, if not outright false. The first problem is that a majority of the studies fail to distinguish between different types of conflict. While this may seem like a trivial flaw, there are good reasons to suspect that it might in fact have a considerable impact on the findings. For example, consider the 1973 military coup in Chile and the prolonged Palestinian struggle in Israel. Both are serious events that have caused several thousand deaths (although only the former qualifies as a civil war, according to the Correlates of War project, as it generated more than 1,000 deaths in a single calendar year). One of these conflicts was initiated by the military elite, largely in reaction to a deteriorating economy, massive strikes, and sporadic public violence. The other is perhaps best characterized as urban guerrilla warfare by an ethnic minority against an established state, and where the very existence

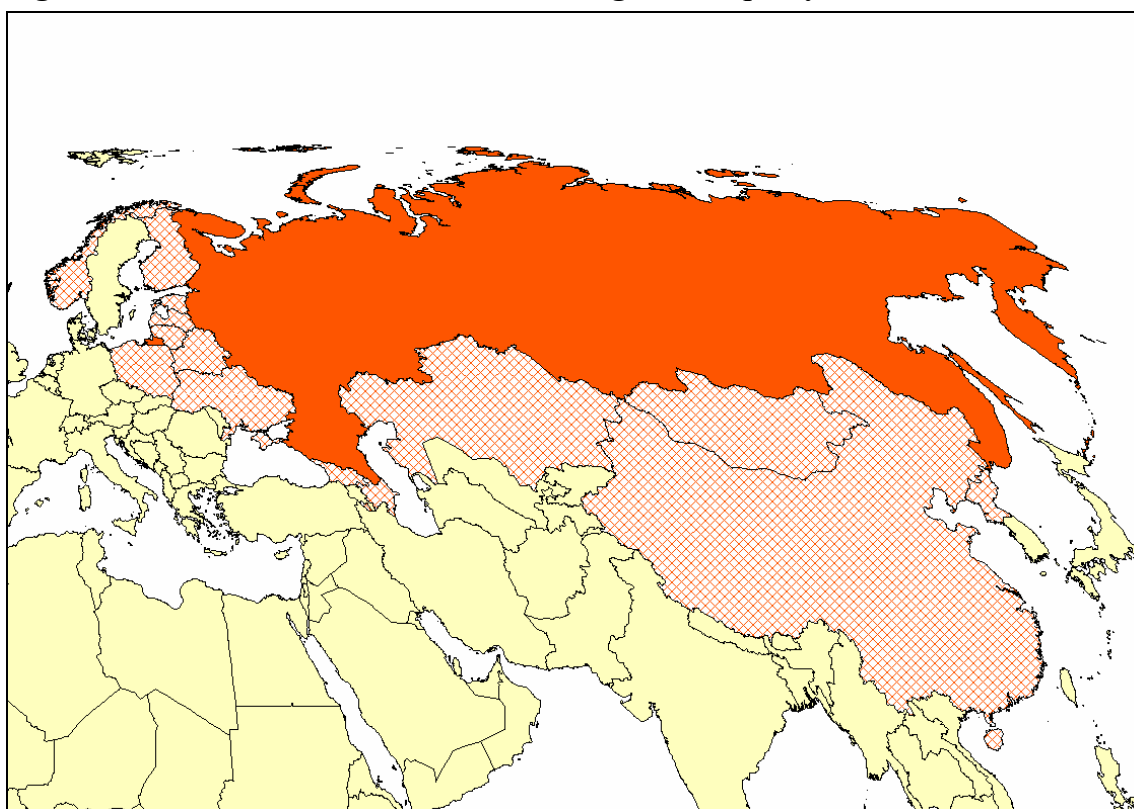
of the two nations in conflict is at stake. Although these cases may have several issues in common, the differences are certainly more apparent. Why, then, should we expect these wars to be shaped by the same factors and in the same order of importance – which is in fact the inevitable (if inadvertent) assumption when they are grouped together in one statistical model? This issue will be dealt with in more detail in Chapters 2, 4, and 6 in particular, where I demonstrate that conflicts over a central government and conflicts over independence for a limited piece of territory indeed display different causal mechanisms.

The second flaw that renders previous findings less credible than we would like to think concerns the scale of measurement. The theories and hypotheses about geography and conflict often speak of sub-national or local conditions. For example, according to the so-called greed proposition, valuable natural resources may provide an important source of finance for rebel groups. This is usually tested by estimating the statistical association between a country's resource wealth and its involvement in civil war. The problem is, even though a highly resource-dependent country hosts a rebellion, that need not imply that the rebel group (or government forces for that sake) exploits the commodities. Although Russia has significant diamond fields as well as an ongoing secessionist war, few would claim a causal link between the two. The reason is simple; the resources are located in Siberia and the conflict in Chechnya. A similar problem concerns the empirical evaluation of the rough terrain hypothesis. While the theory simply states that inaccessible terrain favors guerrilla tactics and hence that militarily inferior rebel groups should prefer to operate in such terrain if possible, quantitative investigations exclusively use measures of rough terrain in the country as a whole. Even if we manage to uncover a systematic relationship between a country's share of mountainous terrain and its propensity for conflict, we do not know whether this confirms our hypothesis or whether terrain merely captures the effect of a correlated factor that is not controlled for. See Chapters 5 and 6 for a more extensive discussion on this matter.

An unfortunate consequence of failing to study conflict at the appropriate level is that the potential importance of location is ignored. This is particularly troublesome if we want to understand the dynamics of conflict: why some civil wars last so much longer than others and why some spread to neighboring countries while others are maintained within the boundaries of the state. For example, it seems fair to assume that the Russian civil war in Chechnya is more likely to ignite conflict in other countries in the Caucasus region than spread to the Nordic countries. Nonetheless, as long as we *de facto* use countries, not conflicts, as the focal point of data generation, our analyses are

unable to account for the spatial association between units and we are likely to end up with a situation as illustrated in Figure 1–4, where the expected impact of a conflict is identical for all neighbor states. In several of the chapters in this dissertation, as well as in Buhaug et al. (2005), the role of relative location is further investigated. To anticipate the content of the subsequent section, the solution to these problems is to disaggregate the study of civil war.

Figure 1–4. Civil War in Russia: Are All Neighbors Equally Affected?



1.3. Disaggregating the Study of Civil War

This project has been motivated by the all too often overlooked fact that civil wars are sub-national events that rarely span throughout the conflict-ridden countries. Undeniably, some of the most important factors in explaining the occurrence of intrastate conflict, such as low rates of GDP per capita income and lack of democratic institutions, only make sense when we treat the country as a single political entity. But if we are to explore the influence of such factors as environmental scarcity, population

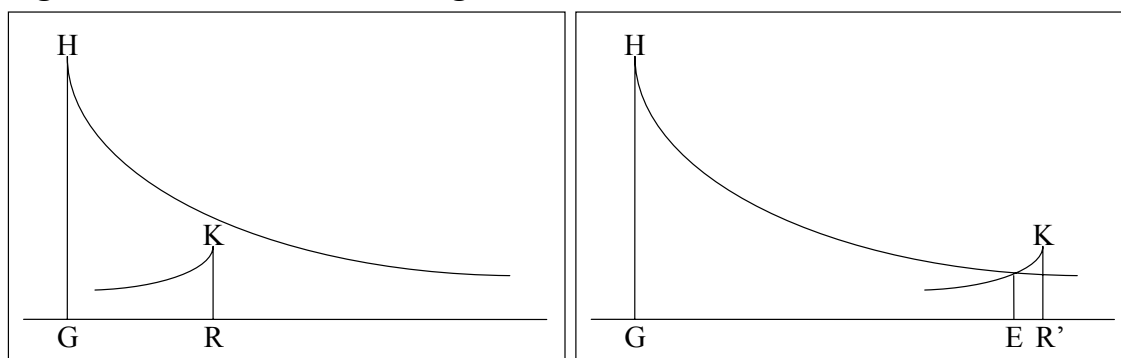
pressure, resource availability, ethnic composition, terrain, and even unemployment rates, education levels, and economic inequality, we need to break out of the ‘territorial trap’ (Agnew 1994) and develop research designs that are able to account for local conditions. A similar trend is already visible within the quantitative study of human behavior by geographers (O’Loughlin & Witmer 2005).

As previously mentioned, theories concerning the impact of resource wealth and rough terrain on the onset and dynamics of conflict actually presume a disaggregated, or local, level of analysis. But two other forms of opportunity for rebellion, namely atypically low cost and social cohesion (see Collier & Hoeffler 2004), are also likely to vary in intensity from one sub-national region to the next. Therefore, if rebellion is indeed more probable when foregone income is low (which is associated with e.g. unemployment, low school enrolment, availability of cheap arms, and weak government) and the population is ethnically homogenous (which reduces coordination cost), it should emerge most often in the sub-national regions that best fit these characteristics. This is consistent with the literature on relative deprivation, and also corresponds to Horowitz’ (1985) observation that poor regions are the leading secessionists.

Some researchers have noted that contemporary conflicts often occur in the rural periphery (Collier & Hoeffler 2004; Fearon & Laitin 2003). In addition to remote locations generally being less economically developed and more likely to contain a minority population with detached identity structures, the sheer distance to the center of state power implies that the government is less able to exert full and unlimited authority. This brings us back to Boulding’s (1962) seminal work. The capability of a country (i.e. its ‘national strength’) is largest at its home base and declines as the nation moves away. The extent of decline by distance may vary from one country to the next and is determined by the loss-of-strength gradient (LSG). While this model is discussed solely within the context of international conflict, it is easily applicable to the study of civil war. Imagine, as illustrated in Figure 1–5, that we have a government with a home base (the capital city) at G and a rebel group with its base R at some distance from G. The maximum home strength of the government, measured by line GH, is clearly superior to that of the rebel group, RK. The strength of both parties decline as they move away from their home bases; the maximum amount of projected power for a given distance from the base is given by the slopes from H and K, respectively. Let us suppose that the rebel base is relatively proximate to the capital, as illustrated in the left panel. Evidently, the rebel group falls within the government’s sphere of influence – its maximum home strength is less than the government’s projected strength at R. If a rebellion were to

occur here, it would be a swift one with absolute government victory. Now, suppose instead, as on the right, that the rebel group is based at a considerable distance from the government. Here, the projected power of the government is less than the maximum rebel strength at its base R' . In fact, the government's authority ends at E , the point of equal strength, beyond which the rebel group is dominant. A rebellion at R' , then, is likely to end with considerable government concessions.

Figure 1–5. Relative Rebel Strength as a Function of Distance



The horizontal line that separates the government and rebel bases represents not only geographic distance but all sorts of factors that might affect the LSG, including type of terrain, level of infrastructure and logistics capabilities, extent of local support, and moral. Therefore, a rebel group that resides in an otherwise favorable region is able to mount a revolt closer to the capital than a group in a less advantageous area, all else being equal. From this follows that civil war is most probable in poor, weak, and failed states, in which the national home strength is comparatively small and the regime's LSG is overwhelming. The model further explains how rebel groups are able to push further towards the capital – or manage to gain increasing levels of self-determination – as they grow stronger.

A major advantage of most rebel groups, and certainly separatist movements, is that they decide where the conflict occurs. The strategic decision will be based on such factors as aim of the rebellion, ease of rebel recruitment, financing opportunities, type of terrain, and an assessment of relative military effectiveness (see Gates 2002a and Buhaug et al. 2005). If the group is vastly inferior to the government side, it must take advantage of any possible factor that might decrease its LSG and increase the discount factor of its opponent. This might mean establishing bases in the mountains or behind national borders, limiting the area of operation to rural districts where the rebellion

enjoys local support, and generally conduct hit-and-run assaults.^v If irregular insurgents were to engage in open encounters with regular military forces, they would lose (Mueller 2001). However, hiding in the mountains also means that the guerillas are unable to inflict real damage to anything other than isolated government outposts and local civilians; thus, secession may be the only realistic aim of the peripheral rebellion. A relatively stronger rebel movement might be able to establish strongholds in regional centers and will be less dependent on rough terrain or safe havens in neighboring countries. Only the strongest revolutionary groups – usually involving some, if not all, branches of the regular armed forces or otherwise enjoying massive and widespread public support – are able to challenge the government on its home ground.

The LSG model and Figure 1–5 also offer some insight on the dynamics of conflict, and on the duration in particular. As Fearon (2004), Buhaug et al. (2005), and Chapter 5 demonstrate, separatist conflicts usually last considerably longer than other forms of rebellion. This is presumably because secessionist movements emerge along the rim of the country, far from the capital city. In such cases, the regimes should be less worried about losing their hold on power, and the conflicts are also likely to be perceived as less costly than if a revolutionary rebellion were to occur (unless the disputed territory is associated with exceptionally high economic or cultural value). As a consequence, separatist conflict is less likely to be met with the complete and utter force of the regime; the stakes are simply not high enough. This implies that self-determination movements need not be particularly large or militarily capable to counterbalance the projected government force. In fact, since secessionist groups tend to be quite small, and the LSG combined with substantial conflict-capital distance ensure that allocated government forces are equally feeble, neither side may be able to destroy the other completely. The result is protracted peripheral insurgency.^{vi}

1.3.1. Geo-referenced conflict data, Mk I

Any systematic attempt to investigate the role of relative location and the influence of local conditions requires geo-referenced data on a finer resolution than the country. No such data were available when this project was initiated; hence, a major challenge at the outset was to collect and add spatial information to a forthcoming database on conflicts, the Uppsala/PRIO Armed Conflicts Dataset, or ACD (Gleditsch et al. 2002). To develop such data, a necessary starting point is to formulate a precise definition of a conflict zone. What do we mean when we talk about zones of conflict – which areas are

relevant, and which should be excluded from our operationalization? Given the limited time until the release of the database, and also in part to facilitate user friendliness, I deliberately sought simplicity over richness. Accordingly, the conflict zone is simply defined as consisting of all localities of fighting between the opposing parties to the conflict as well as all rebel-held territories in the conflict-ridden country. This definition thus excludes areas that might be severely but indirectly affected by the conflict, due to e.g. migration or a collapsed state economy. It also excludes all territories beyond the boundaries of the country in conflict, even if battles occurred on the soil of a neighbor state or the rebel group operated from bases across the border.

Next, how to operationalize, or code, the conflict zones had to be determined. Given that the location data were to be included in the ACD database, it did not leave much leverage with respect to the format of the data. Again, simplicity was preferred to accuracy. The geographic scope of the conflict is operationalized as the smallest possible circle that encompasses all reported locations of battles and all known rebel-held areas during the course of the conflict. In the database, this is represented by latitude and longitude coordinates, denoting the mid-point of the conflict circle, and a radius variable (rounded upwards to the nearest 50 km), reflecting the geographic extent from the centroid. See Chapter 3 for further details.

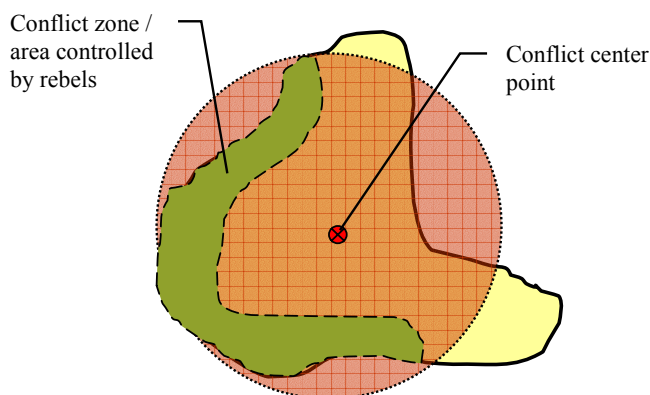
Prime sources of information on the location of the battle-fields were the archives of the Uppsala Conflict Data Program (UCDP) at the Department of Peace and Conflict Research, Uppsala University,^{vii} as well as Tillema (1991) and various volumes of *Keesing's Records of World Events*. The accuracy of the information varies greatly from one case to the next, depending on the nature of the conflict and on the reliability of the available information. Some conflicts – in particular the ones in the least developed parts of the world and those that occurred early in the period (late 1940s and 1950s) – are sparsely documented. In these cases, an administrative region or even the entire country may be the best possible estimate. Other conflicts may be pinpointed down to specific cities and villages. On the whole, however, the location data give a reasonable account of the whereabouts of the armed conflicts, below the scale of the country. Accordingly, these data allow testing hypotheses that relate to aspects of the conflict, rather than the country. For example, do insurgencies generally occur in the peripheral and inaccessible parts of the country, as predicted by guerrilla theory (Guevara 1969)? And do conflicts in resource-rich countries overlap the extraction sites of the commodities? Geo-referenced data are already available on such potential explanatory factors as population density, land usage and degradation, precipitation levels, and forest cover and mountainous terrain, while another PhD project at NTNU

(also associated with CSCW) has developed spatial data on the distribution of certain gems, minerals, and fuels (see Lujala et al. 2005). In Chapter 5 and 6, these data are used to explore the geographic characteristics of intrastate conflicts. The conflict location data further enables the researcher to consider the role of location of the conflict relative to the center of state power and neighboring states, which may contribute to explaining why some conflicts last longer than others and why some countries are infected by neighboring conflicts whereas other neighbor states remain at peace (see Buhaug et al. 2005 as well as Chapters 3, 4, and 5).

1.3.2. Geo-referenced conflict data, Mk II

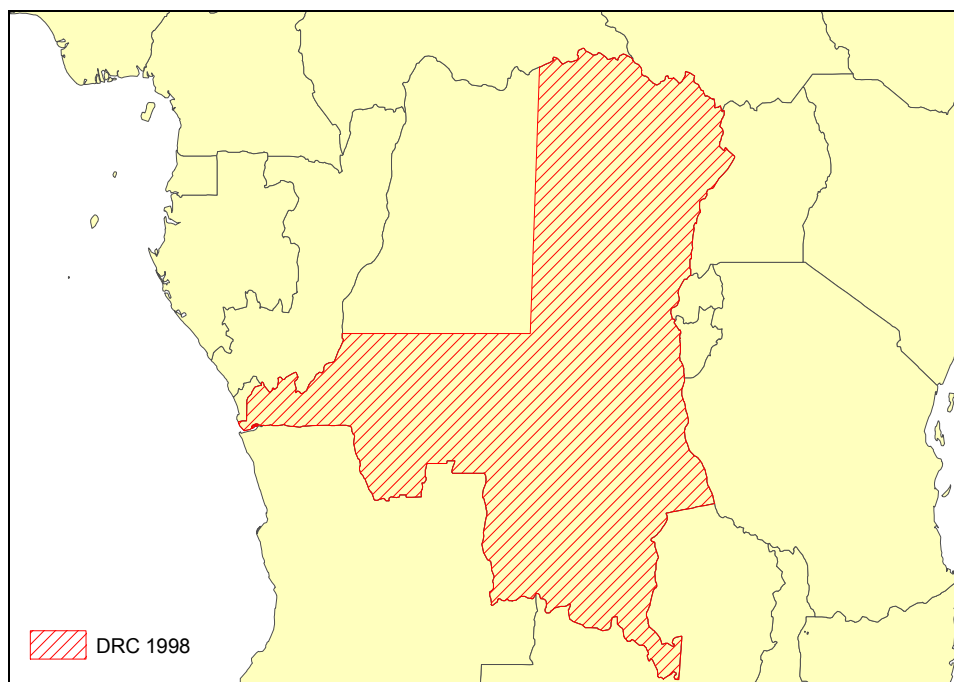
While the initial version of the location data constitutes a significant improvement over alternative datasets when it comes to exploring geographic aspects of armed conflict, the crude nature of the operationalization is not unproblematic. For example, imagine a civil war that takes place mainly along the borders a country (Figure 1–6). In this situation, the geographic midpoint of the conflict circle would be near the center of the country – outside the area directly affected by the conflict – and the total area of the coded conflict zone vastly overestimates the true area of the conflict. This also implies that (in this case) the distance from the centroid of the conflict circle to the capital city is a rather poor indicator of relative location. This example represents a worst case scenario (most conflicts that occur along the rim of the country actually tend to be quite small in geographic terms), but nonetheless points to an area of possible improvement.

Figure 1–6. Why the Circular Conflict Location Data May Be Problematic



A second problem with the initial version of the location data is due to the structure of the ACD. Since the conflict database contains only one record per conflict (unless it includes a major shift in participants on one or both sides to the conflict, involves a military intervention by an outside actor, or re-emerges after a lull, see Gleditsch et al. 2002), the location data must represent the maximum extent reached during the total course of conflict. This may be substantially different from the scope of the conflict in its initial phase, which is probably what we would want to measure if we were to study the impact of local conditions on the dynamics of conflict (otherwise, we might fall prey to issues of endogeneity). That said, this problem is less severe than one might imagine since a large majority of the conflicts reach their maximum geographic extent during the first year of fighting.

Because of these shortcomings, I have started developing more refined location data (see also the ongoing work of Raleigh & Hegre 2005). Based on the same sources of information as referred to above and through extensive use of Geographic Information Systems (GIS), each intrastate conflict is represented by one or more polygon(s).^{viii} Figure 1–7 shows the polygon for the civil war in the Democratic Republic of the Congo in 1998. This conflict occurred predominantly in the peripheral southern (Katanga) and eastern (Kivu) regions of the country whereas the (similarly peripheral) northwest and, to a lesser extent, the urban western parts have been spared. In this case, the polygon is clearly better able to represent the geographic scope of the conflict than the crude circle, which inevitably covers the entire country. Moreover, as conflicts occasionally display large dynamics with respect to the loci of the battle-fields over time, the GIS version can store multiple consecutive representations of each conflict. A preliminary version of the GIS conflict data is used in the disaggregated analysis in Chapter 6.

Figure 1–7. Conflict Polygon for D. R. Congo, 1998

1.4. Content of Dissertation

This dissertation consists of five independent but related research papers. All investigate some aspect of the geography-civil war relationship and all include novel empirical analyses with disaggregated conflict data, but the extent of disaggregation and the context of the research questions differ between them. In Chapter 2, I argue that there are important distinctions between different types of civil war, and that the conventional procedure among large-N comparative studies to treat conflicts as one homogenous group is likely to produce biased or even misleading results. Moreover, while some previous work has made a distinction between ‘ethnic’ and ‘ideological’ wars, this classification is problematic for a number of reasons. Instead, I propose to separate between conflicts based on the stated aim of the rebellion; whether to gain increased levels of self-determination for the aggrieved group (territorial conflict) or to change the composition of the government and see through political reforms (governmental conflict). While strong and capable regimes are expected to be particularly able to deter challenges over state authority, certain geographic factors, such as population size, rough terrain, resource abundance, and ethnic diversity, are expected to have a larger influence on territorial conflicts. An empirical analysis of the onset of 214 intrastate

conflicts between 1950 and 2001 offers strong and robust evidence that the two types of conflict are indeed associated with different causal mechanisms.

Chapter 3, which first appeared in *Journal of Peace Research* (Buhaug & Gates 2002)^{ix} and was later reprinted in Diehl (2005), is the first systematic attempt to explore the spatial attributes of civil war and the first analysis to use geo-referenced conflict data on a sub-national level. Drawing on classic geopolitical thoughts as well as contemporary theories of civil war, we argue that physical characteristics of countries and the aim of rebel groups play a considerable role in determining the location and scope of armed conflicts. In particular, separatist and ethnic conflicts in large countries are expected to occur at a considerable distance from the center of the state. Conflicts close to the border, in resource-rich, mountainous, and forested regions, as well as long-lasting wars and wars in sizable countries should cover the largest geographic area. Both OLS and simultaneous equation models offer considerable support to the outlined propositions while also demonstrating substantial dependence between scope and location.^x

Chapter 4, which is a manuscript co-authored by Kristian S. Gleditsch^{xi}, seeks to shed some light on a rarely acknowledged characteristic of armed intrastate conflicts, namely their tendencies to cluster in space. While most studies of civil war exclusively consider domestic factors, those that investigate and report indications of spatial dependence among conflicts generally fail to explain the origins of these findings. One explanation could be that factors associated with increased risk of conflict are distributed in a similar manner, and consequently that there is no neighborhood effect of conflict whenever these factors are accounted for. However, the clustering may also reflect a contagious nature of civil conflicts. Refugee flows, cross-border rebel sanctuaries, access to cheap arms, smuggling, and transnational ethnic linkages may all function as important mechanisms of diffusion, and particularly so regarding separatist insurgencies. Using new data on the location of conflicts relative to neighboring countries, as well as a variety of indicators of neighborhood characteristics and interaction opportunities, we show that civil wars do increase the risk of conflict in the neighborhood. However, the contagion effect – which is mainly a characteristic of territorial conflicts – seems to be of a weakest link type rather than following the principle of least effort, and the risk does not increase proportionally with the number of proximate conflicts. This is taken as suggestive evidence that transnational identity linkages constitute a vital means of influence, although poor data thwart a more comprehensive investigation of this association at this stage.

In Chapter 5, which was published in *Political Geography* (Buhaug & Lujala 2005)^{xii}, we review contemporary empirical work on geographic aspects of civil war and show how conventional research designs and applied measures often are unsuitable to test the proposed causal linkages. While statistical analyses are conducted at the scale of the country, theories frequently refer to local conditions and local relationships. We then demonstrate how GIS can be used to generate precise measures of relevant space-varying factors at the desired sub-national scale. A comparison of various country- and conflict-specific geographic features reveals significant differences. Conflict zones on average have a lower share of rugged and forested terrain than the host countries, and nearly half of the conflicts in resource-rich countries do not overlap the resource deposits. Moreover, a duration analysis of civil war shows that the performance of several covariates is indeed dependent upon the scale of measurement. This demonstrates that country averages are poor approximations for characteristics of the corresponding conflicts.^x

The manuscript that constitutes the final chapter of the dissertation, co-authored by Jan Ketil Rød^{xiii}, is the first truly disaggregated study of civil war. Based on prevailing theories of insurgency and the insights offered by the previous chapters, we present seven hypotheses on the relationship between local geographic attributes and the risk of civil war. All else being equal, conflict is expected to be more likely in regions that are sparsely populated, far away from the country's capital city, adjacent to neighbor states and valuable resource deposits, with a high share of rough terrain, with poorly developed infrastructure, and with local dominance of a minority language. These hypotheses explicitly require a sub-national level of analysis; hence, the country is discarded in favor artificial grid cells as the units of observation. Controlling for regime type and economic development, we find considerable evidence that local geography matters. Armed revolts in remote regions with a small minority population are likely to take the form of secessionist insurgency whereas rebellion in urban areas, proximate to lootable diamonds, more often seek government control.

1.5. Conclusions

1.5.1. What have we learned?

This project was motivated by a need to develop better data and research designs in order to evaluate extant theories on the nexus between geography and civil war in a more appropriate fashion. A key challenge in this regard has been to collect spatial conflict data and generate relevant measures of explanatory factors at a sub-national scale. In addition, the project has sought to widen our understanding of geographic aspects of armed conflict, where issues of location relative to the state center, neighbor countries, and other conflicts, as well as the scope of the conflict zone have been of particular interest. The project has both adopted and modified prevailing hypotheses and made use of classic theories of international relations to formulate specific expectations about local determinants of civil war. These have then been tested in a variety of empirical settings, ranging from the onset of conflict at a disaggregated level, via estimation of regional clustering and diffusion of conflict, to duration models. So, what have we learned?

In my own view, the single most important finding of this project is that the type of conflict matters. This is not because it was unexpected, which it really was not, but rather because so much of contemporary work on civil war is unaware of this fact. In all reported models throughout this dissertation, conflicts that concern access to state authority stand out as significantly different from self-determination conflicts. In addition, the models that are estimated separately for the two types of conflict demonstrate largely dissimilar causal patterns. For example, country size (both country area and population size), ethnic polarization, and neighboring separatist rebellion are all positively associated with the risk of territorial conflict but fail to influence the likelihood of governmental conflict, all else held constant. Economic development, too, has a substantially stronger – albeit negative – effect on the risk of territorial conflict. Democracy level is found to have a parabolic effect on the likelihood of governmental conflict, where institutionally inconsistent regimes are most at risk, whereas it has a positive and linear effect on the risk of territorial conflict. Moreover, I show that cross-border contagion is predominantly a characteristic of separatist wars.

In general, models of territorial conflict perform substantially better than governmental conflict models. Territorial conflicts are to a greater extent shaped by structural and contextual factors that can be measured across countries and over time.

Few of the most popular explanations for civil war found in the quantitative literature are strongly and robustly associated with the outbreak or duration of governmental conflict. This has an important implication as it calls for a more careful development and re-development of theories of civil war that explicitly acknowledge the heterogeneous nature of armed conflict.

A second significant insight offered by the work presented here is the influential role of location. Through the generation and use of spatial conflict data, I have been able to explore geographic aspects of civil war at a higher level of precision than what has been done in earlier work. Most importantly, I demonstrate that the distance to the center of state power is a strong determinant of risk, type, duration, and indirectly also diffusion of conflict. Displeased groups in remote parts of the country are likely to see secessionism as a more viable strategy to redress their grievance than attempting to topple the regime. Once underway, conflicts in peripheral areas are considerably harder to end within a short period of time. To some extent, this is due to characteristics unique to separatist conflicts (for example, questions of nationality and the right to self-determination may be harder to compromise on that issues relating to specific policies and the composition of the ruling government), but results presented here and elsewhere (see Buhaug et al. 2005) suggest that relative location is a much more powerful factor. Moreover, I show that areas along the country boundaries are more at risk of civil war. This is consistent with the opportunity explanation of rebellion, where neighboring territories are presumed to offer vital rebel sanctuaries and facilitate trade and smuggling.^{xiv} Surprisingly, the effect of the distance to the conflict zone on the risk of conflict in neighboring states works only indirectly, as conflicts proximate to neighbor states are likely to be over secession.

The joint inference from the various papers in this dissertation should inspire a revival of interest in the classic literature on geography and international war, and in particular Boulding's (1962) seminal work. The simple, yet elegant loss-of-strength model, which is usually (and successfully) used in studies of interstate conflict, has also stood the test of contributing to our understanding of intrastate conflict. As elaborated upon in section 1.3 and verified by the empirical investigations in subsequent chapters, the LSG model may be applied to such diverse assignments as explaining the risk, type, location, and duration of civil war. No countries are exempt from the risk of civil war. Even the richest and most technologically advanced countries are likely to host a number of dissents at any given time. Whether and when they decide to organize and mount a rebellion will depend not only on the intensity and form of the grievance but also on contextual and case-specific factors (such as the emergence of an

entrepreneurial leadership). What the LSG model tells us, however, is that unless the aggrieved group is very large (which is extremely unlikely in liberal democracies) or draws on support from the regular armed forces, the rebellion will occur in the remote countryside and involve demands for increased autonomy or secession. Contemporary events in the UK (Northern Ireland), France (Corsica), and Spain (the Basque region) serve as relevant examples. Moreover, due to the high political costs of waging a war against its own population, separatist insurgencies in democracies are less likely to be crushed immediately and more likely to be met with a combination of limited military operations and negotiations.^{xv}

As a final and more general contribution, this project has demonstrated the inaptness of using aggregated data to explain local phenomena. Prevailing theories of insurgency and guerrilla warfare, which feature so prominently in contemporary studies of civil war, stress the importance of having peripheral areas of operation, establishing inaccessible bases in the mountains or behind national boundaries, gaining superior knowledge of local conditions, and generally taking advantage of any available factor, be it valuable contrabands or an oppressed minority population, in its struggle against the regime. To the extent that these elements have been accounted for in previous empirical investigations, they are proxied by characteristics of the country of observation. This dissertation presents evidence that several of the applied indicators are poor representations of the real thing. To solve this incompatibility in scales between theory and measurement, we need to make use of Geographic Information Systems software. GIS not only facilitates data generation but also an increasing range of analytical methods. Exploratory spatial data analysis and spatial regression are still in their infancy within the context of peace studies (see Starr 2002 and Ward & Gleditsch 2002 for notable exceptions) but should provide invaluable contributions to the field in the future.

1.5.2. Recommendations for future research

Having briefly summarized the main insights offered by this project, the natural follow-up question remains: Where do we go from here? One obvious challenge is to collect better disaggregated data on factors commonly assumed to influence the risk and dynamics of armed conflict. Among these factors, the geographic distribution of ethnic groups should be considered top priority. Prevailing theories on ethnic insurgency describe how the opportunity for rebellion is affected by settlement patterns. Gates

(2002a), for example, argues that rebel recruitment is easier and waging a rebellion less costly if the principal (the rebel leader) can recruit among geographically proximate individuals belonging to the same ethnic group. This corresponds to Fearon (1998), who states that minority groups that are geographically concentrated will have an easier time seceding from the majority population, possibly even without military means (as demonstrated by the peaceful separation of Czechs and Slovaks in 1993).

Economic and social inequalities constitute another potentially important factor that needs to be measured below the scale of the country. Data released by the Demographic and Health Surveys (see <http://www.measuredhs.com/>) provide a good starting point. These data are available for a large number of countries and are collected for individual households. What makes this a particularly promising source is that each household is registered with geographic coordinates, which may then be used to generate aggregate measures on education, standards of living, infant mortality rates, etc. at the desired level of analysis. Yet, these data are far from complete as the surveys for obvious reasons are generally not conducted in areas with widespread violence. Data are also missing for most of the developed world.

A third factor that should be dealt with in the near future is gathering and analyzing data on the location and spread of refugees. Refugee flows are normally considered a byproduct of armed conflict, but recent events, including the conflicts on the Balkans and in the Great Lakes region, suggest that transnational population movements may also be a causal factor in the equation. For example, refugee flows may contribute to the spread of conflict by putting severe strains on available resources in the host country, which can exacerbate economic competition between communities; they may change the ethnic composition of the receiving country and thus spur ethnic hatreds; they may carry arms and ideologies conducive to violence; they may encourage organized opposition directed towards their host country as well as their country of origin; and they may provide funding for sustained opposition at home (see Salehyan & Gleditsch 2006). All these mechanisms are likely to be particularly influential at the local level, i.e. in the sub-national regions where the refugees are accommodated.

The conflict data also need to be improved in order to better capture the spatio-temporal dynamics of individual conflict zones. Moreover, we need to study and understand civil war as repeated interactions between a state actor and individual rebel groups, while considering potentially intervening factors such as competing dissident movements, transnational linkages, and outside mediators. Work along this path has already been initiated through the conference on ‘Disaggregating the Study of Civil War

and Transnational Violence^{xvi}, sponsored by the University of California Institute of Global Conflict and Cooperation (IGCC), and the emerging intra-European network on Geographic Representation of War (GROW-Net).

Disaggregated data on civil war and conflict-promoting factors further facilitate the development of prediction models. Within Geology, so-called hazard maps are used extensively to identify areas exposed to certain natural hazards, such as avalanches and land slides. Admittedly, such hazards are easier to predict than civil wars. For example, the terrain needs a certain minimum degree of slope (approximately 30°) for an avalanche to be possible, and there is also a maximum level of slope (about 55°), beyond which snow never attaches to the mountain side in sufficient amounts to constitute a risk. In addition, you need to consider such environmental factors as temperature, precipitation, and wind, but not much else. Armed conflict, however, is usually caused by a multitude of factors, many of which may be difficult to identify and quantify in advance. No country characteristic represents a guarantee against public unrest and no attribute is unconditionally linked to armed violence. Nonetheless, Phase III of the State Failure Task Force project (Goldstone et al. 2000: 13), to give one example, has developed models that predict state failures (civil wars, genocides, and abrupt regime changes) with a reported 70- to 80-percent accuracy.^{xvii} With the combination of disaggregated data on ethnic, socio-economic, and political conditions, as well as on contextual events, we may be able to generate comparable forecasting models that predict the timing and location of such societal hazards as communal violence, separatist rebellion, and forced migration, with an acceptable rate of precision.

Notes

ⁱ Parts of this section are based on Buhaug & Gleditsch (2006).

ⁱⁱ Since one-fourth of all conflicts are between non-contiguous minor powers, the assumption that politically ‘irrelevant’ dyads do not fight is false. Still, the bias produced by such non-random exclusion of observations is generally quite small (Lemke & Reed 2001).

ⁱⁱⁱ The scatterplot and the calculation of the global *I* statistic were done using a beta version (0.95i) of Luc Anselin’s GeoDa software, see <https://geoda.uiuc.edu/default.php>.

^{iv} We do, however, find evidence that globalized dyads are overall less likely to be involved in militarized disputes and wars. For a complete table output, see Buhaug & Gleditsch 2006, Table 8.3).

^v See Kocher (2004) for a similar theoretical development.

^{vi} There are, of course, other and complementary explanations for protracted wars. Addison et al. (2001) show that sustained, low-level warfare may be beneficial for all fighting parties, including the government, since it provides economic opportunities that are not available during peacetime. Although conflict is detrimental to society at large and is extremely costly to the general citizenry, the participating armed groups may experience higher total revenues/utility from extracting natural resources or other rents (such as foreign aid) during conflict than during peace.

^{vii} See http://www.pcr.uu.se/research/UCDP/about_UCDP1.htm.

^{viii} A polygon is a flat, closed plane made up of at least three lines.

^{ix} Equal authorship.

^x Some minor modifications to the article have been made in order to correspond to the general outline of this dissertation. The references have been updated (where necessary) and moved to the back of the dissertation, and headings of sections, tables, and figures have been numbered. In addition, the figures are presented in color.

^{xi} Gleditsch is secondary author.

^{xii} Equal authorship.

^{xiii} Rød is secondary author.

^{xiv} For example, half of Angola’s production of diamonds in 2000 – 5 percent of the annual rough diamond sales worldwide – was smuggled into neighboring countries, see *Africa Recovery* no. 4, 2001: <http://www.un.org/ecosocdev/geninfo/afrec/vol15no4/154diam.htm>.

^{xv} From this follows that the LSG of a democratic country is largely dependent on whether it campaigns a civil or international war. Since the audience costs are generally lower for non-democracies (Fearon 1994), the difference in LSGs between domestic and international operations for these regimes is likely to be smaller.

^{xvi} For contributions to this conference, see <http://weber.ucsd.edu/~kgledits/igcc/dscwtv/dscwtv2005.html>.

^{xvii} See also the Kansas Events Data System (KEDS, <http://www.ku.edu/~keds/>) project, which uses automated coding of news reports to provide early warning of conflict in the Balkans, the Middle East, and West Africa.

2

Exit, Voice, and Violence. Determinants of Territorial and Governmental Conflict, 1950–2001*

Abstract

Just as displeased customers either voice their discontent directly to management or exit the firm, aggrieved groups of society can either seek to change the political system or attempt to secede. Relative capacity and the nature of the opportunity determine what direction the conflict will take. In democratic and economically advanced countries, any opposition group is likely to be inferior to the government. These groups will see secession as the most viable strategy to redress the grievance. Weak and unstable regimes are easier to topple and are thus more likely to attract coups and revolutions. Large and ethnically diverse countries with considerable rough terrain are expected to be particularly suitable for peripheral guerrilla warfare. Smaller countries offer fewer opportunities for separatist insurgency, but in such countries, capturing the government is also a more realistic option. A statistical investigation of 214 civil conflicts since 1950 provides robust empirical support to most propositions and demonstrates that territorial and governmental conflicts are shaped largely by different mechanisms.

* A previous version of the paper was presented at the Network of European Peace Scientists (NEPS) conference, Tinbergen Institute, Amsterdam, 27–29 June 2005. Replication data and do-files will be made available on the web upon publication.

2.1. *Introduction*

Armed civil conflicts come in two types. Some conflicts aim at overthrowing the ruling coalition or in other ways modifying the political regime. Military coup d'états and popular revolutions belong to this category. Other conflicts concern the control of a specific territory within the state. These conflicts are usually labeled separatist or secessionist insurgencies. What makes some rebel groups fight for independence while others seek to topple the rulers? At the country level of analysis: What separates countries with territorial civil wars from countries experiencing armed challenges to state authority?

This paper starts from the premise that a major determinant of rebel strategy is relative capability. Frustrated opposition groups that are able to project a considerable amount of force are likely to demand government control. Relatively weak dissidents, however, have no other realistic option than to seek secession for a limited part of the nation. From this follows that economically and institutionally weak states are particularly predisposed to challenges to state power whereas domestic violence in rich and politically legitimate regimes will almost exclusively concern claims of self-determination. By the very nature of the warfare involved, geographic factors such as country size, rough terrain, and ethnic diversity should have a particularly large influence on opportunities for territorial rebellion.

With the exception of economic development, which proves to be a larger discouragement to secession, the empirical analysis presented here offers considerable support to the propositions. Poor and institutionally inconsistent regimes are most at risk of governmental rebellion whereas impoverished democracies are most likely to face separatist rebellion. Ethnic composition only affects the risk of territorial conflict where diverse societies are significantly more likely to foster separatist movements. The overall best predictor of type of conflict is country size; conflicts in less populated countries almost exclusively focus on government control whereas a majority of conflicts in populous countries relate to issues of self-determination.

2.2. *Exit and Voice, or Territorial and Governmental Conflict*

In his influential book *Exit, Voice, and Loyalty*, Hirschman (1970) elaborates on the dynamics between a firm's performance and the responses by its customers. The theoretical foundation of this work, which has implications far beyond its original application, is that displeased clientele of deteriorating companies will act in accordance with one of two strategies. A customer may choose to stop buying a firm's products or leave the organization. This is what Hirschman labels the *exit* option. The alternative strategy is for the customer to express his dissatisfaction directly to management or to the public at large. This is the *voice* option. The interplay between firms and displeased customers is analogous to that of states and aggrieved citizens. Hence, Hirschman's grand theory carries an important message to the study of civil war as it suggests a typology of exit and voice conflicts. Discontented groups of society can either seek separation from the nation-state or strive to change the system from within.ⁱ

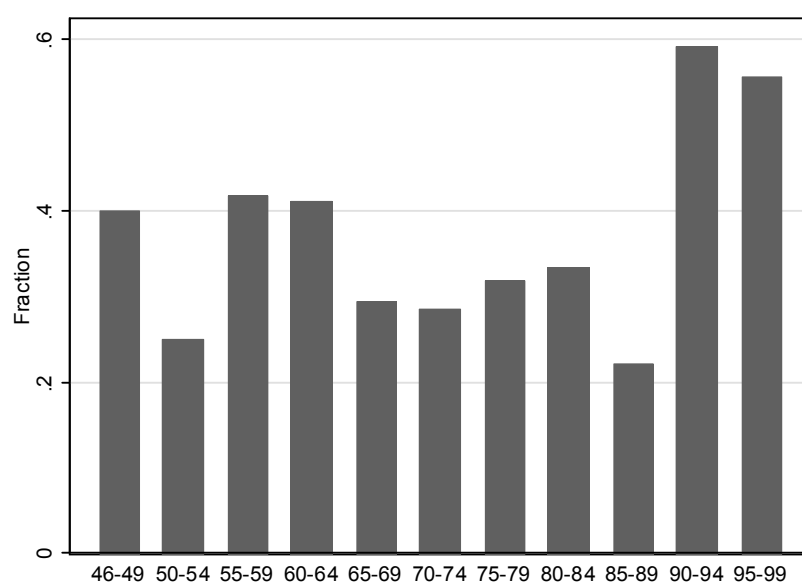
Typically, separatist activities are conducted by ethnic minorities who reside in the rural periphery and seek independence for their 'homeland' by means of guerrilla warfare. Governmental conflicts, in contrast, are armed struggles over the control of the state apparatus. These conflicts take the form of popular revolutions or military coup d'états. A limited number of wars, including the recent carnage in Sierra Leone and Liberia, may not easily be placed in either of the two categories. These wars are dominated by warlords and thugs, where economic gains from looting appear to be a primary motivation for rebel recruitment.ⁱⁱ The following passage from the report of the UN's Panel of Experts on Liberia (UN 2002: 12) illustrates this clearly:

LURD [*Liberians United for Reconciliation and Democracy*, the main rebel group in Liberia] has probably some 2,000 men fighting for it. These are a motley bunch, including Liberian dissidents that had formerly fought for the Sierra Leone "Special Forces", some 500 Kamajor fighters, defectors from AFL and other units from Liberia and up to 200 ex-RUF fighters from Sierra Leone who had been offered several hundred dollars in cash and the fruits of the war to fight for LURD.

In a few other cases, the aim of the rebellion shifts during the course of conflict. One such example is the ongoing rebellion in Southern Sudan, initially a territorial conflict, which now has elements of both types of incompatibility (Eriksson & Wallensteen 2004). However, these are exceptions. Most civil wars correspond well to one of the two categories.

Governmental conflicts dominate over the territorial type. According to the Uppsala/PRIO Armed Conflicts Dataset (Gleditsch et al. 2002), roughly two-thirds of all intrastate conflicts since 1946 have been challenges to state authority. A similar pattern is found in Fearon & Laitin’s (2003) data on major civil wars. The initial decade after the Cold War saw a relative increase in separatist activities (Figure 2–1), with the years 1990–94 also being the overall most violent period with 21 new territorial conflicts and 24 conflicts over governance. The first three years of the new millennium have been comparably peaceful with nine onsets of governmental conflicts but not a single new separatist conflict. Descriptive statistics further show that territorial conflicts are more difficult to end; the average territorial conflict lasts 2,123 days, compared to 1,290 days for the average conflict over state governance.

Figure 2–1. Territorial Conflicts as a Share of All Intrastate Conflicts, 1946–99



Source: Uppsala/PRIO Armed Conflict Dataset, v. 3.0 (Gleditsch et al. 2001).

Despite the intuitive distinction between territorial and governmental conflicts, this framework is yet to be used in large-N empirical investigations of onset of conflict. Rather, studies that acknowledge the heterogeneous nature of civil wars tend to focus on ethnic (or ‘identity’) versus ideological wars (Doyle & Sambanis 2000; Licklider 1995; Regan 2002; Reynal-Querol 2002; Sambanis 2001). The classification of conflicts as ethnic or ideological is not unproblematic, though. The most fundamental question is whether there really exists something called ‘ethnic conflict’. Scholars sympathetic to

an instrumentalist or constructivist view would argue that ethnicity is only one of a number of possible bases of identity that can be created and manipulated by political entrepreneurs in response to external threats. Although the concept of ethnic conflict usually entails that “the issues at the core of the conflict must be integral to the concept of ethnicity” (Sambanis 2001: 261–262), it is often almost impossible to distinguish between constructed and factual causes of protest and rebellion.ⁱⁱⁱ For example, the thirty-year long struggle for independence of Eritrea is usually considered an ethnic conflict and is coded as such in several datasets on ethnic wars; yet, the notion of a unique Eritrean identity evolved gradually among disparate tribes and is almost entirely a *product* of the war (Gurr 2000). Similarly, Collier & Hoeffler (2005) argue that the Ibo rebellion in Biafra in the late 1960s was initiated by a number of small ethnic groups who conveniently redefined themselves as non-Ibos when the rebellion was crushed.^{iv} Besides, several conflicts that involve ethnic minorities also constitute clashes between political ideologies.

Another problem, which relates directly to the quest of this investigation, is that quite a few studies mistakenly equate ethnic wars with wars of secession. For example, Walter’s (2003) analysis of government response to claims of self-determination is limited empirically to claims by ethnic minorities. Similarly, Collier & Hoeffler (2005) use data on ethnic wars to test general theories of secession. Neither of these authors discusses the potential mismatch between the theoretical and operationalized concepts. Common wisdom holds that ethnic and separatist conflicts overlap, but there is no shortage of cases to the contrary. The recent ethnic wars in Rwanda and Burundi were both wars over government control, and the same goes for the ruthless, ongoing feud between the secular Algerian government and radical Islamist activists. Conversely, the secessionist conflicts in Yemen (1994) and Comoros (1997) appear to be driven by economic and political motives rather than by ethnic issues. Table 2–1 presents a more complete picture of the association between ethnicity and aim in civil war. With very few exceptions, violent separatist claims are launched by distinct ethnic (minority) groups. This corresponds well to observations by Horowitz (1985), Gurr (2000), and others, and explains why ethnic wars are often assumed to equate wars of secession. On the other hand, almost half of all ethnic conflicts concern government control. Hence, the deduction that ethnic wars are wars of secession because secessionist wars are conducted by ethnic minorities is fallacious.

Table 2–1. Cross-Tabulation of Aim and Ethnicity in Civil Wars since 1946

		<i>Gleditsch et al. (2002)</i>		<i>Fearon & Laitin (2003)</i>	
		Territorial	Governmental	Exit	Center
Sambanis (2001)	ethnic	40	30	33	27
	other	5	35	7	33
Licklider (1995)	ethnic	41	32	32	31
	other	2	29	5	25
State Failure III	ethnic	40	29	35	25
	other	3	23	3	24
Fearon & Laitin (2003)	ethnic	33	27	37	29
	other	3	28	3	31

2.3. *Relative Capability and Rebel Strategy*

The more restricted the strength, the more restricted its goals must be.

Carl von Clausewitz (1832/1984: 283)

Previous empirical work has demonstrated that the frequency of domestic unrest is inversely related to state capacity. Transitional and institutionally inconsistent regimes as well as impoverished countries account for a large majority of all contemporary civil wars (Collier et al. 2003; Fearon & Laitin 2003; Hegre et al. 2001). The reason is simple: A state's monopoly on use of force is secured only by its ability to dissuade potential challengers. Higher-capacity regimes avoid armed unrest by increasing the costs to insurgents of using violence to make their claims (Tilly 2003). This is comparable to the logic of deterrence; domestic unrest is more probable if there is uncertainty about the supremacy of the state. A similar assumption is found in Timasheff (1965: 156): "revolution commonly breaks out when both parties have, or seem to have, a fair chance of victory." A weakening regime, then, facilitates the growth of dissidents, which explains why revolutionary upheavals often emerge in the wake of military defeat (Gurr 1970).

By definition, civil conflicts have two parties, one of which is the government of a state. The opposition side occasionally includes several competing factions but they all seek some kind of concession from the regime. The decision whether to seek self-determination or aim at government control, I argue, depends largely on relative capability. Capturing the state apparatus will almost always require more power and resources than securing authority over a limited territory of the country. This means that weak groups that demand changes to the status quo are left with a single possible strategy, the exit option. This is consistent with Horowitz' (1985: 241) claim that groups

“with a keen sense of weakness, are easily convinced [...] that their only hope of resisting domination lies in some form of separation” However, even secession may be deemed unfeasible unless the group is geographically concentrated along the rim of the country and constitutes a majority of the population in the region. In contrast, powerful groups of society, in particular those that enjoy the support of the military, are more prone to claim government control as this constitutes the ultimate prize. Since relative capability is a function of state *and* rebel capacity, it follows that weak regimes are particularly likely to attract coups and revolutions whereas domestic violence in powerful regimes almost exclusively concern claims of self-determination.

Capacity can be defined and measured in various ways. Tilly (2003: 41) defines governmental capacity as “the extent to which governmental agents control resources, activities, and populations within the government’s territory.” The least capable regimes – that is, the states that are least able to control the population’s actions – are the semidemocracies (Hegre et al. 2001). These regimes combine some level of repression with a limited degree of openness, a mix that is unsuited to strangling public disturbances before violent conflict breaks out. The intermediate regimes are predominantly poor, and thus have fewer resources to allocate to infrastructure and policing. Poverty is also associated with higher levels of unemployment, inequality, and corruption, which further lower the opportunity costs of rebellion (Collier & Hoeffler 2004). In totalitarian regimes, the narrow concentration of power in the hands of an autocrat severely restricts potential challengers’ access to political influence. Widespread and unconstrained repression against any perceived enemy of the state further discourages disobedient behavior. Nonetheless, autocracies are generally less stable than democracies due to the lack of institutional arrangements for the succession of rulers (Gates et al. 2004) and because the power of the autocrat is at the mercy of the Janus-faced armed forces. Consolidated democracies, in contrast, enjoy a rigid, self-enforcing system of power-sharing institutions that prevents any one actor from gaining unlimited authority. High standards of living and high legitimacy of the political system further imply that it is virtually unthinkable for any group of society to claim a legitimate *casus belli* against the regime and generate massive public support. This means that armed rebel movements in liberal democracies are likely to be limited in size and capability. Given the supreme counterinsurgent capacity of democratic and economically developed states, dissidents in such countries are bound to be vastly inferior to the government forces and will most likely not be able to pose a credible threat to the regime at large. This leads to our first hypotheses:

Chapter 2

- H1: *Democracies are better able to prevent conflicts over government than over territory.*
- H2: *Developed countries are better able to prevent conflicts over government than over territory.*

To some extent, country size represents another aspect of state capacity. The size of the population has traditionally been considered an important military asset and can be used to explain why e.g. Russia or China has never been successfully captured by invading forces. However, while population size may still be relevant when comparing the military capacity between states, it may in fact be an impediment to effective and secure rule within states. For example, the higher birthrate of the Palestinians has been used by Israeli Deputy Prime Minister Ehud Olmert as an argument to support an independent Palestinian state in order to preserve Israel's "Jewish and democratic character" (BBC 2003). A large population may be problematic on other grounds as well. Fearon & Laitin (2003) argue that larger populations contain higher numbers of potential rebel recruits and are harder to monitor by the central government. Besides, population size generally is positively associated with the geographic area of the country. Successful theories of interaction, such as the gravity model (Linnemann 1966) and Boulding's (1962) notion of a loss-of-strength gradient (LSG), emphasize the impeding role of distance. Both positive interaction and negative interaction occur predominantly between proximate actors. Similar arguments can be made regarding patterns of domestic interaction. Distance reduces the intrusiveness of the central government. Sparsely populated hinterlands favor guerrilla tactics where even a small band of rebels can sustain prolonged combat.

Large countries should be particularly disposed to separatist conflicts because they are more likely to contain groups with deviating identity structures and because a larger share of the population resides at a distance from the capital. In smaller countries, any subgroup is relatively close to the center of power and therefore has a higher baseline probability of reaching the political elite by military means. Partitioning a small country may also be unrealistic because an even smaller entity might simply be too weak to maintain sovereignty.

- H3: *Country size has a larger, positive influence on the risk of territorial than governmental conflict.*

Rough terrain is assumed to favor rebellion as it provides cover from detection and impedes conventional military warfare. The logic behind the argument is comparable to that of the LSG, where a rugged and generally inaccessible landscape raises the discount factor of projected government force. Doornbos' (1979: 74) narrative of the Ugandan highlands provides a fine example: "The Ruwenzori mountain areas are extremely inaccessible; effective administration had never become established in the higher altitudes and, in a sense, anybody could set up an independent government there without facing the consequences for at least some time." However, while a remote rebel movement is harder to reach by government forces, the rebels are also less able to impair the chief executive and topple the regime. Their chance of success lies in seceding from the motherland. Flat landscape without large forests offers poor opportunities for guerrilla insurgency. Emerging dissidents in such countries have to conduct urban warfare, which substantially lessens their chances of sustained resistance. Knowing that it will most likely be a swift rebellion, the rebels can only be successful if they manage to overthrow the ruling elite.

H4: *Rough terrain has a larger, positive influence on the risk of territorial than governmental conflict.*

Some previous research suggests that ethnically dominant or polarized societies – that is, countries with one or a few, large ethnic groups – have a higher propensity for conflict (Collier & Hoeffler 2004; Elbadawi & Sambanis 2000; Ellingsen 2000; Hill & Rothchild 1986). The notion is that while ethnicity is suitable for generating rebel identity and constructing a legitimate cause of conflict, greater social fragmentation implies greater coordination and transaction costs (Gates 2002a). However, coordination problems due to ethnic diversity should largely pertain to revolutionary wars (Sambanis 2001), since territorial rebellions are usually initiated by distinct ethnic groups in any case. In a similar vein, Horowitz (1985) claims that more divided societies should have a higher probability of facing secessionist movements. Ethnic minorities that form a majority within their regions should be particularly prone to demand self-determination since they are bound to play an inferior role in national politics and have a regional base upon which to form a rebellion.

H5: *Ethnic diversity has a larger, positive influence on the risk of territorial than governmental conflict.*

A final opportunity factor to be considered here is natural resources. Horowitz (1985: 241) writes that, although rarely a decisive cause, the economic costs of separatism may be tempered by the prospect of securing resources in the secessionist area. The World Bank's report on civil wars (Collier et al. 2003) is less cautious, stating that secessionist rebellions are significantly more likely if a country has valuable natural goods. While resources might be exploited to finance any type of rebellion, the potential of capturing the resource ownership permanently makes the exit option particularly attractive. Several contemporary cases, such as in the oil-rich regions of Aceh, Cabinda, and Southern Sudan, offer some evidence of this (see Ross 2004a, b). However, resource abundance might also be linked to governmental conflict. Le Billon (2001b) distinguishes between proximate and distant resources and argues that the former type is generally associated with coups and rioting. Moreover, Auty (2001), Collier & Hoeffler (2004), and de Soysa (2002) point to the fact that resource-dependent countries often suffer from bad politics as their governments mismanage the wealth, initiate massive domestic spending, and tend to be genuinely corrupt. As a result, these states are generally less capable than their level of income suggests. A final hypothesis follows:

H6: *Oil-dependent countries are more likely to experience any type of civil conflict.*

2.4. Data and Research Design

A statistical analysis of the outbreak of intrastate conflict between 1950 and 2001 serves as the empirical test of the hypotheses. The conflict data are derived from the Uppsala/PRIO Armed Conflict Dataset (ACD), v. 3.0, and include every armed conflict between a state government and an organized opposition group that caused at least 25 annual battle-deaths (Gleditsch et al. 2002). To separate between conflicts over territory and governance, I use the 'incompatibility' indicator of the ACD. Gleditsch et al. (2002: 619) define territorial conflict as involving "demands for secession or autonomy."^v Governmental conflict concerns "type of political system, the replacement of the central government, or the change of its composition." Only the first year of each conflict is coded as an onset. Subsequent years of governmental conflicts are dropped; by nature of the ACD coding procedures, a state can only have one conflict over state governance at any time. Ongoing years of territorial conflict are censored (assigned a value of '0') since a regime might be challenged by new separatist groups (and thus coded with a

new onset) while other territorial conflicts are enduring. In cases of discontinuous events, a two-year rule is applied, which means that if a conflict falls below the casualty threshold for more than two consecutive calendar years, the next observation between the same parties is treated as a separate onset. In the investigated period, there were 129 outbreaks governmental conflict, 85 onsets of territorial conflict, and a total of 212 country years of conflict among the 6,370 valid observations.^{vi}

The models include two complementary proxies for state capacity. Institutional capacity is proxied by the democracy-autocracy index of Polity IV (Gurr et al. 1989), which ranges from -10 (perfect autocracy) to 10 (perfect democracy). To account for non-linearity, a squared term is added. As one would expect, most civil conflicts occur in non-democratic regimes. Even so, 48 conflicts occurred in countries with at least 6 points on the polity index, the most popular threshold for democracy. Hence, the claim of a general democratic civil peace (Hegre et al. 2001) seems premature. As a measure of economic capacity, I use Gleditsch' (2002a) data on GDP per capita income. The variable is log-transformed since the distribution of the raw data is skewed and because there are theoretical reasons to expect a non-linear effect. The GDP data are only available from 1950 to 2000, which limits the temporal domain of the analysis.^{vii} To reduce problems with direction of causality, the capability indicators are lagged one year.

Country size is represented by logged population size (in thousands), taken from COW's National Material Capabilities dataset, v. 3.01 (see Singer et al. 1972). The models also include two proxies for rough terrain, based on measures by Buhaug & Lujala (2005). The mountain and forest variables give the logged share of the two-dimensional area of a country covered by the given type of terrain. To explore the effect of ethnic diversity, I include Fearon & Laitin's updated ethnicity statistics, which are based on the *Atlas Narodov Mira* (1964). The variable has values between 0 and 1 and denotes the probability that two randomly drawn persons belong to different ethnic groups. The models also include a squared ethnicity term to capture effects resulting from polarization. To test the final hypothesis on resource-dependence, I include an oil exporter dummy. This variable is similar to the one by Fearon & Laitin (2003) and marks off country years in which fuel exports exceeds one third of total export revenues. Finally, I include a control for whether at least one of a country's contiguous neighbor states is in civil war in the given year, as well as a dummy representing the post-Cold War period (1989–2001).

The statistical investigation is conducted using Stata 8.2 and all models are estimated through maximum likelihood logit regression with robust standard errors

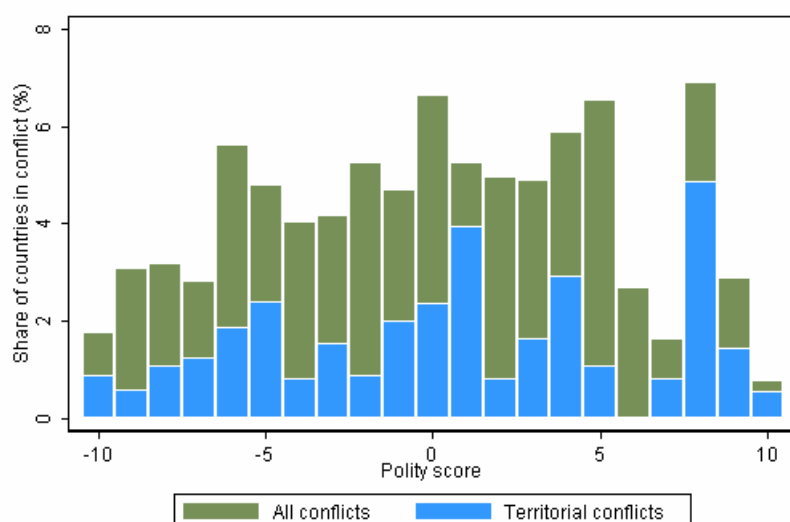
clustered on countries. To correct for temporally correlated residuals, all models include a peace-year count measure (see Beck et al. 1998). Tests showed that additional smoothing spline functions did not improve the fit of the models so they were omitted from the reported regressions.

2.5. Analysis

2.5.1. Empirical findings

A bivariate investigation of the association between level of democracy and conflict involvement is presented in Figure 2–2. The green bars denote the share of the observations with onset of civil conflict for each of the twenty-one polity categories. Not surprisingly, regimes that contain a blend of authoritarian and democratic elements have the highest ratio of conflict. The blue bars suggest that political system also affects the type of civil war. Among the democratic states, most conflicts concern issues of territoriality, such as claims of increased autonomy or secession. Among the non-democracies, however, rebel groups are more likely to seek government changes. The figure thus provides preliminary support for Hypothesis 1; democratic governments are relatively less likely to be challenged over office by armed opposition groups.

Figure 2–2. Share and Type of Conflict by Level of Democracy, 1950–2001



Next, I present the results from a multivariate assessment of the theoretical propositions (Table 2–2). Three models are reported. Model 1 explores the determinants of all civil conflicts in the period; Model 2 is limited to governmental conflicts, whereas only territorial civil conflicts are examined in Model 3. According to the all-inclusive Model 1, the best guarantee of domestic peace is economic development. For a country with median values on all independent variables, the probability of onset of civil conflict in any given year is 0.020 or 2%. If we increase the level of GDP per capita to the 95th percentile while maintaining the other variables at their median, the probability of conflict decreases to about half, at $p=0.11$.^{viii} The other proxy for government capability, regime type, also behaves as expected. The democracy variables show a very distinct parabolic effect, where institutionally inconsistent regimes (polity score=0) with median characteristics are more than 50% more likely to experience civil conflict than otherwise similar perfect democracies and about twice as conflict-prone as harshly authoritarian states.

In line with previous findings, large countries have a higher conflict involvement, and the effect is comparable to that of GDP per capita. The terrain measures fail to make a significant impact and the coefficients actually have opposite signs. Ethnic diversity shows a positive but non-linear effect. Accordingly, ethnically homogenous countries are less exposed to civil war than heterogeneous societies, but the degree of fractionalization in the latter group matters less. As expected, the oil exporter dummy has large and positive estimate. Holding all other variables constant, oil producers are twice as often involved in civil war as other states. Finally, we see that both conflict in the neighborhood and the post-Cold War period are associated with increased risk of intrastate conflict.

Model 1 largely supports prevailing theories on determinants of civil war. Poverty and weak political institutions are significant and substantial factors that increase the general risk of domestic conflict. Large, oil-rich, and ethnically diverse states are also found to be disproportionately often involved in civil wars. Still, we do not know whether these variables apply to all types of conflict alike or whether some factors tend to be associated with specific types of incompatibility. I have argued that relatively capable regimes should be particularly well suited to prevent conflicts over governance. Geography and ethnicity are expected to have a larger impact on the risk of territorial conflicts. Models 2 and 3 test these assumptions empirically.

Table 2–2. Logit Regression of Onset of Civil War, 1950–2001

	All conflicts	Governmental	Territorial
	(1)	(2)	(3)
Democracy level t_{-1}	0.012 (0.86)	–0.008 (0.44)	0.029 (2.05) *
Democracy level squared t_{-1}	–0.007 (2.80) **	–0.014 (4.65) **	–0.001 (0.26)
GDP per capita (log) t_{-1}	–0.357 (3.04) **	–0.216 (1.67)	–0.541 (2.92) **
Population (log)	0.290 (5.36) **	0.011 (0.18)	0.669 (8.64) **
Mountains (log)	0.093 (1.66)	0.165 (2.23) *	0.034 (0.26)
Forest (log)	–0.030 (0.54)	–0.086 (1.54)	0.117 (1.01)
Ethnic fractionalization	3.780 (2.78) **	0.937 (0.60)	11.678 (4.58) **
Ethnic fractionalization squared	–3.227 (2.07) *	–0.082 (0.05)	–10.827 (4.07) **
Oil exporter	0.706 (3.38) **	0.680 (2.54) *	0.778 (2.97) **
Neighboring civil war	0.326 (2.31) *	0.340 (1.90)	0.492 (1.89)
Post-Cold War	0.511 (2.98) **	0.248 (1.18)	1.229 (4.88) **
Peace years	–0.012 (1.63)	0.001 (0.13)	–0.050 (4.51) **
Constant	–3.953 (3.88) **	–2.174 (1.76)	–8.943 (5.37) **
Log pseudolikelihood	–841.42	–580.98	–328.63
# conflicts	212	129	85
<i>N</i>	6,370	5,813	6,370

Note: Logit regression coefficients, robust z scores are in parentheses. * $p < .05$; ** $p < .01$.

The two issue-specific models reveal that the link between democracy and civil conflict is less straightforward than normally assumed. According to Model 2, democracies and autocracies are equally negatively associated with governmental conflicts. The size of the coefficient for the squared term implies that the shape of the curvilinear relationship is substantially steeper than in Model 1. Accordingly, the relative difference in conflict proneness between anocracies and ideal-type systems is particularly large with respect to governance conflicts. Model 3 actually suggests a positive and linear relationship between level of democracy and risk of territorial conflict. A coherent democracy is nearly twice as likely to face secessionist insurgency as an otherwise similar autocracy (see Table 2–3). Still, care must be taken when interpreting and generalizing this result. All control variables included in the models correlate with democracy, which means that democracies tend to differ from autocracies on other dimensions besides political institutional arrangements.^{ix} Therefore, the

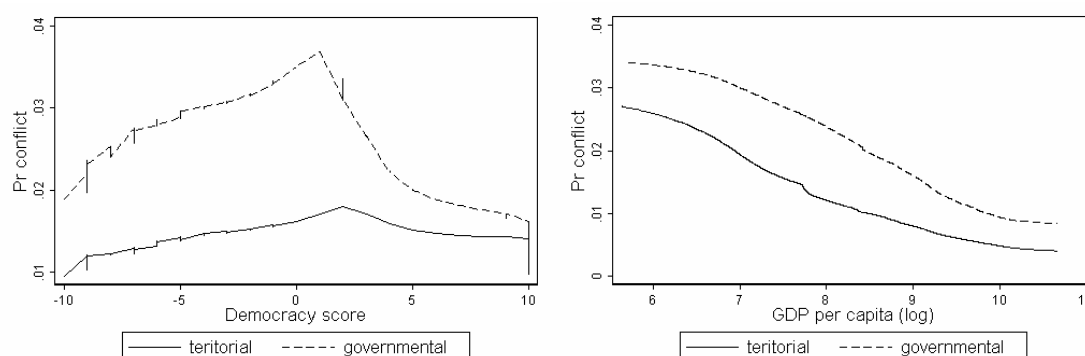
assumption of ‘otherwise similar values’ is often not particularly realistic and may in fact lead to counterfactual inference (King & Zeng 2005). To demonstrate this, let us compare a typical authoritarian state, Syria, with the Netherlands, a democracy of similar size (population of 16 million). In 2000, Syria has a polity score of -9 (similar to the 5th percentile value) whereas the Netherlands is considered a consolidated democracy (polity score of 10, corresponding to the 95th percentile value). Focusing only on the marginal effect of democracy in Model 3, we would predict the Netherlands to be almost twice as exposed to conflict as Syria. However, when all characteristics of the two countries are taken into account, the model actually predicts Syria to be more than ten times more likely to experience a territorial conflict during the year 2000. Since democracy is relatively better suited to prevent unrest aiming at government changes than secessionist rebellion, Hypothesis 1 is supported.

A comparison of Models 2 and 3 further reveals that the behavior of economic development, too, is dependent on the type of conflict. Even though the estimates are always negative, the size of the coefficient in the governmental conflict model is not statistically distinguishable from zero. Apparently, wealth is primarily a deterrent against separatist movements. If this finding proves to be robust across samples and model specifications, it questions the universal applicability of the recent World Bank report’s conclusion that poverty is the factor most consistently associated with civil war (Collier et al. 2003). How do we explain this surprising finding? The most apparent explanation has to do with multicollinearity problems. As already mentioned, several of the explanatory factors tend to co-vary across cases, which means that some of the effect of wealth is captured by the other variables in the model and standard errors are likely to be inflated. If we drop the insignificant linear democracy term from Model 2, the estimate for GDP per capita increases slightly, the standard error shrinks accordingly, and the effect becomes significant with a 5% margin of error. In fact, a log-likelihood test would show that this reduced model is superior to the one reported in the table. Even so, economic capacity clearly has a smaller influence on the risk of conflict over state authority than conflict over self-determination. Hypothesis 2 is not supported by the empirical data.

Figure 2–3 visualizes the association of democracy score (left panel) and economic development (right panel) with the probability of territorial and governmental conflict, based on the output in the models above. Apparently, a high concentration of power and unlimited control over the armed forces are about as effective tools as institutional mechanisms of checks and balances in preventing armed challenges to state authority. The means to ensure stability are radically different, though; ruthless

repression deters annoyed individuals from organizing a rebellion whereas fair elections and unbiased public goods delivery prevent frustration related to the political system. The association between regime type and territorial conflict is considerably flatter and the non-linear pattern with a distinct peak is far too weak to generate a significant estimate for the squared democracy term in Model 3. We also see that the baseline probabilities of territorial and governmental conflict are almost identical for the most democratic regimes whereas non-democracies are relatively more exposed to conflicts over state control. The parallel lines in the right panel appear to suggest that the pacifying effect of development is comparable between the two conflict types. However, the change in relative risks between the least and most developed countries is substantially larger in the territorial model. Besides, since the predicted risk of conflict is generated from the full models, the shape of the lines is affected by all explanatory factors.

Figure 2–3. Risk of Civil War by Democracy and Income



Note: The figure shows the smoothed predicted probability of governmental and territorial civil conflict as a function of democracy level (left) and GDP per capita income, controlling for remaining covariates in the model.

The two issue-specific models reveal a number of other novel findings as well. Large states are more often involved in territorial conflicts than would be expected by chance. In fact, country size is by far the most influential explanatory factor in Model 3. This very strong result indicates that aggravated groups in these countries usually view secession as the most viable strategy to improve living conditions. The finding also corroborates the notion that larger populations are harder to control by a central government – not only because of the size per se but also because larger populations are likely to contain several identity groups – which thus lower the opportunity costs of separatist rebellion. In contrast, size fails to make an impact on Model 2. The same

results appear if we substitute the population measure with (logged) country area. This offers some hint at why peripheral groups like the Assamese in India and the Tuaregs in Mali and Niger engage in separatist insurgency whereas the Hutus and Tutsis in Rwanda and Burundi compete for government control. In all, Hypothesis 3 is strongly supported; the relative effect of size is substantially larger with respect to territorial conflicts.

The linkage between terrain and conflict is one of the most popular conjectures in the civil war literature but it has not received much empirical support. Inconsistent findings may be explained at least partly by poor operationalizations and questionable assumptions, e.g. by using country-level statistics to explain local events (see Buhaug & Lujala 2005). But could it also be because previous studies have ignored the type of civil war? Table 2–2 provides little evidence for such an explanation. Even though the coefficient estimates for the mountain and forest variables vary somewhat between the models, the differences are not dramatic by any standard. Even though small guerrilla groups tend to establish bases in rough terrain, there is no systematic relationship between extent of mountainous and forested terrain and the onset of civil war at the country level. Hypothesis 4 is not supported by the analysis.

According to Model 2, ethnicity does not increase the risk of governmental conflict. In stark contrast, the marginal effects of the ethnicity indicators in Model 3 indicate that ethnically polarized states have a substantially higher risk of experiencing territorial conflicts than homogenous and very fragmented states. The estimated risk is highest when the fractionalization index has a value of about 0.5, all other factors held constant.^x However, the negative effect of the squared term is substantially moderated when we control for the other regressors in the model, which tend to be correlated with ethnicity. As a result, the net effect of ethnicity is largely linear with respect to both types of conflict, although the relative impact of ethnicity is evidently larger in the territorial model. Hypothesis 5 is strongly supported.

Table 2–2 further reveals that oil wealth increases the risk of both types of domestic armed conflict. This finding corresponds to the view that valuable oil deposits motivate locals to demand autonomy in order to secure the goods permanently *and* the view that oil-dependent regimes are often corrupt and weaker than their income suggests, which are likely to motivate attempts to topple the government. Either way, Hypothesis 6 is supported.

Finally, we see that the neighbor civil war dummy just misses the customary significance threshold in the issue-specific models (p-values of 0.058 and 0.059, respectively), whereas the increase in outbreaks of civil war since the end of the cold

war is almost entirely a product of emerging separatist movements. Overall, the territorial model performs substantially better than the governmental model. This suggests that violent coups and revolutions to a much larger degree are shaped by unmeasurable case-specific features, rather than by structural and contextual factors that dominate prevailing theories of civil war.

Table 2–3. Predicted Probabilities

Variable	Governmental			Territorial		
	5 th p	95 th p	Δ p	5 th p	95 th p	Δ p
Democracy level	9.7	6.5	1.5	2.5	4.2	1.7
GDP per capita	19.1	10.1	1.9	6.6	1.3	5.1
Population	13.8	14.8	1.1	0.7	17.4	24.9
Ethnic fractionalization	11.1	22.4	2.0	0.3	1.7	5.7
Mountains	8.7	16.6	2.0	2.9	3.2	1.1
Forest	18.8	13.1	1.4	2.2	3.3	1.5
Oil exporter	14.0	28.0	2.0	3.0	6.6	2.2
Neighboring civil war	14.0	19.7	1.4	3.0	4.9	1.5

Note: The table shows the predicted probability of governmental and territorial civil conflict for the 5th and 95th percentile value on the given variable, all other covariates held at their median values. To facilitate reading, all probabilities have been multiplied by 1,000. Δ p denotes the factor of difference between the lowest and highest predicted probability for each variable. Calculations are based on estimates in Models 2 and 3, respectively.

2.5.2. Robustness Checks

While the results presented above are largely in line with the outlined expectations and thus potentially constitute a more comprehensive explanation of the causes of civil war, certain problematic issues call for further testing. One concern relates to the fact that several covariates are nearly or completely time-invariant, in which yearly observations makes less sense. As an alternative research design, I estimate the same issue-specific models with observations at five-year intervals (1950–54, 1955–59, 1960–64, ..., 1995–99), where the independent variables are measured at the initial year of each period and the dependent variables indicate whether there was an outbreak of conflict during the period. If a governmental conflict was ongoing for an entire period, it is coded as missing, whereas the territorial conflict variable is coded ‘0’ in all periods without a new onset. This reduces the number of observations to about one-sixth of the original time-series cross-sectional dataset. The results are given in Table 2–4.

Overall, the alternative Models 4 and 5 perform remarkably similarly to the corresponding models in Table 2–2. Level of democracy has a clear, inverted U-shaped effect in the risk of governmental conflict and a weak but positive and linear effect in

the territorial conflict model. This adds strength to our notion that democratic systems provide few excuses to initiate attempts of unconstitutional regime change while not being sufficiently repressive to dissuade violent claims of self-determination. We also see that economic development again fails to explain the onset of governmental conflict, despite having a large, dampening effect on the risk of separatist conflict. Population size is strongly associated with territorial conflict but has no substantive impact on the estimated likelihood revolutionary conflicts. The terrain proxies are generally quite weak, but forest produces a significant, negative estimate in the governmental conflict model. Model 5 further reproduces the finding above that ethnic composition has a substantial influence on the risk of separatist insurgency, where the most homogenous and heterogeneous societies are least vulnerable, *ceteris paribus*. Moreover, we see that the alternative research design has some influence on the oil dummy, which now indicates a much stronger association with self-determination conflicts. Nonetheless, the two first models in Table 2–4 corroborate the initial evaluation of the six hypotheses.

A second issue that should always be considered when assessing the reliability of the findings is choice of the dependent variable (for more on this, see Sambanis 2004a). The original analysis is based on the Uppsala/PRIO ACD, which uses a casualty threshold of just 25 annual battle-deaths rather than the more typical lower limit of 1,000 deaths. Accordingly, the reported findings are based on a considerable larger sample of conflicts, most of which are too small to be counted in comparable investigations. This raises the question of whether the findings are an artifact of choice of conflict data. To answer this question, the models were re-estimated with Fearon & Laitin's (2003) civil war data for the period from 1950 to 1999. They define a civil war as fighting between a state and an organized non-state actor that killed at least 100 on each side and at least 1,000 in total. Of particular relevance to this study, they have classified each conflict as being aimed either at government control ('center') or at autonomy/secession ('exit').^{xi} To maintain consistency, the neighboring conflict dummy is also based on Fearon & Laitin's civil war data.

As is evident from Models 6 and 7 (Table 2–4), the higher casualty threshold means the number of conflicts is considerably reduced. This leads to inflated standard errors and less significant estimates on most covariates, compared to the initial findings in Table 2–2. Even so, the performance of most variables is consistent with earlier findings. The parabolic effect of democracy on governmental conflict is reproduced, although Model 7 suggests a non-linear relationship even with respect to territorial conflict. Moreover, population size and ethnic fractionalization have much larger effects in the exit model. As in Model 2, mountainous countries have a higher baseline risk of

governmental conflict (contrary to expectations) whereas type of terrain has no significant impact in the separatist model.

The most discernible deviation from the original analysis concerns the economic capacity variable. Previous models, based on the inclusive ACD conflict data, suggest that poverty is primarily a determinant of separatist conflict. Using the stricter civil war definition, however, economic capacity has almost identical negative effects on the probability of the two types of conflict. This suggests that wealthier regimes, while being challenged by militant opposition groups just as frequently as less developed states, are better able to contain the conflicts before they escalate to the level of outright war. A second contrast to the findings above (but in line with Ross 2004a), Models 6 and 7 suggest that oil-dependent states are predisposed to a particular type of civil war: secession. The reason is simple, yet puzzling; while the oil-exporting countries hosted approximately 20% of both the territorial and governmental conflicts (ACD, at least 25 annual battle deaths), they participated in 33% of the ‘exit’ wars but only in 12% of the ‘center’ wars (Fearon & Laitin data, at least 1,000 killed in total). The implication is that separatist insurgencies in oil-rich countries tend to develop into severe civil wars whereas armed challenges to the state apparatus of these regimes are particularly swift. This is certainly a discovery that deserves further investigation.

Finally, the results are robust to the exclusion of any one conflict and they also stand up to the separation of the sample into shorter sub periods. The independent variables were further evaluated in a series of more parsimonious models, since the inclusion of too many covariates often introduces complex correlation structures and other statistical problems (see e.g. Achen 2002 and Ray 2003). Overall, the various sensitivity tests demonstrate that with two exceptions – GDP per capita income and oil dependence – the initial findings are not due to selection bias or attributable to a sample dominated by minor conflicts. Of the hypothesized relationships, only H2 and H4 failed to receive any support. H6 was partially supported; the empirical evidence in favor of this proposition appears to be sensitive to sample selection criteria. H1, H3, and H5 were all strongly supported by the empirical analysis.

Table 2–4. Logit Regression of Onset of Civil War, Alternative Specifications

	<i>5-year periods</i>		<i>Fearon & Laitin's civil wars</i>	
	<u>Governmental</u>	<u>Territorial</u>	<u>Center</u>	<u>Exit</u>
	(4)	(5)	(6)	(7)
Democracy level t_{-1}	-0.004 (0.23)	0.051 (2.05) *	-0.010 (0.33)	0.050 (1.96)
Democracy level squared t_{-1}	-0.016 (4.43) **	0.006 (1.09)	-0.012 (2.99) **	-0.014 (2.07) *
GDP per capita (log) t_{-1}	-0.243 (1.69)	-0.758 (3.68) **	-0.557 (2.59) **	-0.568 (2.69) **
Population (log)	0.029 (0.37)	0.887 (6.96) **	-0.103 (0.92)	0.726 (5.51) **
Mountains (log)	0.136 (1.52)	0.045 (0.25)	0.244 (2.19) *	-0.117 (0.64)
Forest (log)	-0.154 (2.28) *	-0.168 (1.42)	-0.160 (1.78)	0.012 (0.12)
Ethnic fractionalization	0.436 (0.27)	16.417 (4.32) **	-0.643 (0.26)	9.117 (4.14) **
Ethnic fractionalization squared	0.642 (0.36)	-14.492 (3.94) **	1.113 (0.38)	-9.614 (4.08) **
Oil exporter	0.618 (2.13) *	1.147 (2.79) **	0.324 (0.74)	1.256 (3.79) **
Neighboring civil war	0.176 (0.75)	-0.267 (0.69)	-0.018 (0.06)	0.138 (0.42)
Post-Cold War	0.047 (0.19)	0.732 (2.11) *	0.016 (0.05)	0.572 (1.62)
Peace years	-0.374 (0.27)	-10.293 (4.50) **	0.012 (0.94)	-0.017 (1.31)
Constant	-0.004 (0.23)	0.051 (2.05) *	0.794 (0.38)	-9.019 (4.90) **
Log pseudolikelihood	-328.51	-153.87	-282.02	-173.11
# conflicts	128	62	52	34
<i>N</i>	1,090	1,153	6,064	6,064

Note: Logit regression coefficients, robust z scores are in parentheses. * $p < .05$; ** $p < .01$.

2.6. Concluding Remarks

This paper represents a first cut at disentangling the causes of separatist and government conflicts. Based on the assumption that capturing the state requires more strength than securing control over a limited area of the country, this paper has argued that capable states are relatively more likely to face secessionist claims whereas rebellions in weak states are likely to concern government control. Moreover, geographic factors, such as size, terrain, and ethnic composition, were expected to exert a larger influence on the risk of territorial civil wars. An empirical analysis of 214 intrastate conflicts produced generally supportive results, but with a couple of noticeable exceptions. First, wealth appears to be a better guarantee against separatist rebellion than coups and revolutions.

Only when the analysis was limited to outright civil wars did per capita income display a similar, preventive effect with respect to governmental conflict. Second, mountainous and forested terrain were found to have slightly larger effects on the likelihood of governmental conflict but in opposite directions. Nonetheless, the impact of rough terrain is generally quite weak.

The combination of a strong, inverted U-shaped effect of democracy on the risk of governmental conflict and the positive and linear association between democracy and territorial conflict suggests not only that democracies are particularly successful at preventing challenges to the political system. This result is also consistent with discontented groups in politically legitimate states seeking independence in cases where similarly underprivileged people in non-democracies might attempt to overthrow the ruling elite. Knowing that an inherent democratic system will never accommodate an unconstitutional regime change, a group that seeks to alter the status quo is left with a single option: to demand greater level of self-determination. In contrast, authoritarian leaders by definition lack political legitimacy and credibility, which make it easier for any potential opposition group to create or draw on objective grievances to receive domestic and international support in its struggle against the unjust regime. Moreover, the fact that the parabolic effect of democracy level applies even to territorial challenges when only the most severe domestic conflicts are considered indicates that separatist conflicts in democratic regimes are likely to be contained at a relatively low intensity level.

The analysis also offers a plausible explanation of why previous studies have failed to demonstrate a robust link between ethnicity and civil war. Ethnic composition only affects the probability of separatist conflict, where diverse societies are found to be significantly more at risk. Since most civil wars are contests over state apparatus, the estimated effect of ethnicity is substantially deflated unless the research design captures the distinction between territorial and governmental conflicts.

Of all tested covariates, population size is the factor that best explains why some countries are prone to separatist movements while others experience military coups and revolutions. Controlling for institutional and economic capacity, size does not affect the propensity for violent regime change, regardless of fatality threshold. On the other hand, larger countries are substantially more at risk of territorial conflict. This is presumably because such states contain a higher number of peripheral groups whose main source of identity differs from that of the nation state. Besides population is highly correlated with country area, which implies that populous countries also contain hinterlands that are

favorable to insurgency. Small countries offer limited opportunities for guerrilla warfare and the state apparatus may appear as more viable target.

Finally, the analysis uncovered a possible interaction between oil dependence and severity of intrastate conflict. Using the inclusive Uppsala/PRIO Armed Conflict Dataset, oil-rich states account for approximately 1/5th of governmental and territorial conflicts. However, according to a sample of major civil wars, only 1/9th of the wars over state power were located in oil-rich states. In stark contrast, 1/3rd of the separatist wars occurred in these countries. Since longer conflicts are generally more severe in terms of battle-related deaths, this suggests that oil-exporting regimes are relatively less able to strangle separatist attempts – or less willing to grant demands – before the unrest turns into bloodshed. The comparatively low share of oil producers among countries with major governmental civil wars implies that these regimes are either particularly easy to topple or especially able to fight off revolutionary attempts rapidly. I shall not elaborate on an ad hoc explanation of this discovery but rather recommend that this be explored further in future investigations.

These results indicate that Hirshman's (1970) dichotomy of exit and voice offers a valuable contribution to the study of civil war. Distinguishing between territorial and governmental conflicts is a promising path; almost all conflict-promoting factors are linked to these types in different ways. The comparably poor performance of the governance models implies that there is a shortage of good predictors of coups and revolutions. Several conventional explanatory factors, including ethnicity and geography, are simply not able to explain the occurrence of such conflicts. Perhaps governmental conflicts to a larger extent are caused by case-specific factors, such as characteristics of the political elite, that are harder to measure in large-N studies. Be that as it may, the broad conclusion of this paper is that we need to return to the drawing board and develop theoretical schemes that are better able to explain various *subsets* of civil wars. Only then will we be able to generate more precise quantitative measures of interest and, eventually, accumulate a richer understanding of the underlying causes of civil war.

Notes

ⁱ See Ayres (2000) for a similar classification of civil wars. The distinction between territorial and non-territorial disputes is well established in the international conflict literature (see Vasquez 1995).

ⁱⁱ Indeed, one might question whether these cases should be treated as civil wars at all or rather as large-scale crime (see Berkeley 2001; Grossman 1999).

ⁱⁱⁱ Others apparently use a less restrictive definition of ethnic conflict (although in reality there are few discrepancies between the datasets). Fearon & Laitin (2003: 79) define ethnic wars as “conflicts in which the fighters were mobilized primarily along ethnic lines” whereas the State Failure project (Goldstone et al. 2000) define ethnic conflict as violent episodes “between governments and national, ethnic, religious, or other communal minorities (ethnic challengers) in which the challengers seek major changes in their status” (www.cidcm.umd.edu/inscr/stfail/sfcodebk.htm). These definitions avoid the instrumentalist dilemma as they do not point to the origin of the rebellion but conversely run the risk of being too inclusive.

^{iv} See Fearon (2003) and Gilley (2004) for further discussion of the notion of ethnic conflict.

^v Although some might argue that there is a substantial difference between the two, autonomy is often the compromise in a separatist dispute. Besides, the decision whether to claim a higher degree of autonomy or outright independence is likely to be influenced by the capability of the dissidents and recent developments on the battlefield. This explains why demands occasionally shift from autonomy to independence and back again (Horowitz 1985: 232).

^{vi} Two countries experienced outbreaks of both territorial and governmental conflict in the same year (Iran 1979 and India 1990), which explains the deviation between the combined number of territorial and governmental onsets (214) and the number of country years with conflict of any type (212) in the dataset.

^{vii} Since the GDP per capita measure is lagged one year except in the first year for each observation, the sample covers the period from 1950 to 2001.

^{viii} Marginal effects were calculated with the aid of CLARIFY, see Tomz, Wittenberg & King (2003).

^{ix} For example, most coherent democracies are highly developed – the democracy and development measures correlate at $r=0.47$ – which means that the effect of democracy should be interpreted in combination with that of GDP per capita.

^x Surprisingly, a dummy for ethnic polarization, marking the countries where the largest ethnic group contains between 45% and 90% of the population (based on Fearon’s (2003) ethnicity data), failed to produce a significant effect even on the risk of territorial conflict.

^{xi} Some conflicts are coded as mixed or ambiguous. They were excluded from this analysis.

3

The Geography of Civil War*

Abstract

Geographical factors play a critical role in determining how a civil war is fought and who will prevail. Drawing on the PRIO/Uppsala Armed Conflict Dataset covering the period 1946–2000, the authors have determined the location of all battle-zones for all civil wars in this time period, thereby identifying the geographic extent and the center point of each conflict. Using ordinary least squares (OLS) and three-stage least squares (3SLS) estimation techniques, factors are analyzed that determine the scope of the conflict (area of the conflict zone) and the location of the conflict relative to the capital. It is found that in addition to geographical factors such as the total land area of the country, scope is strongly shaped by such factors as the adjacencies of a border of a neighboring country, the incidence of natural resources in the conflict zone, and the duration of the conflict. The distance of the conflict zone from the capital is influenced by the scope of the conflict, the size of the country, whether or not the objective of the rebels is to secede, and whether or not the rebel group has a religious or ethnic identity. Also, evidence is found of an endogenous relationship between scope and location.

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When I took a decision, or adopted an alternative, it was after studying every relevant ... factor. Geography, tribal structure, religion, social customs, language, appetites, standards – all were at my finger-ends.

T. E. Lawrence, *Letter to B. H. Liddell Hart, June 1933* (Collins 1998: 3)

3.1. Introduction

Lawrence of Arabia's observation is as true today as it was in his time. In recent years our theoretical and empirical understanding of the factors identified by Lawrence as related to the onset and duration of civil war has progressed tremendously.¹ Yet, despite important insights gained from this research, we have very little systematic knowledge about the actual fighting of civil wars. Ironically, one reason for the general lack of understanding in this regard is that there is little or no actual fighting or war in these models of war onset or duration. There are no battles, no deaths, no weapons, no guerrilla tactics, and no counter-insurgency activities. Territory and resources are never lost or gained. There are no victories and there are no defeats. Yet, motivations regarding peace and war are clearly linked to the prospects of winning or losing a civil war. In addition to securing wealth through the capture of resources, civil wars are often fought over a political objective – control over the apparatus of the state or the creation of a new sovereign state. Clearly, different objectives will alter the way a civil war is fought. A war over control of the state will fundamentally differ from a war of secession. Military historians and strategists have long understood how geographical factors play a critical role in influencing how a civil war is fought and who will prevail. Taking military history as a departure point, this paper examines how strategic objectives and geographical factors affect the location, relative to the capital, and scope (measured conflict area) of armed civil conflict.

3.2. Geographic Factors and Armed Civil Conflict

3.2.1. Physical geographical factors

The earliest military strategists understood the role of geography and conflict. In his *Discorsi*, Machiavelli (1517/1988: 52–53) wrote that a soldier must become “familiar with the terrain: how mountains rise, how the valleys open out and plains spread out, as well as with the characteristics of rivers and swamps.” Keegan (1993) in his *History of Warfare* features the role of geographic variables and distinguishes between ‘permanently operating’ and ‘contingent’ factors. Permanent factors include terrain and climate. These factors have long been the focus of military tacticians and military historians.ⁱⁱ And presumably because such stories are more interesting, the majority of such studies have featured the catastrophic blunders caused by commanders ignoring geography, including the likes of Major General George McClellan at Antietam (1862), General Baron Levin Bennigsen at Friedland (1807), General Ludwig Benedek at Königgratz (1866), and Lieutenant General Mark Clark at Rapido in the Battle for Italy (1944). In contrast, gifted generals, of course, consistently have taken such factors into account, and where possible, have used them to their advantage.

Keegan’s second concept, contingent geographic factors, relates to the constraints on logistics and intelligence. To ignore these factors is to ignore Clausewitz’s admonition, “[t]he end for which a soldier is recruited, clothed, armed and trained, the whole object of his sleeping, eating, drinking, and marching is *simply that he should fight at the right place and the right time*” (Murray 1999: 210). Geography is not just important on the battlefield, but at the operational level as well. With ruinous results, such renowned military minds as Napoleon and the *Oberkommando des Heeres* (OKH) of Nazi Germany neglected these factors in their attempts to conquer Russia and the Soviet Union respectively. It seems that social scientists, too, in their analyses of civil war also have tended to ignore the role of geographic variables with regard to the fighting of civil war.

Influenced by classical theorists, most applications of geography to war have been geopolitical analyses applied to military strategy or global security issues. The basic premise though almost seems too obvious – that the location and size of a country affect the design and nature of military strategy. Mackinder (1904) speaks of the pivot area, or heartland, while Ratzel (1896) draws on Darwin’s survival of the fittest when arguing for a ‘law’ of territorial growth.ⁱⁱⁱ For the most part, geopolitical strategic

analysis has been global in perspective, applied to explain the international politics of Germany, Great Britain, and the United States. Yet, even for civil war such factors as the size of a country, its location, and the nature of its borders are extremely important, influencing temporal and spatial domain as well as the potentiality for diffusion.

Empirical studies addressing the geographic aspect of conflicts typically consist of statistical, nation/dyadic-level analyses regarding interstate war, and rest on different measures of proximity of states (Bremer 1992; Diehl 1991; Gleditsch 1995; Vasquez 1995). Following Boulding (1962), Sprout & Sprout (1965), and Richardson (1960), geography is treated primarily as a concept of contiguity and distance, affecting interstate interaction. These studies have demonstrated that inter-capital distance and number of borders are essential predictors of conflict proneness. However, such measures are less interesting when studying internal conflicts.

When it comes to exploring determinants of the *location* of conflicts, little or no systematic effort has been made. Attributes of the conflict-ridden countries (topography, climate, population) as well as characteristics of the conflicts (severity, duration, goal of rebel group) have only to a limited extent been included in quantitative conflict studies, and always as exogenous factors affecting outbreak or duration. Fearon & Laitin (1999) and [previous versions of] Collier & Hoeffler (2004) both include crude measures of mountainous terrain and forest cover as predictors of onset of conflict. And in an effort to determine relevant South-American dyads, Lemke (1995) acknowledges the relevance of terrain by constructing a time-distance measure of interstate transportation cost.

3.2.2. Natural resources

Recent work on the economics of civil war clearly demonstrates that to understand civil war today we need to understand the role played by natural resources in financing the purchase of arms. Theoretical studies such as Addison et al. (2002) push our theoretical understanding of the role of resources with regard to conflict (particular as a source of loot to finance a war), while empirical studies by Auty (1998), Collier & Hoeffler (2004), de Soysa (2000), Ross (2004a) and others provide evidence of the wide array of problems associated with resource abundance. Resource extraction is for the most part spatially fixed. Businesses engaged in such activities cannot choose where the natural resources are located, and unlike enterprises in other types of economic activity, they cannot relocate. As a business, you must decide not to invest or to disengage. To sustain

access to the resources and protect their investments, natural resource extraction businesses generally rely on paying “whoever is in power” (Le Billon 2001b: 569). This makes natural resources extremely amenable to taxing and to looting.

Natural resources differ a great deal with regard to their concentration.^{iv} Point resources tend to characterize oil drilling operations and pit mining. Illegal drugs (cocaine, hash, heroin, etc.), timber resources, and alluvial diamond mining are more widely dispersed and are therefore more difficult for a government to control. Alluvial diamonds in particular, regarded as the ultimate loot, have served to finance civil wars in Sierra Leone, Angola, Liberia, and the Democratic Republic of Congo. Timber and drugs, too, have financed many rebel groups. Timber has played a big role in financing the conflicts in Burma, Cambodia, Liberia, and the Philippines, while drugs have financed conflicts in Afghanistan, the Caucuses, Colombia, Kurdistan, and Tajikistan (Le Billon 2001b: 573).

Geographical location and the concentration of the resources are critical with regard to the opportunities of belligerents to seize or retain control of the resource revenues (Addison & Murshed 2001; Auty 1998; Le Billon 2001b). One crucial aspect of location is the proximity to the decision-making center. Natural resources located closer to a country’s capital should be easier for the state to control (Le Billon 2001b). Poor data on location and significance have so far prevented scholars from including natural resources in cross-national conflict studies.

3.2.3. The human geography of identity

A substantial amount of today’s civil wars are related to identity; i.e. they are fought between different ethnic or religious groups. As a consequence, there is a widely held belief that ethnic (and religious) diversity causes conflicts. Reality may not be so simple. Ethnic composition may be operationalized along two dimensions. The first dimension is fragmentation: the more groups, or the higher the probability that two individuals drawn on random are from different groups, the higher the level of fragmentation. There is a consensus that this is negatively related to conflict risk if related at all (Collier & Hoeffler 2004; Fearon & Laitin 1999). The other dimension is polarization or dominance. As defined by Collier & Hoeffler, dominance occurs if the largest ethnic group constitutes 45–90% of the population. There is a broad consensus that this variable is positively related to conflict (Collier & Hoeffler 2004; Elbadawi & Sambanis 2002; Ellingsen 2000; Hegre, et al. 2001; Reynal-Querol 2002). Also, Collier

& Hoeffler argue that ethnic and religious diversity within a region reduces the opportunity for rapid rebel recruitment.^v They find that minorities that have a rural base are far more likely to see large-scale ethnic violence than urban and widely dispersed minorities. Accordingly, separatist wars typically emerge where the ethnic groups are located in clearly defined regions of the states.

As with geographic factors like topography and resources, no study of identity and civil war has been concerned with the physical attributes of the conflict. Whether and how identity-related conflicts differ from non-identity conflicts with respect to location and scope has never been explored. Herein lays a huge challenge.

3.3. Hypotheses

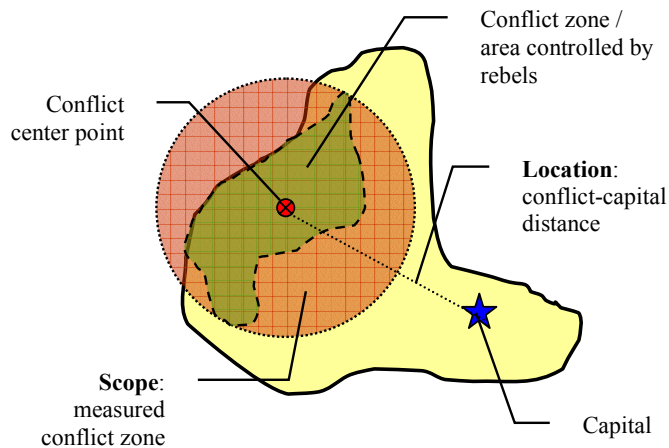
Location and scope geographically define the characteristics of a war. Indeed, with regard to the capabilities, limitations, and vulnerabilities of armed forces, ‘it seems safe to predict that the pertinence of spatial relationships will remain undiminished indefinitely’ (Collins 1998: 11). As noted by Harvey Starr (2003) [in his presidential address at the 2001 Peace Science Society (International) meetings], absolute and relative space are relevant to the study of conflict.

The objective of this paper is to examine factors that determine location and scope of civil wars. This rather unconventional choice of dependent variables contrasts most conflict studies’ focus on outbreak, incidence, duration, or ending of war. As a consequence our findings may not be immediately comparable with other studies on civil war. Having said that, most of our research questions do involve elements of generality too – if physical characteristics of nations, such as size, topography, and natural resources are found to influence the spatial domain of civil wars, they probably affect the temporal dimension as well. Moreover, future work may involve exploring to what extent our geographic data manage to predict outbreak, duration, and recurrence of civil wars.

A civil war is inherently about armed conflict between the state and an organized rebel group. Hence a key reference point is the capital of a country; after all, the capital is where the state is based. We can therefore presume that state power is centered at the capital. The other main reference point is the geographic center of the zone of conflict. From these two reference points we define the location of the conflict, measured in terms of the distance between the capital city and the conflict center point (hence we treat location as a relative concept). The other key concept, scope, is defined

as the geographic domain of the conflict zone, measured as the circular area centered around the conflict center and covering all significant battle zones (see Figure 3–1). We discuss the particulars of these operationalizations in the next section.

Figure 3–1. Defining Location and Scope



3.3.1. Location of conflict

The distance between the capital of a country and the zone of conflict in a civil war is hypothesized to be related to a number of factors. Two primary explanatory factors are identified, the strategic objective of the rebellion (or the nature of the incompatibility), and whether the rebellion is based around an ethnic or religious identity. These relationships can be expressed in terms of two hypotheses:

- H1: *Rebel groups that aim to seize power from the state will tend to fight their wars closer to the capital city than secessionist groups, ceteris paribus.*
- H2: *Rebel groups with an ethnic/religious identity will tend to fight their wars further away from the capital city than non-identity groups, ceteris paribus.*

We argue that, by the very nature of secessionism, rebel groups aiming to create a new state will focus their fighting against the state in the territory that they are trying to liberate. Such territory is presumed to be not proximate to the capital, the seat of state power. A similar reasoning applies to ethnic groups engaged in armed rebellion against

the state. The presumption is that an ethnic group engaged in armed rebellion against the state will not be the group that is concentrated in the capital. Rather, the identity of aggrieved groups tends to be made with respect to the dominant ethnic groups concentrated in the capital.

We control for two key variables, the size of the country and the scope of the conflict. At the margins, the size of the country will limit the conflict-capital distance. Small countries in armed civil conflict will by their very nature find the location of the conflicts to be nearer the capital than the location of conflicts in countries with large areas. The scope is also hypothesized to be associated with the location from the capital. After all, the zone of conflict is a measurable area, which is related to the total size of the country and the distance between the capital and the zone of conflict. This relationship, too, at the margins exhibits a certain deterministic quality. Though given the irregular shapes of countries and the influence of other geographical features, the extent of mathematical determinism is minimal.^{vi}

3.3.2. Scope of conflict

The scope of conflict is also hypothesized to be associated with a number of factors. Several explanatory variables are featured, the duration of the conflict, whether the conflict zone abuts an international border, whether a resource is present, as well as the extent of mountainous and forested terrain. These relationships can be expressed in the form of the following hypotheses:

- H3: *The scope of an armed conflict is positively associated with the duration of a conflict, ceteris paribus.*
- H4: *The scope of conflicts that abut an international border will be larger than the scope of those that do not, ceteris paribus.*
- H5: *The scope of conflicts with natural resources present will be larger than the scope of those that are without, ceteris paribus.*
- H6: *The scope of conflicts in mountainous terrain will be larger than the scope of those that are not, ceteris paribus.*
- H7: *The scope of conflicts in forested terrain will be larger than the scope of those that are not, ceteris paribus.*

Duration is hypothesized to be related to war, given that time increases the possibilities for a rebel army to increase its zone of activity. Also short-lived conflicts, such as coup d'état, are concentrated in the capital city. Insurgency movements that endure year after year tend to encompass a broad territory.

International borders are hypothesized to be related to the size of a conflict zone because such borders are so valuable to a rebel army. Rebels will push to gain access to an international border because neighboring countries often provide a safe refuge away from governmental troops, but also because weapons and natural resources are traded and transported across these borders. Control of international borders thus ensures that the rebel army will fight another day.

Natural resources, whether point or dispersed resources, provide revenue for a rebel army. A rebel army has an interest in expanding its zone of control to capture these resources and thereby derive financial gain from them, regardless of whether secessionism or state power is the ultimate political goal.

Rough terrain is ideal for guerrilla warfare and difficult for a government army to control. Mountain areas, giving advantage to rebel troops, allow the rebels to expand the scope of conflict, whereas forests provide cover, particularly against detection or aerial attack. This aids in the freedom of movement and shipment of arms, thereby associated with a wider zone of conflict.

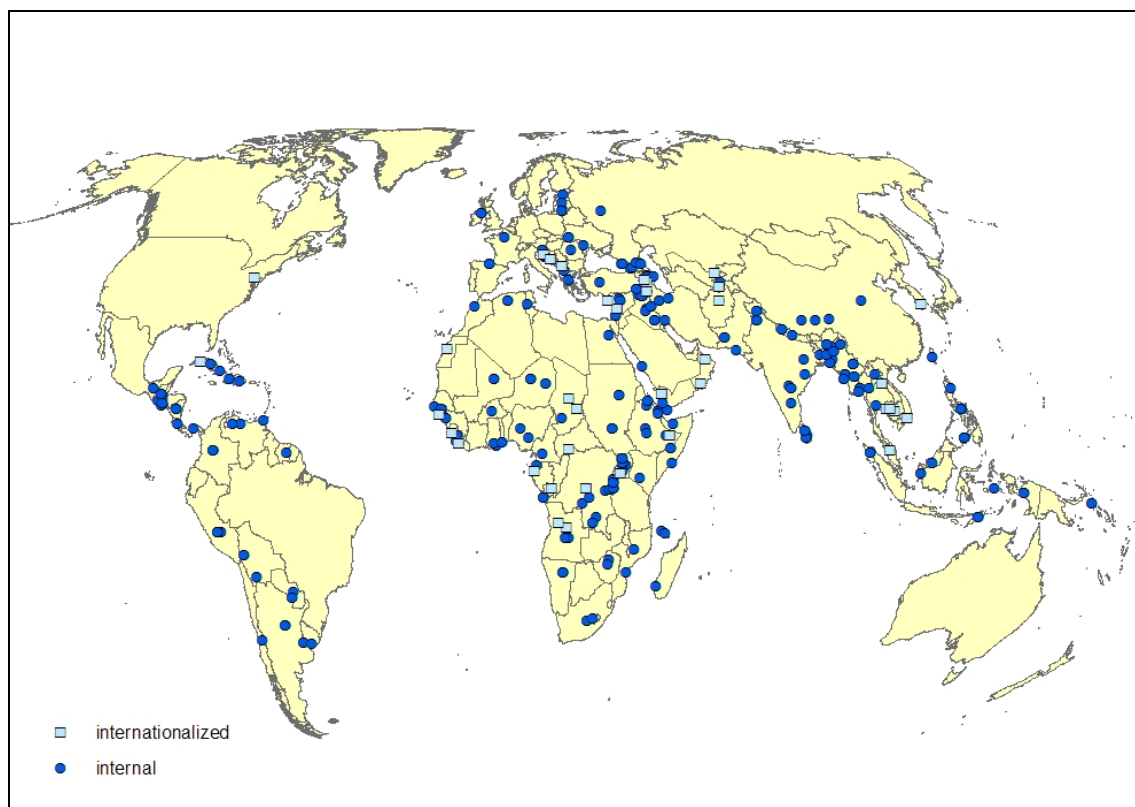
We control for two variables to account for the scope of conflict, the total size of the country and the location of the conflict relative to the capital. These relationships follow the same pattern as in the location model, except that with scope we are working in two dimensions rather than in one. At the limit, the relationships are mathematically deterministic, but given the wide variety of shapes of countries the relationship remains probabilistic and can be estimated statistically.

3.4. Description of Data

The unit of analysis in our study is armed civil conflicts, as defined by the PRIO/Uppsala Armed Conflict Dataset (Gleditsch et al. 2002). However, in this dataset, quite a few intrastate conflicts are subdivided into several separate conflict units, either reflecting varying severity from one year to the next (from 'minor' to 'intermediate' to 'war', or vice versa), or because violence has temporarily decreased below the threshold of conflict (i.e. less than 25 battle-deaths per year).^{viii} As our analysis is mostly concerned with studying geographic attributes of conflict zones, data on disaggregated

conflicts are not necessary. Consequently, the ‘subconflicts’ were merged if they consisted of identical actors, incompatibility, geographic location, and less than three years passed from one conflict unit to the next. In total, our dataset includes 265 civil conflicts for the 1946–2000 period. These conflicts are displayed in Figure 3–2.

Figure 3–2. Civil Conflicts, 1946–2000



Note: Adapted from Gleditsch et al. (2002), using software developed by Jan Ketil Rød. For full details on specific armed conflicts, see www.prio.no/cwp/ArmedConflict/.

3.4.1. Dependent variables

Our major contribution to this dataset is the inclusion of variables representing location and scope of the conflicts. Quite a few conflicts are limited to one specific place, either a city or an administrative region. These conflicts were assigned conflict center points equaling the geographic coordinates for the specific city/region. As for larger conflicts (in geographical terms), we first identified the major battle zones – i.e. places where the fighting resulted in loss of lives – and areas controlled by rebel groups.^{viii} The conflict center was then defined as the mid-point of these locations. Determining the center of

each conflict is not trivial since different sources frequently diverge on the exact whereabouts (and severity) of the battles. Moreover, as a number of conflicts are located along dispersed border zones, some conflict centers actually refer to areas quite unaffected by the fighting. Future work on the conflict data will be dedicated to reducing this problem, most likely by utilizing GIS.

Our first dependent variable – the operationalization of location – is measured as the distance from the conflict center to the capital city. The values on this variable were calculated using a geodetic distance calculator, estimating the conflict-capital distances with accuracy far superior to our requirements.^{ix} The conflict-capital distances vary between 0 km (the capital is the center of conflict) and 3,360 km (from West Papua to Jakarta). The location variable was log-transformed prior to use.

Additionally we constructed two proxies of scope, the absolute area of the conflict zone (log-transformed), and the conflict area as a proportion of total land area. For simplicity, we defined the conflict zones as being circular and centered around the conflict center point; the radius of the conflict zone equals the distance from the center to the most distant battle zone, rounded upwards to the nearest 50-km interval to ensure that all significant battle zones were covered. Conflicts that took place within a single city were assigned a 50-km radius.^x All estimations reported below were run with logged and unlogged variables. The models estimated with logged variables produced much stronger results.

3.4.2. Explanatory and instrumental variables

To control for identity-based conflicts, we constructed a dummy identity variable, given the value 1 if the rebels originate from different ethnic and/or religious groups than the government. The main sources for this variable were the ‘wartype’ variable of Sambanis (2000)^{xi} and various volumes of *Keesing’s Record of World Events*. According to our data, 59% of the conflicts are related to identity.

Our second explanatory variable is the PRIO/Uppsala dataset’s dichotomous incompatibility variable, indicating whether territory (secession) or governance (control over the state) is the incompatibility between the government and the rebels. Some 40% of our conflicts concern territory. This variable is closely related to the identity indicator ($r=.6$), as conflicts over territory almost by definition are related to identity. However, 35% of the conflicts over state power were also fought between different ethnic/religious groups.

In this dataset, all conflicts have been ascribed a start- and end-year. As we expect conflicts in remote areas – typically providing rebel hideouts in forests, mountains, or behind international boundaries – to endure longer than conflicts of more urban nature, we constructed a variable on conflict duration (end year minus start year).

In order to control for rebels hiding beyond national borders or conflicts that for other reasons frequently involved neighbor territory, we constructed a dummy indicator on whether or not the conflict zone abuts a border with another country. Roughly one half (51%) of the conflicts in our sample extend to (or across) the national border of the conflict-ridden country.

Previous conflict studies seem to confirm that primary commodities serve as a major source of rebel finance (Collier & Hoeffler 2004). Thus we include a dichotomous resource variable, simply indicating whether or not the conflict zone contains essential natural resources such as fossil minerals, metals, or diamonds. This variable was constructed by comparing the scope of the internal conflicts with maps on resource distribution from *Kunnskapsforlagets Store Verdensatlas* (1997), *Oxford Economic Atlas of the World* (1972), as well as descriptive data from the CIA (2001).

Data on country area (log-transformed prior to use) and forests were drawn from World Bank (2000). The forest variable gives the proportion of land area covered by forest, varying between 0 and 96%. We also include a measure of mountainous terrain, identical to Collier & Hoeffler (2004); the values vary between 0 and 81%.^{xiii} Although these measures describe the type of terrain for each country, they do not indicate extent of mountains and forests specifically for each conflict zone. An important improvement will be to construct these variables from gridded data on topography through the aid of GIS tools, thus facilitating a comparison between the terrain in the conflict zone and the terrain in the rest of the country.

Table 3–1 summarizes the descriptive statistics for each of these variables. Table 3–2 is the correlation matrix for these variables.

Table 3–1. Descriptive Statistics

	Obs.	Mean	Std. dev.	Min	Max
Location	258	5.23	1.82	1.6	8.1
Absolute scope	258	4.60	1.65	2.3	9.2
Relative scope	246	44.41	38.03	0	100
Land area	251	6.04	1.64	.7	9.7
Identity	262	.59	.49	0	1
Incompatibility	265	1.59	.49	1	2
Duration	265	5.45	7.93	1	53
Border	258	.51	.50	0	1
Resource	262	.21	.41	0	1
Mountain	256	23.19	21.78	0	81
Forest	247	30.23	21.56	0	96

Table 3–2. Correlation Matrix

	Location	Absolute scope	Relative scope	Land area	Identity	Incompatibility	Duration	Border	Resource	Mountain
Absolute scope	.60									
Relative scope	.008	.48								
Land area	.54	.44	-.46							
Identity	.54	.27	-.06	.28						
Incompatibility	-.55	-.09	.31	-.31	-.60					
Duration	.15	.25	.20	.04	.19	-.18				
Border	.35	.33	.17	.12	.32	-.30	.27			
Resource	.11	.27	.10	.14	.05	.16	-.06	-.03		
Mountain	-.006	-.01	.02	-.04	.08	-.10	.07	.06	-.32	
Forest	.09	.10	-.002	.10	-.13	.06	.02	-.12	.12	-.12

3.5. Method of Analysis and Results

3.5.1. OLS single equation models

In order to test our three hypotheses regarding conflict location, we first specify two models to fit the OLS regression of the conflict-capital distance. As Table 3–3 demonstrates, both models yield very similar results and their explanatory powers are very high. Both conflict area (Model 1) and conflict area as a proportion of land area (Model 2) are important determinants of the conflict location. Accordingly, the more distant the conflict centers, the larger the battle-zones – both in relative and absolute

terms. Not surprisingly, the conflict location is also positively associated the size of the country. As noted above all models were estimated with logged and unlogged distance and area variables. Not only did the logged variables produce higher levels of statistical significance, but they also performed better with regard to the diagnostic analyses (omitted variable tests, Cooks' distance, lvr2plots and avplots) that accompanied the OLS estimations (but not reported here).

Table 3–3. OLS Estimation of Location, 1946–2000

	(1)	(2)
Absolute scope	0.49 ** (.062)	
Relative scope		0.02 ** (.003)
Land area	0.21 ** (.065)	0.61 ** (.058)
Identity	0.54 ** (.199)	0.61 ** (.216)
Incompatibility	-1.27 ** (.190)	-1.41 ** (.208)
Constant	3.45 ** (.476)	2.65 ** (.490)
<i>N</i>	243	243
<i>R</i> ²	.620	.575

Note: * $p \leq .10$, ** $p \leq .05$, and standard errors are in parentheses.

According to Hypothesis 1, secessionist conflicts should generally be located further away from the capital city than conflicts over state power. The findings confirm our prediction – the incompatibility variable is statistically very significant in both models. Supporting our second hypothesis, we see that identity is positive and significant regardless of model, although the effect is less impressive than that of the incompatibility variable. This will be more thoroughly discussed in the final section.

Table 3–4 reveals the results from the second part of the OLS regression section, addressing the hypotheses regarding the scope of conflict. As we have two endogenous variables of scope – measuring absolute and relative conflict area respectively – Models 3 and 4 generate estimations of absolute scope of conflict, while Models 5 and 6 consist of the relative scope of conflict. At first glance, we see that most of the exogenous variables generate very robust results, being significant in all four equations. Moreover, the R^2 are quite high (though not in the league of Models 1 and 2).

Table 3–4. OLS Estimation of Absolute (3–4) and Relative (5–6) Scope, 1946–2000

	Absolute scope		Relative scope	
	(3)	(4)	(5)	(6)
Location	0.39 ** (.048)	0.38 ** (.050)	5.64 ** (1.235)	5.62 ** (1.299)
Land area	0.18 ** (.050)	0.16 ** (.050)	-14.88 ** (1.226)	-15.14 ** (1.283)
Duration	0.03 ** (.010)	0.03 ** (.010)	0.77 ** (.302)	0.73 ** (.306)
Border	0.39 ** (.192)	0.43 ** (.204)	9.49 ** (4.545)	9.34 * (4.868)
Resource	0.83 ** (.213)	0.92 ** (.233)	17.51 ** (5.533)	17.47 ** (5.989)
Mountain		0.004 (.004)		0.09 (.098)
Forest		0.003 (.004)		0.06 (.094)
Constant	0.96 ** (.271)	0.86 ** (.295)	91.62 ** (6.897)	90.43 ** (8.070)
N	246	230	246	230
R ²	.466	.474	.374	.375

Note: * p≤.10, ** p≤.05, and standard errors are in parentheses.

Hypothesis 3 states that the duration of armed conflict is positively associated with the scope of conflict. This is supported in all four models; the estimate is statistically significant although the coefficient is quite small. We are thus led to the rather intuitive conclusion that longer-lasting conflicts generally involve a larger geographic area. In line with Hypothesis 4 (another seemingly obvious relationship), internal conflicts that abut – or cross – international boundaries are also associated with higher-than-average conflict zones. The impact is not overwhelming, but always significant at the 0.10 level. According to Hypothesis 5 the presence of natural resources increases the conflict area. Table 3–4 demonstrates that this clearly is the case; the resource dummy is robust throughout. The only variables that do not fare well in the OLS estimation are the physical geography indicators: mountain and forest. Neither of these had any impact on the scope of conflict, regardless of choice of endogenous variable.^{xiii}

3.5.2. Results of the three-stage least squares estimations

In this section we check for robustness of our results with respect to the endogeneity of area and distance, while examining the relationship between our explanatory variables and the two endogenous variables, scope and location. The distance between the capital city and the center of the conflict zone is highly correlated with the area of the conflict

zone ($r=0.602$). Accordingly we assess the estimated effect of the explanatory variables controlling for this relationship between the two endogenous variables.

In order to test this, we have developed a simultaneous equation model, in which the distance between the capital and the center of the conflict zone, the size of the area of the conflict zone (measured both as the natural log of the area and the percentage of the total land area), and the total logged area of the country are endogenized and are explained as a function of exogenous variables, so-called instrumental variables (which are the same as the independent variables reported in our OLS results section). All estimations were undertaken with three-stage least squares (3SLS) in STATA for all variables analyzed in our single equation OLS estimations. Three-stage least squares involves three steps: First, predicted or instrumented values of the endogenous variables (scope and distance) are generated, using all exogenous variables in the system. Second, a cross-equation covariance matrix is estimated. Third, the simultaneous equation with the two endogenized variables is estimated with generalized least squares using the instrumented variables, other exogenous variables as well as the estimated covariance matrix.^{xiv} The estimation technique 3SLS has the important advantage over two-stage least squares (2SLS) in that it uses the covariance matrix of disturbances, which improves the efficiency of estimation leading to smaller standard errors. However, this improvement depends on the consistency of the covariance matrix estimates, since with 3SLS the misspecification of one equation affects the estimates in all other equations. In sensitivity analysis we have therefore tested the system of equations with 2SLS instead and found no substantial changes.

Table 3–5 reports results for our three-stage least squares simultaneous equation estimations. From the regressions and their associated R^2 values one can see that our instruments work well in explaining cross-sectional differences in distance (location) and area (scope). For the most part, our results do not vary too much from the single equation OLS results. A simultaneous 3SLS version of each pair of the single equation OLS models was analyzed. We tested four models (Models 7–10). Models 7 and 8 produced the best results in terms of overall measures of fit. Models estimated in terms of the relative area of the conflict zone (percent of total land area in the combat zone) produced markedly worse results than the models in which the actual area of the conflict zone was measured (the natural log of the square kilometers). In terms of the two equations being estimated, the estimation of the distance produced much stronger results than the estimation of the size of the conflict zone. The specific z-scores associated with each coefficient across each model are quite robust. No single estimation challenges our evaluation of each hypothesis.

Table 3–5. Three-Stage Least Squares Estimation of Absolute (7–8) and Relative (9–10) Scope, and Location, 1946–2000

	Absolute scope		Relative scope	
	(7)	(8)	(9)	(10)
<i>Scope</i>				
Location	-.13 (.135)	-.070 (.125)	-7.55 ** (3.190)	-9.61 ** (3.492)
Land area	.45 ** (.091)	.41 ** (.090)	-7.84 ** (2.302)	-6.82 ** (2.360)
Duration	.040 ** (.012)	.037 ** (.012)	.95 ** (.295)	1.05 ** (.302)
Border	.86 ** (.231)	.90 ** (.236)	22.18 ** (6.02)	22.87 ** (5.955)
Resource	.94 ** (.227)	1.02 ** (.239)	19.73 ** (6.08)	19.50 ** (5.816)
Mountain		.005 (.0046)	.11 (.113)	
Forest		.005 (.0044)	.11 (.112)	
Constant	1.71 ** (.406)	1.31 ** (.416)	104.22 ** (10.625)	114.29 ** (10.549)
<i>Location</i>				
Absolute scope	.49 ** (.119)	.50 ** (.116)		
Relative scope			.023 ** (.006)	.022 ** (.006)
Land area	.21 ** (.070)	.21 ** (.070)	.65 ** (.078)	.64 ** (.075)
Identity	.50 ** (.206)	.60 ** (.216)	.56 ** (.230)	.44 ** (.216)
Incompatibility	-1.31 ** (.199)	-1.35 ** (.206)	-1.63 ** (.251)	-1.59 ** (.238)
Constant	3.53 ** (.484)	3.47 ** (.510)	2.50 ** (.629)	2.69 ** (.602)
Scope R ²	.261	.314	.123	.034
Location R ²	.620	.647	.598	.571

Note: * p≤.10, ** p≤.05, and standard errors are in parentheses.

With regard to Hypothesis 1, we find strong support. Rebel groups whose objective is to secede from the country do tend to fight further away from the capital than groups intending to take control of the state. The purported objectives of different rebel groups are related to the Uppsala coding of the nature of the compatibility. We find that across models, incompatibility is significantly associated with the distance between the capital and the center of the conflict zone. These results reflect what we found with the single equation OLS estimations.

Hypothesis 2 is also confirmed. Identity-based groups tend to fight their battles further away from the capital than non-identity groups. Across models this relationship

is always statistically significant at $p < .05$, though the effect is not half as strong as for the incompatibility variable – the single strongest predictor of location.

Hypothesis 3 is strongly supported. Duration and the size of the conflict zone are positively and statistically significantly associated across models and measurements of size of the conflict zone. We can conclude that longer lasting conflicts in general encompass larger areas.

With regard to Hypothesis 4, conflict zones that abut an international border will tend to be larger than conflict zones that do not. This finding is extremely robust. Hypothesis 5 is also strongly supported. The presence of natural resources in the conflict zone is positively and strongly statistically significantly related to the size of the conflict zone across all the models. Hypotheses 6 and 7 are not supported in any of the models.

As for the endogenous effects, we find that when the scope of the conflict is measured as the natural log of the area, distance is statistically significantly related to absolute scope but absolute scope is not related to distance. When the models are estimated measuring the conflict area as a proportion of the total area of the country (relative scope), the relationship is completely endogenized with both variables associated with one another in the simultaneous estimation. The total land area of the country is also treated endogenously and is entered in both equations. It is robustly statistically significant. As expected, the relationship between the scope of the conflict area and the size of the total area of the country changes with the way in which the battle zone is measured. If measured in absolute terms the relationship is positive. The relationship follows from the expectation that larger countries simply have more room within which to fight. The relationship is negative when the size of the battle zone is measured relatively. As expected, smaller countries tend to be fraught by a higher percentage of land involved in conflict. Despite finding support for these endogenized relationships, our conclusions regarding the hypotheses do not change with respect to the results of the single equation OLS estimations and the 3SLS estimations.

3.6. Conclusion

To our knowledge this is the first systematic inquiry into the scope and location of civil conflict. Drawing on [a preliminary version of] the PRIO/Uppsala Armed Conflict Dataset for the 1946–2000 period (Gleditsch et al. 2002), we have determined the location of all battle-zones for all conflicts in this time period, thereby identifying the

geographic extent and the center point of each conflict. With this data we are able to analyze the factors that determine the scope and location of civil conflict. Using ordinary least squares (OLS) and three-stage least squares (3SLS) estimation techniques we have analyzed the factors that determine the scope (measured in terms of logged square kilometers, and as the proportion of a country that is covered by the scope) and the location of the conflict relative to the capital (measured in terms of logged kilometers). Given the interdependence between location and scope, we modeled these relationships as simultaneous equations, which were estimated with 3SLS.

Geographical factors are indeed important. From our analysis we found that the scope of conflict is associated with such geographical factors as the total land area of the country, whether or not the conflict zone is adjacent to the border of a neighboring country, and whether there are natural resources in the conflict zone. Interestingly, two geographical factors considered to be critical to combat, mountains and forest cover, were found not to be statistically associated with the scope of conflict. This is most likely due to poor data. Our data on mountains and forests pertain to the country as a whole. We do not have precise enough information to inform us as to what extent the zone of conflict is forested or mountainous. When military strategists and historians discuss the central role of terrain, they are thinking in terms of specific battles and the specific nature of local geographical features. Our overly general data does not allow us to assess such a specific role.

A non-geographical factor, the duration of the conflict is also found to be associated with the area of the zone of conflict. Given the lower R^2 values associated with the OLS results and the relevant portion of the 3SLS estimations, it is clear that our findings with respect to the scope of conflict are not as well developed as our understanding of the location of conflict. We consider the primary problem to be related to imprecise measurement. Our method of calculating the area of the zone of conflict imposes as a circular measure where the actual shape is more likely to follow the contours of international boundaries, seashores, rivers, etc. Discontinuous shapes or fragmented zones of conflict, so common in guerilla warfare, are merely approximated by our measurement technique. By imposing a circular zone of conflict, we in many ways impose a favorable operational structure to the battle area (Collins, 1998: 18). In the future we hope to improve our measurement of the area of conflict. GIS technology may be useful for improving this measurement.

We are more confident of our results regarding the location of conflict. We have more confidence in how this variable is measured and our estimations of models with conflict-capital distance as the dependent variable produced much stronger findings.

Chapter 3

Our OLS and 3SLS results show that the location is influenced by the size of the scope, the size of the country, the nature of the rebellion (whether or not the objective of the rebels is to secede), and whether or not the rebel group has a religious or ethnic identity. The relationships between location and scope and total area of the country are not very surprising. If all countries were the same shape, these relationships would be mathematically deterministic. What is more interesting is that the nature of the rebellion and the nature of the rebel group affect where the conflict will be located. The pattern is quite strong. The nature of the incompatibility (basically the reason for the war) plays the biggest substantive role in determining the location of conflict, far exceeding the effect of other variables. This result indicates that researchers examining other aspects of civil war, such as onset and duration, should be looking at this variable. The strategic objective of the rebel group is important.

We have studied a number of factors that play a role in determining the scope and location of conflict. We have found compelling evidence indicating that many of the factors at T. E. Lawrence's finger-tips do indeed affect the nature of conflict. The variables in our analyses relate to most of Lawrence's, including geography (location and scope of conflict, and total land area), tribal structure, religion, language (rebel group identity), appetites (rebel objective or nature of the incompatibility). The factors that affected the nature of the Arab Revolt in 1916–18 seem to apply to civil wars in general.

Notes

ⁱ The other articles included in the special issue serve as testimony to the tremendous strides we have made in understanding the onset and nature of civil war in recent years. See Sambanis (2002) and Gates (2002b) for reviews of the literature.

ⁱⁱ In addition to Keegan (1993), see Collins (1998) and Murray (1999) for discussions regarding the role of geography in warfare.

ⁱⁱⁱ For more modern literature of this nature see Pepper & Jenkins (1985) and Klot & Waterman (1991).

^{iv} Addison et al. (2002), Addison & Murshed (2001), and Auty's (2001) distinction between point and diffuse resources lies not in their geographic dispersion, but the fact that point sourced resource rents are concentrated and capturable. We, like Le Billon (2001b), feature the geographic characteristics.

^v See Gates (2002a) for a related discussion regarding geographical distances, ethnicity and rebel recruitment.

^{vi} If all countries were circles and if physical geographical factors were uniform, then there might be some utility in deriving such a mathematically deterministic relationship. But given the wide distribution of country shapes and geographical features, this relationship can be modeled probabilistically.

^{vii} For example, the conflict in Cabinda between the Angolan government and *FLEC* (1992–97) is originally coded as three separate conflicts, one in 1992, one in 1994, and one in 1996–97.

^{viii} Data on the location of battle zones were drawn from the PRIO/Uppsala Armed Conflict project's archive at the Department of Peace and Conflict Research, Uppsala University, and various volumes of *Keesing's Record of World Events*.

^{ix} This program is available on the web-site of the Geography Department at NTNU:

www.svt.ntnu.no/geo/forskning/konflikt/viewConflicts/.

^x A negative consequence of the assumed circular shape of the conflict zones is that the measured scope inevitably covers some areas not affected by the conflict, thus overestimating the total area of the civil war. Future work on improving the geographic data will reduce this problem.

^{xi} Sambanis' (2000) 'wartype' variable is again made up from several sources, most notably Licklider (1995) and the State Failure Project (Esty et al. 1998).

^{xii} See Gerrard (2000) for a theoretical discussion of definition and operationalization of the mountainous terrain variable.

^{xiii} We also found no evidence that population was related to the geography of civil war. Population density, total population, and dispersion of the population (similar to Collier & Hoeffler 2004) – tested but not reported here – all proved to be insignificant with respect to both scope and location.

^{xiv} This third stage can also be used to estimate an equation for a specific dependent variable using the instrumented variables, the other exogenous variables and the estimated covariance matrix.

4

The Origin of Conflict Clusters: Contagion or Bad Neighborhoods?*

Abstract

Civil wars cluster in space as well as time. Conflict in neighboring states may influence the risk of civil war through such mechanisms as military infiltration, cross-border sanctuaries, refugee flows, political and ideological infection, and solidarity with kith and kin. However, states in conflict regions usually resemble one another with respect to other characteristics that may increase the prospects for conflict, such as low per capita income and lack of democratic institutions. In this study, we evaluate empirically alternative explanations of conflict clustering, and specifically ask whether the non-random pattern is merely a result of a similar spatial arrangement of relevant country characteristics or whether conflicts also display contagious behavior. We use new data to explore whether the risk of conflict depends on the distance to the nearest conflict zone, the number of neighboring conflicts, the length of shared land boundaries with a conflict neighbor, the size of the conflict neighbor, and the severity and type of the neighboring conflict. The results from an analysis of intrastate conflicts between 1950 and 2001 indicate that spatial clustering is not an artifact of failing to control for country attributes, and that there appears to be a genuine neighborhood effect of armed conflict. However, the risk of civil war does not increase proportionally with the number of nearby conflicts. Distance to the neighboring conflict zone and level of intensity also fail to make a significant impact. Rather, conflicts are more likely to spread to those neighbor states that already have a high baseline risk of civil war. We further find that the contagion effects are mainly a characteristic of separatist conflicts. We consider this as suggestive evidence that transnational ethnic ties are an important mechanism of contagion.

* This research paper is co-authored by Kristian Skrede Gleditsch, University of Essex. A previous version of the paper was presented at the Third European Consortium for Political Research (ECPR) General Conference, Budapest, 8–10 September 2005. Replication data and do-files will be available on the web upon publication

4.1. Introduction

The increased salience of civil war in the post-Cold War era has given rise to a large number of studies trying to uncover the causes of violent conflict within societies. Numerous cross-country comparative studies have explored how the risk of civil war is associated with certain attributes of countries. As useful as these quantitative studies are, they tend to ignore the potential influence of regional factors and the international context on the risk of civil conflict. Instead, the probability of domestic conflict is usually assumed to be a function of the attributes of each individual country only. This assumption is highly questionable, as we know that armed conflicts tend to cluster spatially in certain geographic areas. Ward & Gleditsch (2002) and Gleditsch (2005) have demonstrated that countries surrounded by conflictual countries are much more likely to become involved in violent conflicts. Other studies demonstrating clustering of conflict include Anselin & O'Loughlin (1992), Esty et al. (1995), Hill & Rotschild (1996), and Sambanis (2001).¹ The geographic clustering of intrastate conflicts strongly suggests that the risk of civil war is not determined merely by attributes of individual countries, but also by regional factors and events in neighboring states. Hence, cross-country studies of the sources of civil conflict face the perils of Galton's problem (see Galton 1889), the risk that observations that are not fully independent of one another may undermine inferences about causal relations.

Spatial clustering in and of itself does not necessarily imply diffusion or true dependence across observations. We know that many of the phenomena believed to influence the risk of civil war also tend to cluster geographically. Gleditsch (2002b: 19–21), for example, emphasizes how geographic clustering in the distribution of political institutions mirrors the regional patterns of conflict and peace. We will face a reverse Galton's problem if we interpret spatial clustering as evidence of diffusion when it simply could be due to clustering of relevant unit attributes, functionally related to conflict.

In this paper, we develop a more systematic approach to evaluating whether the spatial clustering of civil war merely is an outcome of similarly arranged country characteristics or whether it additionally reflects actual conflict contagion or dependence between countries. We first examine to what extent the geographic distribution of country characteristics that influence the risk of conflict can account for the observed clustering of conflict. We then explore whether the likelihood of conflict

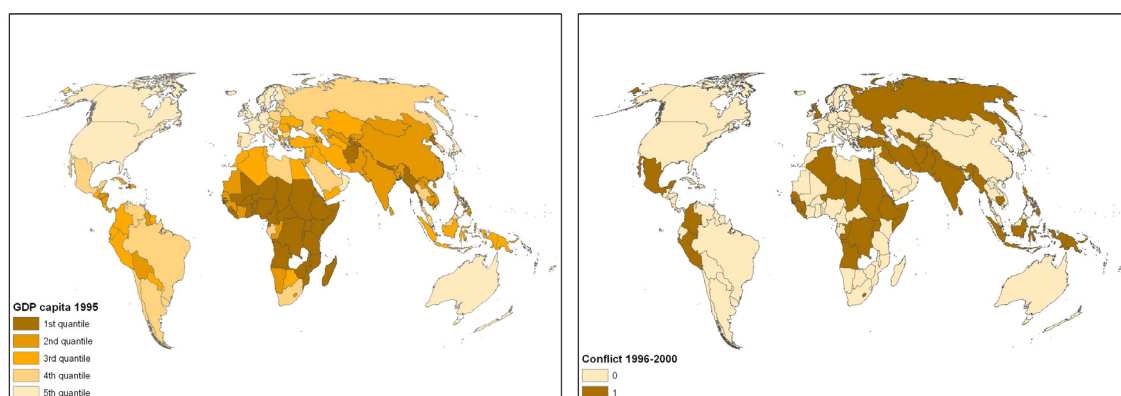
contagion is proportional to interaction opportunities, using new measures based on length of common borders and distance to the nearest conflict zone. Finally, we consider how different types of conflict are associated with different propensities for contagion. The results from an empirical analysis of intrastate conflicts between 1950 and 2001 indicate that the spatial diffusion effect of civil war is genuine, and it does not disappear when taking into account other spatially clustered country-specific features that influence conflict. However, the risk of contagion appears to be a discrete function, where a single neighboring conflict is sufficient to increase the risk and additional conflicts in the neighborhood add little to the likelihood of civil war. Opportunities for interaction with the conflict-ridden country fail to explain the direction of diffusion; rather, conflicts are likely to spread to neighboring countries that already have a high baseline risk of conflict. Moreover, we find that the risk of conflict diffusion primarily applies to conflict over territory, i.e. separatist rebellion. Conflicts over a central government are generally not contagious and appear to be driven by other factors than territorial conflicts. We conclude with implications of our results for furthering research on civil conflict and its transnational dimensions.

4.2. The Origin of Conflict Clusters: Diffusion or Confusion?

Although many researchers have demonstrated the existence of conflict clusters – using a variety of different sources of data on intrastate conflict – questions regarding the origin of these clusters have been left largely unanswered. Most importantly, it remains unclear whether conflict clusters arise simply due to regional similarity in other country-specific features related to conflict or whether they result from actual dependence or diffusion of conflict between countries. By diffusion, we mean situations in which a civil conflict in one country is followed by a new civil conflict in a nearby country within a short time period.ⁱⁱ To illustrate the problems involved in distinguishing diffusion of conflict from the clustering of similar neighbor characteristics, consider the relationship between civil war and income. A recent World Bank report asserts that poverty is the factor most consistently associated with civil war (Collier et al. 2003). The left panel in Figure 4–1 maps the distribution of national income per capita in 1995, while the right panel displays a map of countries that experienced armed intrastate conflict between 1996 and 2000. The maps indicate that

both poverty and conflict cluster in certain regions of the world. What is more, a comparison of the maps suggests a considerable degree of spatial overlap between the two phenomena, where central parts of Africa, the Middle East, and Central and Southeast Asia are particularly disadvantaged. Among the countries in the richest quintile of GDP per capita, only two states – Israel and United Kingdom – saw conflict with at least 25 annual battle-deaths over the period 1996 to 2000. By contrast, half of the countries (18 of 37) in the poorest quintile in 1995 experienced intrastate conflict within the following five-year period.ⁱⁱⁱ Although all continents except North America saw at least one intrastate conflict in this period, Africa – the least economically developed continent – was also the most severely affected by civil war, both in terms of the number of conflict years and the total number of countries with conflicts on their soil.

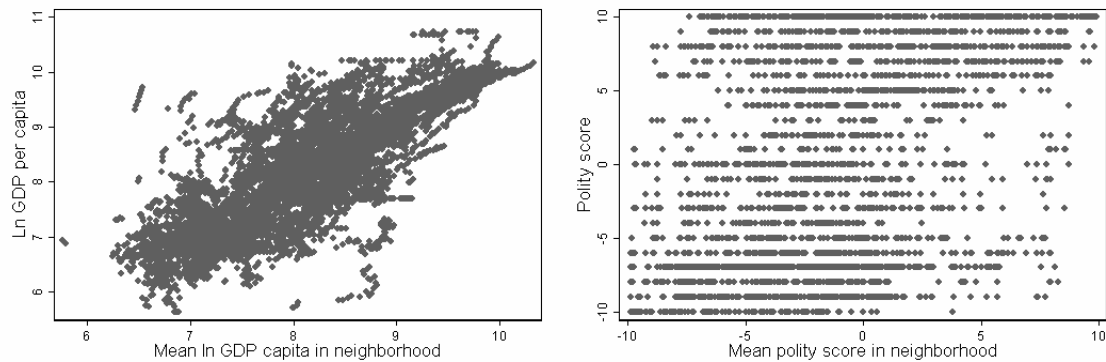
Figure 4–1. Poverty and Intrastate Armed Conflict in the World



Note: GDP per capita data from Gleditsch (2002a), conflict data from the Armed Conflict Dataset (Gleditsch et al. 2002).

To further illustrate the spatial characteristics of some relevant country attributes, Figure 4–2 shows the relationship between a country i 's GDP per capita (left) and level of democracy (right) and the corresponding values for the neighboring countries j , weighted by the inverse of their distance to country i . As can be seen from the plots, there is strong spatial covariance between a country and its neighbors. States with low per capita income tend to be surrounded by poor countries, while rich states are overwhelmingly surrounded by wealthy states. In the case of regime type, we similarly find that democratic institutions are much more likely to be found in countries located among democratic states than in countries whose neighbors are predominantly authoritarian.

Figure 4–2. Spatial Association of Wealth and Democracy, 1950–2001



Note: The scatterplots display the association between a country’s own level and the distance-weighted average level among neighboring countries for economic development (left panel) and extent of democratic institutions (right panel).

Although maps and scatterplots are invaluable tools to visualize geographic relationships, merely establishing spatial overlap and a bivariate relationship is not sufficient to determine causality. Comparing maps or scatterplots alone makes it difficult to take into account the influence of other potentially important factors that are likely to cluster spatially. To establish the relative contribution of different factors and the possible role of diffusion, we need to develop a baseline model of the likelihood of conflict conditional on relevant country characteristics, and assess the extent to which spatial position and proximity to conflicts in other states influence the risk of civil conflict. In the next sections, we develop five testable hypotheses on the origins of conflict clusters, which we then evaluate within a statistical model of civil conflict.

4.2.1. Bad neighborhoods as a source of conflict clusters

One possible explanation for the observed non-random distribution of conflict is that many of the factors believed to promote conflict are likely to be geographically concentrated. According to this line of reasoning, what appears as spatial clustering of armed conflict is merely a product of similar geographic patterns of harmful country attributes, and there should not be a neighborhood effect of conflict once the model controls for these factors. Although the existing literature on civil war rarely explicitly discusses the potential role of international factors, this explanation is at least implicitly promoted by all those studies that exclude measures of the regional context and adopt research designs that only comprise characteristics of the individual country. A more explicit defense of this position can be found in King (1996). He dismisses the

relevance of spatial context regarding electoral behavior and argues that although phenomena may appear to display considerable geographic variation, what is alleged to be a contextual effect tends to diminish when other explanatory factors are introduced in a conditional model. Hegre et al. (2001) put forward a similar claim with respect to civil conflict. These authors find little evidence of diffusion of conflict from neighboring states and conclude that the reason why civil war occurs more frequently in some part of the world than others is due to the clustering of other factors in the model, mainly development and regime type (p. 41).

The extent to which researchers find evidence of residual spatial clustering in statistical models of civil conflict will depend on model specification and data considerations. For example, the Hegre et al. model only considers the influence of the most severe group of proximate conflicts (with more than 1,000 battle-deaths). As we will discuss in more detail below, the broad category of civil war includes a large variety of different types of conflict, not only with respect to severity but also regarding the objective of the rebellion. Very likely, some forms of conflicts display a more contagious behavior than others. Some researchers also use conflict measures without a clear reference to spatial location. Fearon & Latin (2003), for example, treat conflicts in colonies as civil wars in the metropole country. Moreover, few studies to date have tried to take into account the impact of other aspects of the neighborhood besides armed conflict. Exceptions include Gleditsch & Ward (2000), who find that although democratic states are not generally less likely to experience conflict, states surrounded by democratic states are generally less likely to become involved in a war (see also Ward & Gleditsch 2002). Within the context of civil war, the character of political institutions in surrounding states can exert a strong influence on the ability of executives to provide support for insurgencies in other countries (see Gleditsch 2005). Although such mechanisms would be a neighborhood effect in the sense that country-specific attributes alone would not determine the risk of conflict, they are qualitatively different from the diffusion of ongoing conflict to neighboring states. As such, we should also consider the possible effects of clustering in country attributes before making inferences about whether there are residual diffusion or contagion effects.

Our first hypothesis, then, predicts no residual effect of neighboring conflict:

H1: *The positive effect of neighboring conflict on the risk of civil war disappears when country-specific political and economic factors, and the clustering of these attributes, have been taken into account.*

4.2.2. Interaction opportunities and diffusion

Assuming for now that the spatial clustering of conflict is not merely a result of clustering in other country characteristics and that a contagion effect holds even after controlling for these country characteristics, many questions still remain regarding the specific nature of these diffusion effects. Previous work has generally simply included a binary variable for conflict in neighboring countries, defined by some discrete threshold, and tested whether this increases the risk of outbreak of civil conflict.^{iv} However, work on international conflict diffusion compares conflict to the spread of infectious diseases (see Rapoport 1960; Davis et al. 1978; Siverson & Starr 1990). This suggests that the risk of diffusion should vary proportionally with interaction opportunities, just as the risk of an individual catching a disease generally increases with the number of infected people that person interacts with (see Watts 2003).

According to the widely used gravity model, the amount of interaction between two entities is proportional to their combined size and inversely proportional to the distance separating them (Linnemann 1966; Zipf 1949). For most states, a shared border, or close physical proximity to other states, is virtually a necessary condition for a war to be possible. Minor powers simply do not have the military capability to overcome the distance decay and project power to distant locations (see Buhaug & Gleditsch 2006). Assuming that civil wars are shaped by the same set of constraints as other forms of social interaction, we would expect that an ongoing conflict should constitute the greatest risk of contagion to immediate neighboring states.^v Conflicts may diffuse and increase the risk of conflict in neighboring states due to transnational ties, learning from mobilization elsewhere, due to spillover effects or fallouts from conflict in other states, or as a result of increased availability of cheap small arms, and all of these mechanisms are likely to be mediated by distance. If a transnational ethnic group succeeds in mobilizing militarily against the government in one state, then this is likely to change the prospects for mobilization against the government for members of the same group with minority status in other countries (see Halperin 1998; Gleditsch 2005). The Albanian revolt in Macedonia, for example, followed largely in the wake of prior mobilization in the Yugoslav province of Kosovo, and violence actually followed in the wake of more conciliatory policies by the Macedonian Slav government. The likelihood of ethnic ties between individuals in two different states declines the further apart the two states are.

A violent ethnic mobilization in one country may also allow minority groups facing similar situations elsewhere to emulate the neighboring rebels. Kuran (1998), for

example, suggests that nearby ethnic conflict may cause groups to become more aware of their own grievances, raise their expectations of ethnic conflict at home, and make the global public opinion more sympathetic towards other nations' dissimulation in general. Indeed, Lake & Rothchild (1998b: 26) argue that as groups update their beliefs about one another by observing events elsewhere, ethnic conflict can literally materialize out of thin air. However, given that other forms of interaction tend to be geographically confined, it will generally be the case that reference examples and the bulk of media attention will focus on events in nearby states.

Finally, conflict may become more likely when nearby countries experience civil wars due to the direct pernicious effects of conflict for other countries in the region. One of the obvious externalities of conflicts is transnational refugees. Refugee flows often create severe strains on receiving countries, as has clearly been the case in areas such as the Great Lakes region in Central Africa (UNHCR 2004a; see also Salehyan & Gleditsch 2006). Other consequences of conflict, such as access to cheap arms, cross-border rebel sanctuaries, and bounty-seeking mercenaries, can also contribute to the spread of violence. The rebel factions in Liberia and Sierra Leone are examples of the latter, where warlords, thugs, and so-called sobels (soldiers at day, rebels at night) control vital pieces of resource-rich territory on both sides of the border. In addition, civil wars have been shown to exert a negative impact on regional economic growth (Murdoch & Sandler 2002, 2004), which lowers the opportunity costs of rebellion in neighboring states. All of these mechanisms are likely to be mediated by distance; the negative spillover effects are presumably largest for countries near the conflict-ridden country, in particular when battles are close to the border. Salehyan & Gleditsch (2006), for instance, show that only refugees from neighboring conflicts are associated with a greater degree of risk. Similarly, Murdoch & Sandler find that the negative impact on economic growth of civil war elsewhere in a region is inversely related to the distance to the state where the conflict occurs.

The second component of the gravity model, size, may also play a role. While nearby states trade more and go to war more often than distant ones, larger states interact more overall than smaller states separated by the same distance. A larger combined population size means a higher number of potential relationships between individuals and groups in the two states. Such relationships are often vital for establishing economic and cultural ties between nations, but they can also be important in spreading arms and ideologies conducive to insurgency. Moreover, since population mass is traditionally viewed as an indicator of military might, a huge country is likely to arouse greater security concerns among its neighbors. An unfavorable political event in

a large country is likely to have a larger destabilizing effect on the region than a similar event in a small country.

According to this line of reasoning, the risk of civil war should increase with the size of the nearest conflict-ridden state and the proximity to the nearest conflict zone. This can be formulated as follows:

H2: *The risk of civil war is positively associated with the proximity of nearby conflicts.*

H3: *The risk of civil war is positively associated with the size of the conflict neighbor.*

4.2.3. Type of civil war and diffusion

Civil war is usually defined as armed conflict between a state government and a non-state actor that generates more than some minimum number of casualties (see Sambanis 2004a for additional discussion). However, although much of the literature talks about civil war as if it were a uniform class of events, existing data sources clearly lump together many different types of conflicts. In particular, civil wars include efforts by peripheral groups to gain concessions in terms of autonomy or independence from the central government as well as various forms of conflict within the center, such as military coups and popular revolutions. Researchers that do propose distinctions between different types of civil war find evidence that they indeed display quite different characteristics. Fearon (2004), for example, finds that civil wars in the periphery tend to last much longer than coups or ideological conflicts. With respect to contagion, Sambanis (2001) finds that conflicts in neighboring states primarily increase the risk of identity-based (or ‘ethnic’) wars, where the neighboring war dummy is one of the most robust and influential explanatory factors. If different types of civil war involve different risks of diffusion, lumping together all civil wars may lead to misleading results.

Unfortunately, the procedure proposed by many researchers to distinguish between ethnic and ideological civil wars is not easy to apply, and the categories may not even be mutually exclusive. Consider, for example, the civil war in Guatemala. Although the UNRG (Guatemalan National Revolutionary Unit) movement recruited among indigenous communities, the civil war could also be considered ideological, given its Marxist orientation. In this paper, we follow Buhaug (2005b) and distinguish

between civil wars based on their aims rather than their base of mobilization. We identify conflicts as either being over territory (secession) or over control of a central government. In general, the risk of diffusion to nearby states would seem much greater for separatist conflicts because such conflicts often involve identity groups that have kith and kin in neighboring states. The demonstration effects of secessionist conflict are also likely to be much greater than is the case for conflicts over government. Although ethnic conflicts may spread beyond the original kin group, they are less likely to have global repercussions than ideologically motivated revolts, which tend to employ universalistic principles, such as Marxism (Kaufman 1996; Lake & Rothchild 1998a). Finally, conflict externalities for other states are likely to be more severe from conflicts in the periphery, as these in general persist for much longer periods than coups and other forms of conflict over control over the central government, which often last as little as a couple of days (Buhaug et al. 2005).

Another way to separate between conflicts is to consider the level of severity. Although we do not believe that the origins of conflicts of lower intensity are inherently different from the causes of major civil wars, it seems fair to expect conflicts with high fatality figures to constitute a higher risk to neighboring states. Severe conflicts tend to involve a higher number of combatants, cover a larger geographic area, are more devastating to the region in conflict, and generate a higher number of refugees and internally displaced peoples. For example, UNHCR's (2004b: 3) list of the largest exporters of refugees by the end of 2004 consists exclusively of countries that have experienced grave domestic conflicts in recent years, such as Afghanistan, Sudan, Burundi, D. R. Congo, and Somalia. What is more, four of these top-five countries had contiguous neighbor states with armed conflict in 2004, according to the most recent update of the Uppsala/PRIO Armed Conflict Dataset (see Harbom & Wallensteen 2005).^{vi}

Our final two hypotheses, then, are:

- H4: *The risk of civil war is positively associated with the severity of neighboring conflicts.*
- H5: *Separatist wars are more hazardous to neighboring states than governmental wars.*

4.3. Data and Research Design

We test our hypotheses on a sample of annual observations for all independent states, as defined by the Correlates of War Project, over the period 1950–2001. The conflict data are based on the Uppsala/PRIO Armed Conflict Dataset (ACD), v. 3.0 (Gleditsch et al. 2002). This includes a complete list of all violent incidents between an organized opposition group and a state government that caused at least 25 battle-deaths per year. We use three different dependent variables to test the hypotheses outlined in the previous section. Hypotheses 1–4 concern the outbreak of civil war in general. In order to test these hypotheses we use a simple, binary indicator of the onset of intrastate conflict.^{vii} By contrast, Hypothesis 5 makes a prediction about how separatist insurgency is particularly likely to induce contagion. To test this conjecture, we need to distinguish separatist conflicts from other forms of civil conflict. We rely on the ‘incompatibility’ indicator of the ACD, which codes conflicts as being over either government or territory.

The dependent variables mark the onset of conflict, which means that only the initial year of the conflict is coded ‘1’. Ongoing years of separatist conflict are assigned the value ‘0’ whereas ongoing years of governmental conflict are coded as missing. This is because a state may have several contemporaneous separatist conflicts but by definition only one conflict over state governance at any time. In cases of a lull between periods of fighting, we use a two-year rule; incidents separated by more than two calendar years without recorded violence above the minimum fatality threshold are treated as separate conflicts.

Our main independent variable is the presence of conflict in the neighborhood. This is roughly analogous to the concept of a so-called spatial lag of the dependent variable in the spatial statistical literature (see Anselin 1988; Beck et al. 2006). We use a variety of different indicators of conflict in other countries. The most basic variant simply indicates whether at least one of a country’s neighbors experience a civil war in the given year. Only land contiguous countries are considered neighbors, since several factors that contribute to the spread a conflict, such as refugee flows, the smuggling of arms and equipment, and rebel movements, are severely obstructed by distance. We also generated a more inclusive measure where all conflicts in the system are weighted by the inverse distance to the unit of observation, so that nearby conflicts count more than more distant ones. More specifically, we use a distance weights matrix W , given by

$$W_{ij} = \frac{1/d_{ij}}{\sum_{j=1}^n 1/d_{ij}},$$

which considers the inverse of the distance ($1/d$) between state i and any state j as a share of the sum of the inverse distances between i and all other countries j . Data on interstate distances were taken from Gleditsch & Ward's (2001) minimum distance dataset for states separated by up to 950 km, supplemented by intercapital distances for other states, taken from EUGene (Bennett & Stam 2000). The weighted neighboring conflict measure is standardized and can take on values between 0, in the event that there are no intrastate conflict in the international system in the given year, and 1, in the extreme case of conflict in all other countries in the system in the given year. Since there may be a time lag to the diffusion process, we also ran the analysis with extended spells of neighboring conflict. These results suggests that the neighboring conflict variables take on positive values in the two years immediately following each conflict, but the substantive implications of the estimates from the alternative models did not differ notably from the reported results.

In the second stage of the analysis, we estimate the relative risk of civil conflict for conflict neighbors only. We consider four different measures of opportunity for diffusion; the (logged) length of the common boundary between the country of observation and the conflict-ridden neighbor; the (logged) minimum distance from the country to the neighboring conflict zone; a discrete measure indicating whether the boundary of the country abuts the neighboring conflict zone; and the (logged) population size of the conflict neighbor. Data on boundary length are drawn from Furlong & Gleditsch (2003), whereas the distances from the conflict zones to the neighbor states (rounded downwards to the nearest 50 km) were measured using ArcGIS 8.3, based on the location variables in the ACD (see Buhaug & Gates 2002). ArcGIS was also used to identify conflicts that extended to the border of neighbor states. Population statistics are taken from the Correlates of War project's National Material Capabilities dataset, v. 3.02 (see Singer et al. 1972). In addition, we include a (logged) measure of the number of battle-deaths for the neighboring conflict. The battle-deaths data correspond to the list of conflicts of the ACD project and give annual casualty estimates, rather than total deaths for each conflict. These data are drawn from Lacina & Gleditsch (2005). Finally, to evaluate whether the type of neighboring conflict plays a role, we add a dummy for territorial conflict (governmental conflict is the

reference). In cases of multiple neighboring conflicts, the distance, population, and conflict type variables refer to the nearest conflict.

We also include a number of standard control variables, drawing upon existing studies of civil conflict. Level of development is proxied by the natural logarithm of GDP per capita (data from Gleditsch 2002a) with a one-year time lag, except in the initial year of observation. For a measure of regime type, we rely on the democracy-autocracy index from Polity IV (see Gurr et al. 1989). We only include a squared term of the Polity index, as previous research suggests an inverted u-shaped relationship between regime type and domestic conflict (Hegre et al. 2001; Muller & Weede 1990). We also control for the size of the country of observation. Larger countries tend to have more neighbors and contain multiple ethnic groups, and a large population is comparatively difficult to monitor by government institutions. Data on (the natural log of the) population size is taken from the COW's capabilities dataset, v. 3.02. Finally, we add a dummy variable to check for differences in the baseline risk in the post-Cold War period (1989–2001), as it is often argued that the collapse of the Soviet Union and the termination of the bipolar world system lead to important changes in the nature of armed conflict (Mueller 1989). Contemporary conflicts are almost exclusively intrastate contests, whereas the dominant form during the Cold War (in terms of political attention if not in casualties) was conflicts between states. Moreover, both in relative and absolute terms, the number of separatist wars has increased markedly since 1989 (Buhaug 2005b).

We also tested a number of other factors that have been considered in studies of civil war, such as political instability, rough terrain, ethnolinguistic fractionalization, and a dummy for major oil-exporting countries. Although some of these measures gained significant parameter estimates in some models, they did not affect the results of the key explanatory variables and we therefore do not report these results here.

Because our observations are pooled over time we need to consider the possibility of duration dependence, or the possibility that the risk of conflict for unit i at time t may depend upon whether i has recently experienced civil conflict. For example, many of the economies with the lowest GDP per capita emerge out of years of violent conflict. Hence, merely using observed measures of economic performance such as low income as predictors without acknowledging the influence of prior conflict may overstate the apparent impact.^{viii} To correct for temporally correlated observations we include a count variable of consecutive years of peace. Following Beck et al. (1998), we also considered a non-linear specification using smoothing cubic splines. However, tests showed that these do not improve the fit significantly or affect individual estimates of

the remaining covariates so they were dropped from the reported models. All analyses were conducted in Stata 8.2 and results are reported as maximum-likelihood logit estimates with robust standard errors.

4.4. Empirical Results

An initial test of the impact of neighborhood characteristics is presented as Models 1 and 2 in Table 4–1 below. Aside from the peace-years variable and the post-Cold War dummy, only regional measures of intrastate conflict, democracy (squared), and development are evaluated. The only difference between the two models is the operationalization of neighboring conflict; the first model uses the inverse distance-weighted average of regional conflict density whereas the second model uses the dummy variable. Model 1 provides little evidence of conflict diffusion. The coefficient estimate for the neighboring conflict variable, while being positive, is not significantly discernable from 0. In fact, the only explanatory factor to make a substantial impact on the fit of the first model is regional level of development. All else being equal, countries in a poor neighborhood are considerably more likely to experience domestic conflict at any given time than countries with wealthy neighbors.

Model 2, which discards the spatially lagged dependent variable in favor of a simpler dummy indicator of conflict among contiguous neighbor states, presents a different picture. Contrary to the claims of Hegre et al. (2001) and others, we find that neighboring conflict has a significant destabilizing effect on the neighborhood. All else held at median values, a country is about twice as likely to experience an outbreak of conflict if at least one of its neighbors is involved in conflict. The contrasting findings of these two models suggest that the risk of being involved in civil war does not increase in proportion to the share of nearby states in conflict. Rather, the risk of conflict assumes a discrete function where the major divide runs between countries without neighboring conflict and countries with at least one conflict at their borders. Again, we find countries with rich neighbors to have a lower baseline risk of conflict than states in less well-off regions. The coefficient estimate for the regional level of democracy (squared) is negative in both models, but not significantly different from 0.^{ix}

Next, we add the country-specific controls for democracy, development, and population size to the model. Not surprisingly, Models 3 and 4 suggest that a country's own political institutions, income, and size indeed influence the risk of domestic instability. The most powerful covariate in terms of marginal effect is population size.

The risk of civil war is about four times higher for the largest countries in the sample (95th percentile value) than for the smallest countries (5th percentile), all other variables held at median values. When controlling for a country's own characteristics, the estimated role of the neighborhood diminishes. Regional wealth, in particular, is no longer able to distinguish between belligerent and peaceful societies. The coefficient for the neighboring conflict measures also decrease, but the estimate for the dichotomous neighboring conflict measures in Model 4 maintains a substantial effect. Hence, the neighborhood effect persists even when controlling for the key country-specific attributes.

Table 4–1 Onset of Intrastate Conflict, 1950–2001

	(1)	(2)	(3)	(4)
Neighborhood conflict	0.377 (1.58)	0.576 (3.94) **	0.142 (0.52)	0.402 (2.66) **
Neighborhood democracy squared	-0.003 (1.04)	-0.002 (0.81)	0.001 (0.49)	0.002 (0.69)
Neighborhood GDP per capita	-0.416 (4.50) **	-0.370 (3.96) **	-0.089 (0.64)	-0.067 (0.47)
Democracy squared			-0.008 (3.04) **	-0.008 (3.09) **
GDP per capita			-0.276 (2.31) *	-0.251 (2.06) *
Population size			0.303 (6.38) **	0.285 (6.03) **
Post Cold War	0.793 (5.51) **	0.722 (5.05) **	0.687 (4.62) **	0.634 (4.28) **
Peace years	-0.026 (3.91) **	-0.025 (3.80) **	-0.021 (3.17) **	-0.021 (3.20) **
Constant	-0.035 (0.05)	-0.615 (0.85)	-2.969 (3.25) **	-3.333 (3.58) **
Log pseudolikelihood	-904.4	-897.7	-876.5	-873.1
N	6,589	6,589	6,589	6,589

Note: Logit estimates with robust z scores in parenthesis. * p<.05; ** p<.01.

Comparing the estimates of Models 3 and 4 (as well as those of Models 1 and 2) allows us to answer some of the questions we raised in the introduction about the nature of the risk of contagion. Two conclusions can be drawn at this stage: First, the results strongly suggest that only conflicts among contiguous countries constitute a significant threat to internal peace; distant conflicts appear to have little influence. Second, the results suggest that the risk of conflict spreading from neighboring states takes the form of a weak-link function, where a single conflict in the immediate neighborhood is enough to increase the risk of civil conflict for a country by a substantial share.

However, contrary to what one would expect from the assumed association between interaction opportunities and the spread of armed conflict – and from the analogy between conflicts and infectious diseases – we find that the risk of contagion does not increase in proportion to the number of neighboring countries at civil war.

In summary, Table 4–1 demonstrates that *there is a neighborhood effect of civil war*, but it is not proportional to the number of nearby conflicts. Since the effect of conflict among neighboring states remains even after controlling for plausibly spatially correlated country characteristics, the clustering of conflict cannot be written off as a mere artifact due to omitted country characteristics. However, given that there is a conflict in a neighboring state, does the risk of contagion to a neighbor depend on the specific characteristics of the conflict?

In Table 4–2, we explore some alternative specifications of the risk of diffusion in order to answer these questions. Here, the sample of observations is limited to contiguous neighbor states to countries in civil war. Models 5 and 6 consider the role of interaction opportunities with the conflict neighbor. Both models include a measure of the length of the common boundary between the states and the size of the conflict-ridden neighbor state. Model 5 additionally estimates the effect of the distance to the neighboring conflict zone while Model 6 uses a simpler dichotomous indicator of whether the neighboring conflict zone abuts the border of the country. Finally, all models in Table 4–2 include a dummy variable that indicates whether the (nearest) neighboring conflict is over territory or governance and they also control for the intensity of the neighboring conflict.

Contrary to Hypothesis 2, we find that conflicts do not appear to follow the principle of least effort and spread to those neighbor states that provide the greatest opportunities for cross-border interaction. Although the estimate for the log of shared boundary length is positive, it is not significantly different from 0 and we cannot conclude that a neighbor state j with a long shared border with a conflict-ridden country i are neither more nor less likely to experience conflict onset than a neighbor k with a short boundary with i . In addition, the estimate for distance to the conflict zone is negative, but again not statistically significant. A neighbor country that is located 1,300 km away from the conflict zone (corresponding to the 95th percentile value) is only 30% less likely to experience conflict than a country fully adjacent to the conflict zone (i.e., a distance of 0 km, corresponding to the 5th percentile). Model 6, which simply distinguishes between countries with conflict at the border (conflict distance=0 km) and other neighbors (conflict distance>0 km), produces almost the exact same result. The coefficient estimate has a positive sign, but the comparably large standard error renders

it statistically indistinguishable from 0 even with a 20% margin of error. We also find no support for our third hypothesis, which predicted that conflicts in larger countries would be more destabilizing to the neighborhood than conflicts in smaller states. In fact, the parameter estimate for population size of the conflict neighbor is negative in both models, even if the confidence interval includes the possibility of a weak, positive association.

Table 4–2 Onset of Intrastate Conflict for Conflict Neighbors, 1950–2001

	All conflicts		Territorial	Governmental
	(5)	(6)	(7)	(8)
Boundary length to conflict neighbor	0.010 (0.10)	0.014 (0.14)		
Distance to neighboring conflict zone	-0.057 (1.21)			
Neighboring conflict zone at border		0.280 (1.03)		
Population size of conflict neighbor	-0.017 (0.22)	-0.024 (0.31)		
Neighboring conflict over territory	0.492 (2.26) *	0.490 (2.25) *	1.040 (3.22) **	-0.011 (0.05)
Battle-deaths of neighboring conflict	-0.027 (0.52)	-0.027 (0.52)	-0.138 (1.59)	0.065 (1.04)
Democracy squared	-0.004 (1.03)	-0.004 (1.06)	-0.000 (0.03)	-0.011 (2.55) *
GDP per capita	-0.234 (2.01) *	-0.238 (2.05) *	-0.466 (2.24) *	-0.126 (0.95)
Population size	0.299 (5.29) **	0.302 (5.34) **	0.562 (7.28) **	0.079 (1.20)
Post Cold War	0.799 (4.02) **	0.802 (4.04) **	1.698 (5.13) **	0.442 (1.76)
Peace years	-0.023 (2.89) **	-0.024 (2.92) **	-0.065 (5.01) **	-0.013 (1.51)
Constant	-3.835 (3.08) **	-4.076 (3.15) **	-5.529 (2.82) **	-3.018 (2.40) *
Log pseudolikelihood	-463.25	-463.47	-187.26	-315.97
<i>N</i>	2,586	2,586	2,586	2,228

Note: Logit estimates with robust z scores in parenthesis. * p<.05; ** p<.01.

These results are largely consistent with the weak-link interpretation we alluded to above. Having a conflict in a neighboring country increases the risk that a country will experience a civil conflict, but the relative location of the proximate conflict and the interaction opportunities with the conflict neighbor do not appear to exert much impact. Other ties than proximity and distance must shape the risk of contagion. These results seem consistent with the idea that transnational ethnic group linkages serve as a

source of diffusion of conflicts, as appears to be borne out by recent conflicts in the Balkans and the Caucasus.

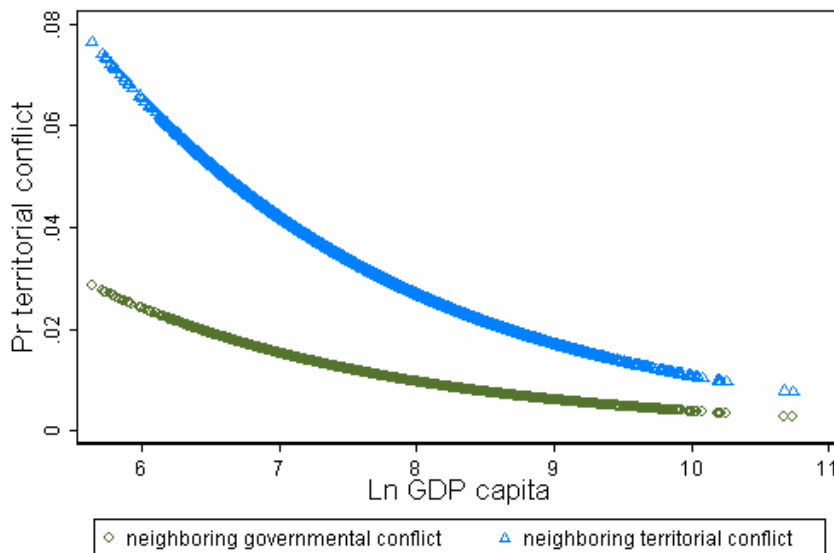
Arguably the most striking finding of Models 5 and 6, we find that territorial conflicts in the neighborhood constitute a considerably larger risk to domestic stability than conflicts over the control of the central government. The estimated probability of conflict is twice as large if the neighboring conflict is over secession rather than over governance, all else being equal. Given the lack of impact of the boundary length and distance measures, this result is not merely due to separatist conflicts more often extending to the border with neighbor states (which they indeed often do). Rather, we interpret this finding as additional indirect evidence that separatist conflict often displays transnational dimensions through the linkages between groups of the same ethnic origin in other states. The particularly hazardous impact of territorial conflicts on the neighborhood may also reflect demonstration effects of mobilization as well as refugee flows, both of which are assumed to be less closely associated with governmental conflicts. Accordingly, we believe that these results lend considerable support to Hypothesis 5, although we are unable to distinguish between the roles of specific group ties and demonstration effects here.

The severity of the neighboring conflict appears to play a diminutive role. This cannot be explained by multicollinearity problems, even if governmental conflicts on average are about three times as violent in terms of casualties. According to the battle-deaths data, the governmental intrastate conflicts between 1946 and 2002 generated an average of 5,638 fatalities per year with a median value of 900 annual deaths. The corresponding figures for the territorial conflicts are 1,837 and 237, respectively. If we estimate the models in Table 4–2 without the territorial conflict dummy, the coefficient for the battle-deaths indicator increases, but the effect is still far from what is normally considered statistically significant. Hypothesis 4 is not supported.

Models 7 and 8 represent the final test of the contagious nature of intrastate conflict, where we estimate the risk of territorial and governmental conflict in separate models. The results call for an amendment of the findings reported above. Above all, we find that the neighborhood effect of separatist conflict as seen in the previous models only applies to the risk of secessionist insurgency. Although the marginal impact of having a neighbor with a territorial conflict (as opposed to a neighboring governmental conflict) may be smaller than that of large differences in a country's wealth, we find that the likelihood of separatist conflict nonetheless trebles if a an ongoing neighboring conflict also concerns issues of self-determination. This is illustrated in Figure 4–3, which displays the predicted likelihood of territorial conflict over GDP per capita for

countries with neighboring separatist (triangles) and governmental conflict (circles), respectively. The severity estimate is also considerably larger with respect to territorial conflict – although still in the opposite direction of what we expected – and it even exerts a statistically significant effect if we fail to control for type of neighboring conflict. Accordingly, it seems that the risk of separatist conflict is highest if the neighboring conflict is contained at a low intensity level. This might be an artifact of peripheral ethnic insurgencies, which often are protracted disputes with relatively few casualties, and which are likely to motivate members of the same minority group across the border to issue similar demands towards their own government.

Figure 4–3. Risk of Territorial Conflict by Wealth and Type of Neighboring Conflict



Note: The plot shows the estimated risk of territorial intrastate conflict for the average post-Cold War country as a function of level of development and type of nearest neighboring conflict. The plot is based on estimates in Model 7.

As for the risk of governmental war, the severity and type of the nearest neighboring conflict play negligible roles. In fact, we find that only type of political institutions contributes to explaining the onset of governmental conflict, where a civil war is less likely in the most repressive and most democratic societies. Conversely, democracy does not have a significant impact on the likelihood of territorial conflict. Government repression or accommodation thus seems to exert less influence when emerging separatist groups can draw on resources or inspiration from movements in the

immediate neighborhood. None of the other control variables seems to be significantly related to conflict over government – including the two most influential covariates in Model 7, income per capita and country size. We also see that there is no post-Cold War effect on the risk of governance conflict, at least not among conflict neighbors. The apparent increase in the clustering of civil wars in recent years is thus mainly a feature of separatist insurgencies. The risk of territorial conflict is also affected by the history of the country to a larger degree. Newly independent countries and countries with a conflict in the recent past are significantly more likely to host a secessionist rebellion but not a revolutionary movement.

The joint inference from Models 7 and 8 corroborates previous research (e.g. Buhaug 2005b; Sambanis 2001) in that determinants of separatist conflict are largely different from the factors associated with coups and revolutions. The comparably poor performance of the governmental conflict model suggests that these conflicts to a much larger extent are driven by particular or case-specific factors, rather than by structural factors that stand out clearly in large-N investigations.^x

4.5. Discussion

We started this paper by demonstrating that intrastate conflicts cluster spatially, and then asked whether this clustering merely stems from clustering of certain country characteristics associated with conflict or whether it also reflects diffusion of conflict across borders. The empirical results we presented provide clear evidence that there is indeed a neighborhood effect, and that there is something about armed conflict in one state that makes neighboring countries more prone to domestic instability. We then asked to what extent interaction opportunities to a country involved in conflict influence the risk of contagion. Our results here are less straightforward, as opportunities for interaction as shaped by geography per se do not exert a large influence on the risk of contagion among neighbors. The main increase in the estimated risk of rebellion is found when distinguishing between cases with and without neighboring conflict in a dichotomous fashion. There is little evidence that the risk of conflict increases with the number of neighbors in conflict, as one might have expected from reading the literature on diffusion of interstate war. Second, among the neighbors to countries involved in conflict, the distance to the conflict zone does not do a good job at predicting which country is most likely to be affected by contagion. Nor does the length of the shared boundaries with – or the size of – the conflict neighbor help to discriminate between

countries that ultimately experience conflict and those remain at peace. Rather, any cross-border contagion of conflict is likely to involve the neighbor that already has a high risk of domestic instability due to adverse political and economic conditions. To use medical jargon, small, democratic, and wealthy states appear to be inoculated against the infectious disease, regardless of their proximity to the contaminated area.

Since the global distribution of conflict-promoting factors resembles the distribution of intrastate conflict, neighboring countries that are close to the conflict zone are also more likely to show characteristics similar to the conflict-ridden country.^{xi} However, our results also point to an additional mechanism through which armed conflict might spread to neighboring countries. Distinguishing between two types of internal conflict confirmed that secessionist wars indeed might give rise to similar conflicts in neighboring states while conflicts over governments are much less likely to be contagious. Since most separatist movements tend to revolve around ethnopolitical groups, and such groups often exist in more than one country, we believe that transnational ethnic ties are one of the key mechanisms of diffusion of conflict between states. Previous research, such as Gleditsch (2005), who uses somewhat indirect indicators of transnational linkages, has already shown that civil conflicts are more likely, the higher the number of transnational ethnic groups in a country. The potential role of such groups in contributing to the spread of violence across international boundaries certainly deserves future attention, but this will require better data on ethnic groups than what is currently available. Current data sources, such as the Minorities at Risk (MAR) data (Gurr 1993), as well as Fearon (2003) and Vanhanen (1999), include counts of the share of a state's population that belong to each particular group, defined on the basis of language, risk, and ethnicity. The MAR database also includes indicators of whether individual groups are at risk of repression or rebellion, the political aim of the group, and whether the group has ethnic kin in other countries, but it does not indicate where the groups are present. Many of the included groups are also summary categories – for example ‘foreigners’ in Switzerland and ‘Muslims’ in France and the Netherlands – that do not necessarily translate into meaningful transnational groups.

Our ability to answer some questions about the nature of conflict diffusion in turn raises new questions regarding how identity ties between states may make conflicts likely to diffuse. Inter-group linkages, rather than geography per se, appear to play a significant role. Ultimately, we believe that new data can help to open the black box of diffusion and allow testing specific connections between conflict actors and the risks of conflict among neighbor states. The Armed Conflicts Data have recently been recoded in a dyadic format, with information about the non-state actors in civil conflicts, as well

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as indicators of relations with other states (see Cunningham et al. 2005). In the longer run, we hope to be able to use sources of ethnic groups and their geographic distribution, such as the Ethnologue data (see Grimes 2003), to code a dataset that permits identifying linkages from an opposition group or territory under contention to communities in other states.

Notes

ⁱ Anselin & O'Loughlin (1992) find strong evidence of spatial autocorrelation for both international conflict and cooperation using the COPDAB data, but little evidence of clustering in internal conflict, as reflected in the coup d'état data compiled by Jackman (1978).

ⁱⁱ Unlike many studies of diffusion of international war, we distinguish cross-country *diffusion* from conflict *escalation* due third-party intervention in ongoing civil wars. See Lake & Rothchild (1998b) for a similar distinction, and Elkins & Simmons (2005) for a more general discussion of the concept of diffusion.

ⁱⁱⁱ These are Afghanistan, Angola, Burundi, Chad, the Democratic Republic of Congo, Eritrea, Ethiopia, Guinea-Bissau, Liberia, Myanmar, Nepal, Niger, Rwanda, Sierra Leone, Somalia, Sudan, Tajikistan, and Uganda.

^{iv} The main exception here is Ward & Gleditsch (2002), which includes a count of the number of conflicts in neighboring states.

^v For a related argument regarding the diffusion of democracy, see O'Loughlin et al. (1998) and Cederman & Gleditsch (2004).

^{vi} These conflict neighbors are, Afghanistan: Uzbekistan; Sudan: Ethiopia and Uganda; D. R. Congo: Angola and Uganda; Somalia: Ethiopia. Burundi did not have any neighbors in armed intrastate conflict in 2004, according to the Armed Conflict Dataset.

^{vii} We use the terms 'war' and 'conflict' interchangeably. Although some other works reserve the former term to the most severe conflicts, typically requiring at least 1,000 deaths, we believe that there is no good reason to expect that the causes of major conflicts must be fundamentally distinct from smaller ones.

^{viii} More troubling is the possibility that many right hand side variables may in this sense be endogenous to conflict propensity (see Christin & Hug 2005).

^{ix} A similarly constructed linear regional democracy term, too, fails to exert a significant impact on the likelihood of domestic conflict.

^x That said, it is possible that the latent risk of one type of conflict makes the other type more likely. For example, governments weakened by separatist strife may be more likely to be challenged over state authority, and separatist movements may try to seize upon coups and general instability to extract concessions. See Chiozza et al. (2004) and Salehyan & Gleditsch (2006) for additional discussion and some preliminary empirical evidence.

^{xi} When estimating the effect of distance to the neighboring conflict without controlling for political institutions or level of economic development, we find that neighbors near the conflict zone are significantly more likely to experience an outbreak of conflict.

5

Accounting for Scale: Measuring Geography in Quantitative Studies of Civil War*

Abstract

The empirical evidence from studies linking geographic factors like terrain and natural resources to civil war is generally weak and not robust to varying samples or coding procedures. We argue that these investigations suffer from a major weakness: although most civil wars are geographically limited to small parts of the host countries, the analyses rely almost exclusively on country-level data. We demonstrate how Geographical Information Systems (GIS) can be used to generate precise measures of space-varying factors at the scale of the conflict. A comparison of several relevant variables measured both at the scale of the country and the conflict demonstrates that country statistics are poor approximations of the conflict zones. An analysis of duration of civil war further shows that certain findings are indeed dependent upon the scale of measurement. We conclude by discussing how GIS and spatial analysis may be applied in future research to increase our understanding of location, duration, and risk of armed civil conflict.

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5.1. Introduction

The link between geography and war has deep roots. From Sun Tzu's (500 BC/1963) classic treatise *Art of War*, via early-modern theoretical works on geopolitics and imperialism, to contemporary conflict studies, scholars of international relations have repeatedly asserted that geographical factors are vital aspects of the origin and conduct of war (see Diehl 1991 for an overview). Features of terrain, subsoil assets, population distribution, and ethnic diversity are aspects of geography that have received particular attention. Typically, the risk and duration of civil war are thought to be high in remote, rural districts, populated by an ethnic or religious minority, with rough mountainous or forested terrain, and containing valuable natural resource deposits. So far, however, empirical studies have been less than successful in establishing a clear link between the geographic distribution of physical and human factors and civil war.

The theoretical framework for empirical studies on civil war and geography is often motivated by how local factors such as rebels' access to easily exploitable natural resources and sanctuaries in rough terrain increase the viability of insurgency. However, our review of the empirical literature shows that most studies ignore local conditions and instead use country aggregates in analysis. We argue that while it may be appropriate to focus on the national scale and use state-level geographical variables when exploring the risk of conflict, this research strategy is less suitable when the conflict is the unit of observation. This is particularly true for conflicts that are spatially limited and in cases with several simultaneous conflicts within the same country. We demonstrate that Geographical Information Systems (GIS) can be used to generate measures of geography that are unique to each conflict zone. To explore the effect of scale of measurement, we compare sample means for several indicators of terrain and natural resources. The t-test shows that all conflict-specific variables differ significantly from the corresponding variables measured at the habitual country level. We then conduct an analysis of duration of civil war, which reveals that some findings are indeed dependent on the scale of measurement. In particular, presence of gemstones and coca cultivation in the conflict zone increases the length of conflict considerably, while they are found to have diminutive effects when measured at the country level. In addition, the use of precise conflict location data allows us to add a new variable to the duration analysis that measures the conflict–capital distance. The relative location of conflict matters: the further the conflict is from the capital, the longer it lasts. This is a powerful

effect that substantially alters the estimates for country size, type of incompatibility, and rainy season. The results show that local conditions and the relative location of the battle zones should be accounted for in conflict studies, and that future research on civil conflict could greatly benefit from use of GIS and spatial methodology.

5.2. Previous Studies of Geography and Civil War

Inspired by the likes of Alfred T. Mahan and Harold J. Mackinder, the 19th- and early 20th-century classic geopolitical literature deals solely with international wars. This is reflected in the quantitative conflict literature, which has until recently almost exclusively studied militarized interstate disputes and wars. Yet, civil war is by far the dominant form of conflict. Since the Congress of Vienna (1814–15), only two decades have produced as many interstate wars as civil wars, and in every ten-year period since the Second World War the rate of civil war onsets has exceeded that of international wars (Sarkees et al. 2003). In fact, the war between India and Pakistan over Kashmir was the sole international conflict among the 34 active conflicts in 2001 (Gleditsch et al. 2002). As the World Bank Policy Research Report (Collier et al. 2003) argues, researchers should pay more attention to civil wars.

Traditionally, quantitative IR and conflict studies define geography in a very narrow sense, merely permitting the concept to include measures of contiguity and distance. This is, of course, mainly due to the general focus on interaction between states, where other factors, including economic issues, regime attributes, alliance patterns, and balance of power, are presumed to be more salient and influential. Yet, with the recent shift in the academic interest from international wars towards civil wars, other aspects of geography are now considered as part of the equation. Natural resource dependence, in particular, has received substantial attention. Among others, Addison et al. (2002), Auty (2004), Collier & Hoeffler (1998, 2002, 2004), and Ross (2004a, 2004b) have promoted the view that valuable and easily exploitable natural resources constitute opportunities for rebellion by providing finance for arms purchase and rebel recruitment. In fact, Addison et al. (2002) claim that since a civil war may provide all fighting groups economic opportunities that are not present during peacetime, the parties may prefer continued fighting to peace. In this way, natural resources may increase the risk of internal armed struggle and at the same time decrease the likelihood of peaceful resolution once the conflict gets going. Some also emphasize the negative

impact of resource abundance on regime stability and economic growth, thus suggesting a more indirect path of causation (see Auty 2001; Sachs & Warner 1995, 2001).¹

The empirical evidence for a causal connection from resource abundance to conflict is less consistent than the theory, although several case studies suggest that such a link exists (Fairhead 2000; Le Billon 2001a; Renner 2002; Smillie 2002). In a study of 78 civil war onsets since 1960, Collier & Hoeffler (2004) report a significant parabolic relationship between natural resource dependence and risk of civil war. However, this finding is not particularly robust, as shown by Fearon & Laitin (2003) and Elbadawi & Sambanis (2002). Using more disaggregated measures of resources, both de Soysa's (2002) and Fearon & Laitin's analyses suggest that oil-exporting countries have substantially higher risks of internal conflict. De Soysa & Neumayer's (2004) work on natural resource rents further suggests that revenues from non-fuel minerals are generally unrelated to the risk of civil conflict. In one of the few studies that analyze the duration of civil war, Collier et al. (2004) find only a weak and statistically insignificant effect of primary commodity exports. In contrast, Fearon (2004) makes a case for how extraction of certain contrabands (gems and drugs) has enabled ethnic groups to conduct protracted warfare. In sum, the empirical evidence for direct connection between natural resource abundance and civil war is far from impressive, and findings seem to vary with the operationalization of the resource proxy.

Several studies have pointed out that rebel movements prefer to operate from peripheral bases in mountainous or densely forested regions, which presumably provide safe havens out of reach of government forces. Collier & Hoeffler (2004), Collier et al. (2004), DeRouen & Sobek (2004), and Fearon & Laitin (2003) all include a measure of mountainous terrain, and some additionally control for forest cover. These terrain measures have so far failed to produce consistent and robust results. In Collier & Hoeffler's study of civil war onset, neither terrain indicator produced a significant effect. Fearon & Laitin (2003: 85) reach the opposite conclusion, stating that 'mountainous terrain is significantly related to higher rates of civil war'. The two analyses apply fairly similar operationalizations of civil war, but the Fearon & Laitin study covers a larger temporal span (1945–99 versus 1960–99), includes more civil war onsets (127 versus 78), and employs annual data compared to Collier & Hoeffler's five-year pooled time series. Nevertheless, the discrepancy is disturbing. In a study of the duration of 55 civil wars since 1960, Collier et al. find that extensive forest cover and mountainous terrain are not significantly associated with longer wars. In contrast, DeRouen & Sobek's analysis of civil war outcomes shows that forest cover increases

the likelihood of prolonged conflict. Mountainous terrain, on the other hand, reduces duration by increasing the likelihood of rebel victory and ceasefire.

In addition to natural resources and rough terrain, the distribution and ethnic and religious composition of the population have been tested in relation to civil war. Collier & Hoeffler (2004) demonstrate that countries with a large but dispersed population face a higher risk of intrastate conflict, as do countries dominated by one ethnic group. Further, they find evidence that social fractionalization decreases the risk of conflict onset. These results are supported by Fearon & Laitin (2003), who find a very strong positive effect of population size, while ethnic and religious diversity have positive but insignificant effects on conflict proneness. The Collier et al. (2004) study on conflict duration finds that large population size tends to prolong conflicts, although this might be an artifact of how civil wars are coded in their dataset. Neither Elbadawi & Sambanis (2002) nor Fearon (2004) manages to produce evidence that population size affects duration. Fearon's analysis further fails to support the alleged links between ethnic fractionalization or ethnic war and duration of civil war, though the influential sons-of-the-soil dummy is likely to capture any potential effect of ethnicity.ⁱⁱ On the other hand, both Collier et al. and Elbadawi & Sambanis suggest a parabolic effect of ethnic fractionalization on conflict duration.

Few empirical studies have explicitly considered the role of distance in civil wars. Buhaug & Gates (2002) find that secessionist and identity-based wars tend to be located further away from the capital than other types of conflict. Their analysis also shows that conflicts that cover a larger area generally last longer, although the size of the conflict zone may be endogenous to the conflict duration. Others have found that separatist conflicts, which presumably are located in remote regions, last longer (Balch-Lindsay & Enterline 2000). In addition, Fearon & Laitin (2003) and Fearon (2004) include an indicator of 'non-contiguous territory' for countries that have populated (over 10,000 inhabitants) enclaves or territories that are separated from the capital city by over 100 km of water. The dummy fails to make an impact except in the model that also includes colonial wars.

Finally, some studies have found evidence of spatial autocorrelation and spillover effects of civil conflicts, strongly suggesting that border length, interstate contiguity, and proximate conflict arenas play a role in shaping intrastate behavior (Anselin & O'Loughlin 1992; Murdoch & Sandler 2002; Ward & Gleditsch 2002).

5.3. *Unit of Analysis: Country or Conflict?*

Despite the evident upsurge in quantitative research on geographical aspects of civil war, we argue that several of these studies suffer from serious weaknesses regarding the data that are used here. This may potentially have a big impact on the validity of the inferences. Above all, our concern relates to the scale of measurement of the various indicators of geography.

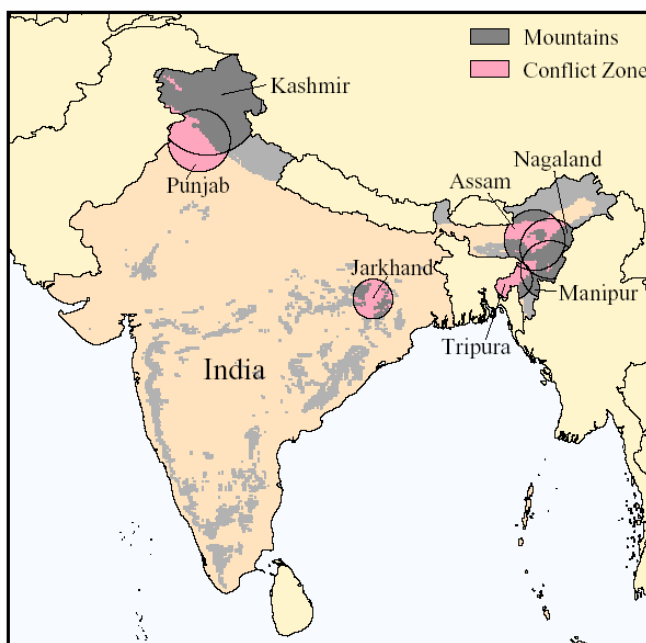
The interaction between geography and civil war is characterized by two facts that most empirical studies fail to account for: civil conflicts are by definition sub-national events, and the fighting rarely spans entire countries. For example, ongoing secessionist conflicts in the Basque provinces (Spain), Cabinda (Angola), and Chechnya (Russia) cover only a fraction of the countries' territories. If we are to estimate spatial spillover effects to neighboring countries (such as the risk of conflict or the impact on the economy), ignoring the relative location of the conflict may lead to biased conclusions. For instance, Murdoch & Sandler (2002) find a negative impact of neighboring conflict on economic growth, and the effect increases with the length of the common border. While this finding sounds reasonable, it makes little sense to argue that Finland, due to its 1,200 km border with Russia, is more affected by the civil war in Chechnya than Azerbaijan, with a 270 km-long common border. When operating with country-level aggregates, the effect of distance from the actual conflict area to neighboring countries is totally ignored.

Second, many frequently proposed conflict-promoting factors, such as terrain, natural resources, population distribution, and ethnic composition, have substantial sub-national variation. Contemporary studies of civil war have so far failed to take account of this. As previously mentioned, valuable natural resources can be a major source of finance for rebel groups. Yet, in order to acquire resource revenues, the rebels must control resource extraction areas or transport channels. If the rebels do not have access to the resources, there is less reason to expect conflicts in resource-abundant countries to be substantially different from civil wars in countries with lower resource endowment. For instance, it is highly unlikely that diamond and other mineral deposits in Siberia have much impact on rebel activities in Chechnya, in contrast to the gas and oil reserves in the Caucasus region. Likewise, the rough terrain argument posits that mountainous and forested terrain is favorable to rebel forces, providing shelter out of reach of government forces. However, unless the rebels operate from such terrain, it really should not matter whether 20% or 80% of the country is mountainous. Thus, the rough terrain proposition may be perfectly valid without there being a general,

probabilistic relationship between country-level statistics of topography and risk or duration of intrastate conflict.

The essence of the problem is that the proxies for geography are generated at the wrong level of measurement: the nation state.ⁱⁱⁱ For example, the most popular measure for resource dependence is the ratio of primary commodities exports to GDP. Likewise, indicators of rough terrain are based on country statistics. Such aggregated measures really only make sense if we can assume that the conflict area constitutes a representative sample of the conflict-ridden country on all explanatory factors, and in cases in which the conflict spans the entire country. However, such an assumption is rarely valid. Consider the case of India. According to the Armed Conflict Dataset (Gleditsch et al. 2002), India has experienced seven territorial intrastate conflicts since 1990 (Figure 5–1). None of these conflicts covered more than 5% of India’s territory. We cannot explain differences between these conflicts (in terms of type, severity, duration, or outcome) if we rely exclusively on country-level regressors. Clearly, we need to control for sub-national variations since there may be huge deviations between nation-level statistics and conflict-specific characteristics. This, we argue, is where GIS will prove useful.

Figure 5–1. Territorial Intrastate Conflicts in India in the 1990s



Note: Conflict data from Gleditsch et al. (2002), mountain data from UNEP (2000).

5.4. *GIS and Studies of Civil War*

Recent developments in GIS have made spatial methodology increasingly available to users of conventional mapping software. Tools that facilitate exploratory spatial data analysis (Anselin 1995) include global and local indicators of spatial association, variance pattern exploration, and distance analysis. In the social sciences, spatial analysis has been around for a few decades; O'Loughlin (2003) credits McCarty's (1954) study of geographical voting patterns in Wisconsin to be the first spatial analysis of political data. Since then, almost all space-oriented quantitative analyses of political data have focused on voting behavior (O'Loughlin 2004b). In studies of international relations and peace research, spatial analyses are still quite rare, and GIS is largely an undiscovered tool. Exceptions include Anselin & O'Loughlin's (1992) exploration of the contextual effects on conflict and cooperation in Africa, and Starr (2002), who uses GIS to generate indicators of interaction opportunities and salience of border zones for the case of Israel. Further, Ward & Gleditsch (2002) develop an autologistic model that estimates the likelihood of war as a function of recent war involvement of proximate states. Studying civil conflict, Buhaug & Gates (2002) construct a relative location indicator by using GIS to measure the distance from the conflict zones to the capital cities, while O'Loughlin (2004a) uses the same conflict location data to illustrate the spatial overlap between conflicts and lack of development. In addition, some recent studies on diffusion patterns employ spatial econometrics (e.g. Gleditsch 2002b; Gleditsch & Ward 2000; O'Loughlin et al. 1998; O'Loughlin 2001b).

Civil wars are rarely spatially contiguous. When contiguity is determined by shared borders, a sample of civil wars will necessarily consist mostly of 'islands', rendering it impossible to compute connectivity matrices and spatial weights. Although other contiguity measures can be used, such as distance or transport networks, the exclusion of relevant null-cases (non-conflict areas) limits the use of spatial regression models whenever the civil conflict is the unit of observation. Instead, we shall demonstrate how GIS may enhance conflict studies by following Gleditsch & Ward (2001), Buhaug & Gates (2002), and Starr (2002) in using GIS software to generate more precise and valid data. However, in contrast to these contributions, we will not limit our task to the measurement of distance. A major reason for introducing GIS to the study of conflict is that it facilitates data generation on a truly sub-national level, as opposed to relying on national statistics. Such measures will undoubtedly improve the validity of traditional regression models where the conflict is (or should be) the unit of observation.

5.5. Empirical Analysis

Our central hypothesis concerns the suitability of using country-level aggregates and averages instead of data collected for the actual conflict zone in empirical conflict studies. In fact, if the level of measurement (country vs. conflict) does not matter for the results, the time-consuming effort to collect data on sub-national level can be spared, and the data and results obtained by using country-level aggregates can be regarded as representative. Before presenting the results, we first describe how we used GIS to collect conflict-level data on geographical factors linked to civil war.

5.5.1. Data generation

A first step towards conducting conflict-specific analyses is to acquire data on the location of conflicts within states. The Armed Conflict Dataset (Gleditsch et al. 2002) provides reasonably accurate geographical data on all interstate and internal conflicts since 1946. Here, each conflict is assigned a circular conflict zone, defined by a conflict center point (latitude and longitude coordinates) and a radius variable, as illustrated in Figure 5–1. This dataset is currently the only source of systematic information on the sub-national location of armed conflicts. Yet, the circular shape of the conflict zones is a crude approximation. For example, a civil war may take place mainly along the borders of a country (the Democratic Republic of the Congo), or the conflict zone may be a long but disproportionately narrow area (Peru). In such cases, the circular operationalization by design exaggerates the real zone of conflict by covering vast areas of unaffected land. Even so, it seems fair to assume that any irregularities in the accuracy of the location data are not correlated with the explanatory variables.

A valuable byproduct of the location data in the Armed Conflict Dataset is that it allows measuring the location of the conflict zones relative to other factors of interest, such as the capital city or neighboring countries. We include one such measure in the analysis: the conflict–capital distance. The relative location of conflict may affect the length of conflict at least for two reasons. First, the farther the conflict is from the capital, the more difficult and expensive it is for the government to project power to reach the opposition force. Second, a government may view remote incidents as less pressing than proximate ones and consequently dedicate less resources to tackle them.

Several geographical variables that are frequently regarded as affecting war propensity are available in GIS format. The World Conservation Monitoring Centre of the United Nations Environment Programme (UNEP-WCMC) recently released a

gridded mountain dataset with global coverage (UNEP 2002). In this dataset, the surface of the earth is divided into grid cells of approximately 10 x 10 km where each cell is assigned a value of 1 (mountain) or 0 (no mountain). The gray shades in Figure 5–1 represent mountainous terrain based on UNEP data. Evidently, rough terrain is not evenly distributed throughout India. The northwestern and northeastern corners are substantially more mountainous than the central regions. Incidentally, India's internal conflicts appear to be located in these parts of the country. Whereas approximately 19% of India's two-dimensional land mass is characterized as mountains, the seven conflict zones have a joint mean score of 49% mountainous territory, with Kashmir obviously having the highest score. The proportion of rough terrain in these conflict regions is clearly above the average for the whole country, and using country-level statistics would thus lead to biased estimates for the effects of rugged topography. In order to assess the degree of similarity between country- and conflict-level measures of terrain, we have computed the share of mountainous terrain for all countries and all civil conflicts since 1946.

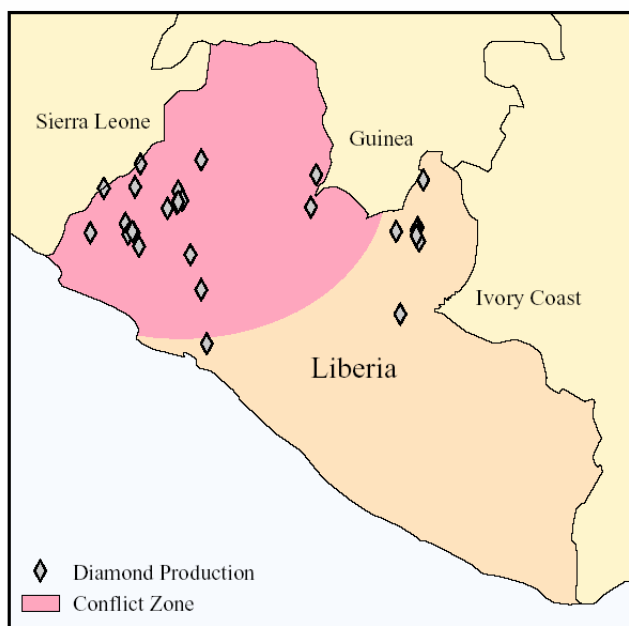
The Food and Agriculture Organization of the United Nations (FAO) has collected comparable forest data (FAO 1999). The released forest map consists of 1 sq. km grids, where each grid is categorized as (1) closed forest, (2) open and fragmented forest, (3) other wooded land, or (4) other land. From this, we created a forest dummy where the first two categories represent forested terrain. Following the same procedure as for the mountain data, we then generated a conflict-specific forest variable that gives the percentage of each conflict zone covered by forested terrain. Both rough terrain measures are logged to avoid outlier bias.

Several recent civil conflicts are dominated by the presence of precious natural resources, such as in Angola, the Democratic Republic of the Congo, Liberia, Sierra Leone (alluvial diamonds), Indonesia, Nigeria, Sudan (oil), Afghanistan, Burma, and Colombia (drugs). Yet, there is a remarkable lack of available systematic information on the global distribution and significance of natural resource deposits. The World Bank (1997, 2002) has estimated the rents for some renewable and non-renewable resource production, but these data are aggregated to the country-level and contain no information on the location of the commodities.

During a conflict, some natural resources are more easily exploited by rebels than others (Ross 2004b). For example, alluvial diamonds are easy to mine and smuggle, and can therefore be considered lootable. Such resources constitute a potential source of finance for rebel groups. Other resources, such as bauxite mines, are more difficult for rebels to exploit and can be considered as non-lootable. Gilmore et al.

(2005) describe an ongoing project that aims to map the location of selected types of natural resources. The resulting database will contain information on location and type, as well as time of discovery and initial extraction. In the analysis presented below, we use a preliminary version of the database to get data on four types of lootable resources: gemstones, coca, cannabis, and opium poppy. Based on these records, we generated two sets of dummies: one set of country-level variables, indicating presence of the given commodity in the country at the time of conflict (coded ‘1’ if present and ‘0’ if not), and a conflict-specific set of variables, indicating the availability of the commodity within the conflict area during the conflict. Figure 5–2 below illustrates the distribution of alluvial diamond deposits and the conflict zone in Liberia in 2000. Evidently, the conflict and the diamonds overlap. Hence, we can assume that LURD (Liberians United for Reconciliation and Democracy), the primary rebel force in Liberia, had access to the highly valuable commodity.

Figure 5–2. Conflict Zone and Diamond Production in Liberia, 2000



Note: Conflict data from Gleditsch et al. (2002), diamond data from Gilmore et al. (2005).

By accounting for the location of conflicts relative to the natural resources, and by considering the temporal component, the research design largely avoids the problem of endogeneity. In contrast to the common proxy for resource dependence – the ratio of primary commodity exports to GDP (Sachs & Warner 1995; Collier & Hoeffler 2004) –

the location of a gemstone deposit is truly exogenous to the model.^{iv} Whereas the total output from a diamond mine might be affected by a nearby conflict, the resource cannot relocate in the face of a civil war. Illicit crops, on the other hand, can be introduced in new areas and act as a source of finance, as has been the case in several contemporary conflicts, including Afghanistan. Even so, by controlling for the timing of the conflict relative to the introduction of the drug, we can exclude cases where there was no production (and hence no causal link) at the outbreak of hostilities.

Population density and ethnic composition are other geographical features that could be measured at the conflict level. The Center for International Earth Science Information Network at Columbia University has released gridded population density data with global coverage for the 1990s (CIESIN 2000). UNEP (2003) has comparable population data for previous decades for Africa and Latin America. The main problem with these databases is the lack of temporal data with global coverage.

Data for other aspects of human geography are even less available. To our knowledge, the spatial distribution of ethnicity, religion, and culture have so far not been mapped at a satisfactory level of detail, even for the contemporary world, and therein lays a huge challenge. Development indicators such as economic growth, infant mortality rates, and unemployment statistics are other aspects that should be measured at a sub-national level, as they are likely to influence the risk and location of civil unrest. For example, Murshed & Gates (2005) show that the death toll due to the Maoist insurgency in Nepal has been highest in the less developed Nepalese districts. Although there appears to be some development and human security data available at the administrative level, they tend to reflect the current situation only and are generally not available for regions with armed conflict. A possible solution would be to identify and use appropriate instrumental variables. A promising example is work by Miguel et al. (2004), who use rainfall variation as an instrumental variable for income shock in Africa. Because the agricultural sector in sub-Saharan Africa is dominant, changes in rainfall have a large impact on growth, and thus indirectly on conflict. However, rainfall is a poor indicator of growth in other, more developed parts of the world, so it will not work as a global proxy for economic development.

Rainfall data can be relevant, however, to the study of conflict in a more straightforward manner. Several regions throughout the world experience rainy seasons that effectively hinder road transportation. Consequently, fighting becomes less intensive and often stops altogether for several months. This provides opportunities for the fighting parties to regroup, rearm, train, and recruit forces, as well as time to raise funds for warfare. Based on precipitation data from the Global Precipitation

Climatology Project (GPCP),^v we have generated dummy indicators for rainy seasons at both levels of measurement. Areas that experience at least one month with average daily precipitation in excess of 8 mm are considered as having rainy seasons.

5.5.2. Empirical test: Comparison of sample means

The following two sections compare operationalizations of geography at the country level with corresponding conflict-specific measures. A paired t-test of sample means serves as the initial analysis. We run the t-test for two samples. The full sample consists of 252 civil conflicts between 1946 and 2001, taken from the Armed Conflict Dataset.^{vi} In addition, we run a test for a restricted sample of relatively small conflicts, where the deviation to the country aggregates is presumably most evident. In this context, a conflict is considered relatively small if the spatial extent of the war is less than 10% of the country in which it is located. About 40% of the sample (97 conflicts) are below this arbitrary cut-off point. The null hypothesis of the t-test is that the mean values of the country variables are equal to the means of the corresponding conflict variables. For the terrain measures, the significance test is two-tailed, since we have no *a priori* expectation of deviation in a particular direction. The mean values of the resource variables can vary in only one direction (the conflict-level variables cannot have higher means than the country statistics), hence a one-tailed test. The results are presented in Table 5–1.

Table 5–1. Paired t-Test of Sample Means

	All conflicts (N=252)					Small conflicts (N=97)				
	Mean country	Mean conflict	Δ Mean	S.E.	p	Mean country	Mean conflict	Δ Mean	S.E.	p
Mountain (log)	3.16	2.91	.26	.07	<.001	3.16	2.71	.46	.15	<.001
Forest (log)	2.83	2.60	.23	.06	<.001	2.97	2.55	.42	.12	<.001
Rainy season	.40	.37	.04	.01	<.001	.41	.36	.05	.02	.012
Gemstones	.42	.21	.21	.03	<.001	.49	.07	.42	.05	<.001
Coca	.02	.01	.01	.01	.042	.02	0	.02	.01	.079
Cannabis	.04	.03	.02	.01	.023	.03	.03	0	0	–
Opium	.23	.10	.13	.02	<.001	.35	.10	.25	.05	<.001

Note: Small conflicts are defined as covering less than 10% of the country area.

Looking at the full sample first, we find very strong evidence that most conflict zones do not simply mirror the geographical characteristics of the host countries. The mean value of every single geographical feature differs significantly between the levels

of measurement. More specifically, the conflict zones are – contrary to general belief – *less* mountainous and forested than the countries in which they occur, and most are not located in resource-rich areas. Even in countries that possess easily exploitable resources, nearly half of the conflicts do not overlap with the lootable resources. Moving our attention to the restricted sample, we note that the mean differences have increased for all but one variable. This implies that relatively smaller conflicts – that is, conflicts that affect only a fraction of the country – are particularly likely to have characteristics that differ from the average figures of the countries. For these conflicts, the reliance on country statistics is particularly problematic.

5.5.3. Empirical analysis: Duration of civil war

The paired t-tests demonstrated that the alternative measures yielded different results, but how substantial are the discrepancies? We can better answer this question by conducting a comparative multivariate regression analysis. Table 5–2 shows the output for three models of civil war duration. The table reports the accelerated failure-time coefficients. A negative estimate implies that the hazard of failure – that is, the likelihood of the conflict ending – is higher than the reference. Hence, negative coefficients are associated with shorter conflicts. We include four control variables that might create omitted variable bias if excluded: country size (logged), population size (logged), issue of incompatibility (dummy, 1 if territory), and a binary indicator of initial intensity (1 if at least 1,000 battle-deaths were reported during the first year of the conflict).^{vii}

The first two models include country-level measures of geography and differ only with respect to choice of resource proxies. Model 1 includes Sachs and Warner’s (1995) well-known measure of primary commodity exports to GDP, whereas the second model uses dummies for specific types of commodities. Because of missing export data, Model 1 loses about one-third of the conflicts. Model 3 relies on conflict-specific variables of terrain, climate, and resources, and additionally includes the relative location measure, the conflict–capital distance.

Table 5–2. Weibull Regression of Duration of Civil War

	Country level		Conflict level
	(1)	(2)	(3)
Country size (log)	.108 (.166)	–.013 (.139)	–.365 ** (.153)
Population (log)	.047 (.148)	.109 (.123)	.215 (.131)
Territorial conflict	.565 (.362)	.977 *** (.300)	.551 * (.334)
Initial intensity	.744 * (.388)	.682 ** (.292)	.689 ** (.299)
Mountain (log)	.291 * (.164)	.258 * (.152)	–.022 (.102)
Forest (log)	–.323 ** (.133)	–.376 *** (.119)	–.242 *** (.088)
Rainy season	1.257 *** (.453)	1.107 ** (.428)	.590 (.385)
Commodity exp/GDP	–.245 (.146)		
Gemstones		.648 * (.352)	.885 *** (.336)
Coca		.999 (1.164)	2.901 * (1.523)
Cannabis		.385 (.403)	.151 (.509)
Opium		–.153 (.459)	–.192 (.472)
Conflict–capital distance (log)			.573 *** (.115)
Intercept	–.768 (1.459)	–.957 (1.233)	–1.919 * (1.146)
<i>N</i>	1,006	1,482	1,482
# conflicts	178	252	252
Wald Chi ²	26.37	41.94	85.54

Note: The table reports accelerated failure-time coefficients with standard errors (adjusted for clustering on country) in parenthesis. * $p < .1$; ** $p < .05$; *** $p < .01$

By comparing the first two models, we see that the resource dependence proxy and most of the various resource dummies fail to make an impact on the duration of civil war. Still, there are notable differences between the models. Whereas the coefficient for the ratio of commodity exports to GDP hints at a negative association, three of the four resource dummies produce estimates in the expected positive direction. In fact, Model 2 offers some evidence that countries with gemstone deposits experience somewhat longer civil wars. Moreover, the aim of the opposition – territorial versus governmental control – only makes an impact on the second country-level model. This is not due to the increased sample size but rather because the territorial dummy is negatively correlated with coca ($r = -0.22$) and cannabis ($r = -0.16$). The other regressors are fairly robust across the two models. The amount of mountainous terrain in the

country is positively associated with the duration of conflict, whereas densely forested countries tend to have shorter conflicts, *ceteris paribus*. Conflicts in countries with distinct rainy seasons are longer on average, supporting our notion that seasonal pauses are exploited to gather strength and prepare for renewed hostilities. Conflicts that immediately reach a high level of violence are also harder to resolve. Finally, the size of the conflict-ridden country appears to be irrelevant.

Model 3 presents the results of the conflict-specific regression analysis. Several findings deserve attention. First, the weakly significant effect of gemstones found in the second model is considerably larger and stronger when measured at the conflict level. Evidently, civil wars that occur in regions with gemstones are substantially harder to bring to an end. We also see that coca, another highly valuable commodity, has a significant impact in the expected direction. However, we must be cautious about making overly general statements from this finding since only three countries in our sample, Colombia, Peru, and Bolivia, are coded as coca producers. Third, the positive and statistically significant estimates of the mountain variable in the country-level models are misleading; there is no link between the degree to which a conflict occurs in mountainous terrain and its expected duration. The unexpected negative effect of forest prevails, though. The most influential factor in the conflict-specific model is the relative location. Civil wars that occur at a distance from the capital – the presumed center of state power – are much more likely to turn into protracted contests than relatively proximate ones. The inclusion of the conflict–capital distance further removed most of the explanatory power of the territorial conflict and rainy season dummies, whereas country size now has a significant, negative effect. The estimates for the remaining variables do not differ substantively from the country-level models.

Summing up, Table 5–2 demonstrates that the scale of measurement affects not only standard errors and significance levels but even the substantive impact of some regressors. In particular, the shifting behaviors of mountains, gemstones, and coca imply that using country-level aggregates as proxies for geographical characteristics of civil wars is indeed a dubious procedure. The analysis also uncovered the importance of controlling for the relative location of the conflict, which in addition to affecting the expected duration of conflict also influences the estimated impact of other variables, such as country size and type of incompatibility.^{viii}

5.6. Future Research

As we have demonstrated, GIS-generated geographical data measured for each conflict zone – undoubtedly being more accurate and representative than country-level statistics – can easily be included in conventional statistical models of civil war. The analyses above illustrate the potential problem with analyses of civil conflict conducted at the country level. Yet, more work is required to fully gauge the impact on various aspects of civil war, including use of more advanced methods that account for spatial autocorrelation and interaction, such as spatial regression and multilevel analysis, even at the country-level analysis (see, for example, Raleigh 2004). However, by using data on conflict location, diffusion and neighborhood effects of civil wars can be studied at the correct regional level. For example, a test of spillover effects on neighboring countries could be restricted to a sample of countries near the conflict, or the neighbors could be weighted according to their inverse distance from the conflict zone. This enables the exclusion or downgrading of irrelevant neighbor countries like Finland and China when exploring the neighborhood effects from the Chechen conflict. When more data becomes available, such as annual death rates and refugee flows, we will be able to analyze other aspects of a conflict's destructiveness besides duration.

One of the challenges is the choice of the unit of observation. The conflict zone can be used as the base unit in cases when we analyze duration of conflict, type of conflict, conflict termination, and location of conflict. However, analysis of risk of conflict requires a unit of observation that includes null cases (cases without conflict), which renders conflict-specific variables inappropriate. One alternative strategy is to use first-order administrative units as the focal point of data generation and analysis. Subject to data availability, such a research design facilitates more precise testing of several prevailing theories on causes of civil war, such as whether conflicts tend to break out in sparsely populated hinterlands with extremely rugged terrain, and near state borders. Unfortunately, the size and number of the units differ greatly from country to country. For example, most of Niger's *departments* (first-order sub-national units) are larger than Rwanda and Burundi combined. Hence, it may not be meaningful to divide all countries into smaller units, in particular if the sub-national units do not vary with respect to the dependent variable and the geographical covariates. Moreover, sub-national administrative units are subject to frequent changes.

A second possible strategy is to define a geometric unit, like a 100 km x 100 km grid, as the basis for measurement, and assign values for conflict and the explanatory variables to each pixel. This solves the problem of huge variations in unit size while

simultaneously permitting the same detailed level of analysis as the administrative unit approach. Unfortunately, sub-national data for income level, infant mortality rate, and other space-varying factors are typically given only for administrative units – if available at all – and must be converted to the crude grid format. Although this could be done by calculating average weighted values based on the relative share of the administrative entities within each grid cell, we still have the problem of huge missing data on the sub-national level. Besides, the grid approach is less intuitive than the administrative level, and policy implications will necessarily be less apparent.

Yet another alternative is to employ point pattern analysis (PPA). PPA does not allow studying of risk of conflict *per se*, but facilitates exploring patterns of conflict onset without including null cases explicitly in the model. By using the centroid of the conflict polygon or the location of rebel headquarters as the unit, one can, for example, measure the distances from any conflict to nearby conflicts and assess whether the spatial distribution of conflicts differs significantly from a random distribution. Ideally, the analysis should also incorporate the time dimension since conflicts in a region may also cluster temporally. In fact, there are good reasons to assume that conflicts do cluster in both space and time (Anselin and O’Loughlin 1992; Ward & Gleditsch 2002). First, the underlying causes of conflict, such as level of economic development, type of political institutional arrangements, and aspects of physical geography, also tend to cluster spatially and temporally. Second, a civil conflict is likely to increase the risk of additional conflicts in the region by means of destabilizing the economy, creating refugee flows, facilitating smuggling, and increasing availability of arms. Therefore, more rigorous point pattern models should be used. They should either incorporate the underlying variables in the model or compare the conflict surface to the distribution of relevant conflict-promoting variables. For example, one could explore whether conflicts follow the distribution of rough terrain, and if so, whether there is any unexplained clustering of conflict left once the terrain is controlled for.

PPA can be used to verify that conflicts tend to cluster, to obtain more nuanced analysis of conflict clustering, and to distinguish between the two forces driving clustering: clustering of underlying causes of conflict and spatial interaction between conflicts. However, conflicts are by nature events that cover considerable areas, and they can hardly be described as points even on a small-scale map. Moreover, the amount of terrain covered by the conflict also varies from case to case. This raises some difficult methodological issues concerning how the various exogenous surfaces should be generated and how they can be compared to the conflict distribution. An additional methodological problem arises from the fact that the study of conflict tends to cover the

entire globe. Hence, the researcher must resolve the issue of how to deal with non-contingent regions, separated by big lakes, seas, and oceans.

5.7. Final Remarks

A large obstacle to testing the relationship between geography and civil conflict lies in the shortcomings of the available data. One of the most acute problems is the lack of relevant data at the sub-national level. This is true both for conflicts and for factors that may explain conflict propensity and conflict characteristics. Nevertheless, this article has shown that with relatively simple methods, the researcher can generate richer and more accurate data for large-scale statistical analyses. A paired t-test of sample means demonstrated that the seven geographic variables all differed significantly between the scales of measurement, and the deviation was particularly apparent in the sub-sample of relatively small conflicts. An analysis of duration of civil war further showed that changing from the national to the sub-national scale did have noticeable consequences. The shifting behavior of gemstones, coca cultivation, and mountain variables were particularly striking. Evidently, country-level measures are not always representative for the circumstances in the conflict areas. The analysis also demonstrated the importance of conflict location in relation to capital. Besides having the largest individual impact on duration, the conflict–capital distance measure also affected the estimated effects of country size, type of incompatibility, and rainy season. Therefore, researchers of civil war should strive to generate more precise proxies for the theoretical concepts related to geography, and always control for the relative location of the conflicts. This work, we believe, is facilitated by the use of GIS.

This article has demonstrated the data-generating capability of GIS. However, the potential contribution of GIS to conflict research goes well beyond overlays and area calculations. By selecting an appropriate unit of analysis, GIS and spatial econometrics will provide much better instruments for assessing the true spatial relationship between geography and civil war.

Notes

ⁱ In seeming contrast to the resource abundance perspective, some scholars argue that environmental scarcity – that is, scarcity of renewable resources – is a major threat to domestic and interstate stability (see Hauge & Ellingsen 1998; Homer-Dixon 1999). The two literatures are not as opposed as it seems, though, since they generally pertain to different types of resources. Advocates of the scarcity perspective concentrate on issues related to regional/global depletion of renewable resources (fresh water, soil, crops, forest), whereas the abundance literature mainly focuses on non-renewable resources (gems, minerals, fuels, drugs). While not dismissing the arguments for scarcity-based conflicts, we limit the discussion and empirical testing in this article to availability of valuable and easily extractable resources.

ⁱⁱ First used by Weiner (1978), the term ‘sons of the soil’ denotes peripheral ethnic minorities.

ⁱⁱⁱ See Agnew (1994) for a related critique of how theories of international relations implicitly and exclusively treat states as fixed territorial entities.

^{iv} The habitual resource dependence/financial opportunities indicator has been criticized on several grounds. First, the proxy merges all natural resources together, assuming that they all influence the likelihood of conflict. Second, for the same reasons that some natural resources are valuable to rebels (e.g. they are easy to smuggle), some resource exports may be under-reported in the national export statistics due to extensive illicit trade. The measure is also possibly endogenous since the level of GDP varies in response to political instability, which often predates civil war. The level and growth of GDP may further be affected by external factors, including neighboring conflict and regional economic shocks, which are generally not related to the looting opportunities for rebels. Finally, the resource dependence measure suffers severely from non-random missing data.

^v See <http://cics.umd.edu/~yin/GPCP/main.html>.

^{vi} We follow Buhaug & Gates (2002) in treating contests over the same issue between the same parties as separate conflicts if the incidents are separated by at least two calendar years without recorded conflict.

^{vii} The population data are taken from COW’s National Material Capability dataset, v.3.0 (Singer et al. 1972). The country size variable is based on the World Bank’s (2002) World Development Indicators. The incompatibility and intensity dummies are from the Armed Conflict dataset (Gleditsch et al. 2002).

^{viii} This finding implies that some measure of relative location should be included in any study of duration of civil war. Although only the Armed Conflict dataset (Gleditsch et al. 2002) currently includes data on location of conflict zones, users of other conflict data could quite easily code a simple, binary indicator that distinguishes between proximate and distant conflicts.

6

Local Determinants of African Civil Wars, 1970–2001*

Abstract

In large-N investigations, civil conflicts tend to be studied and understood at the country level. Popular explanations of why and where civil wars occur, however, refer to such factors as ethnic discrimination, wealth inequalities, access to contrabands, and peripheral havens. The intensity of such factors varies geographically within states. Therefore, any statistical study of civil war that applies country-level approximations is potentially flawed. In this paper, we disaggregate the country and let 100x100 km grid cells be the units of observation. Drawing on preliminary, geo-referenced conflict data from Uppsala/PRIO's conflict database, we use GIS to identify regions of peace and conflict and as a tool to generate sub-national measures of key explanatory variables. The results from an empirical analysis of African civil wars, 1970–2001, demonstrate spatial clustering of conflict that co-varies with the spatial distribution of several exogenous factors. Territorial conflict is more likely in sparsely populated regions near the state border, at a distance from the capital, and without significant rough terrain. In contrast, governmental conflict is more likely in regions that are densely populated, near diamond fields, and near the capital city. These promising findings show the value of the innovative research design and offer nuanced explanations of the correlates of civil war.

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6.1. Introduction

A recent prominent article argues that civil war is caused primarily by conditions that facilitate insurgency (Fearon & Laitin 2003). What makes this claim particularly interesting is that most of these conditions are not spatially invariant within countries – a fact that is largely overlooked in the literature. Insurgency, defined as rural guerrilla warfare, is favored by the presence of sparsely populated hinterlands, support of the local population, underdeveloped infrastructure, cross-border sanctuaries, valuable contrabands, and considerable rough terrain. To the extent that these factors have been measured and tested in quantitative analyses of civil conflict, they have been aggregated and applied to the country level. For example, rough terrain is approximated by the average share of mountainous and forested terrain in the country; availability of valuable natural resources is proxied by the ratio of primary commodity exports to GDP; and a Gini coefficient of population dispersion serves to measure the geographic distribution of the population in the country.

Insurgency – as well as other forms of domestic unrest – is further associated with newly established, institutionally inconsistent, poor, resource-dependent, corrupt, and discriminatory regimes. Some of these characteristics clearly pertain to the country as a single, political entity. For instance, the number of years since the last regime change, type of political system, and whether or not the country is a major oil exporter, are constants within countries. Statistical studies that aim to explore the government side in civil war and consequently focus on political aspects of the regime will necessarily have to be conducted at the country/government level. Other aspects, however, such as ethnic diversity, inequality, unemployment, and secondary school enrolment may vary extensively between sub-national regions. Even so, socio-economic characteristics of a society are invariably measured at the aggregated country level.

We argue that the empirical study of civil war often suffers from a disturbing mismatch between theory and analysis. While standard statistical investigations are conducted exclusively at the country level, most hypotheses actually pertain to sub-national conditions. Consequently, quite a few commonly held notions about the correlates of civil war are still to be tested in an appropriate manner. Put generally, there is a tendency to neglect the spatial aspect of the context (Abler et al. 1971; Anselin 1999; O’Loughlin 2001a; Starr 2003). Let us provide one example: The rough terrain proposition posits that inaccessible landscape (mountains, jungles, swamps, etc.) is

favorable to rebel groups as it provides shelter from less mobile government forces and is ideal for guerrilla tactics (hit and run). Does this mean that Norway is more at risk of conflict than Spain because it has relatively more mountainous and forested terrain (presuming that these countries are similar on every other aspect)? Not necessarily. Yet, this is essentially what is assumed when studies use aggregated country statistics to test the (local) rough terrain argument. What the theory does predict is that rebels who seek refuge in the mountains are better able to withstand a militarily superior opposition, and consequently, that rebel groups will take advantage of such terrain, whenever available. We do not believe that terrain in and of itself is a cause of conflict, nor does the rough terrain proposition anticipate such a relationship. A more appropriate test of the theory would be to explore whether rebel groups tend to operate in the forested or hilly regions of the conflict-ridden countries. Our central contention is that whenever we investigate theories of civil war that have an element of geography, we should abandon the habitual country level of analysis in favor of a disaggregated approach. Otherwise, we are likely to fall prey to the ecological fallacy.

The exploratory nature of this study means that we do not develop new theory or draw on one particular theoretical stand. Rather, the aim of this investigation is to study whether certain geographical factors associated with insurgency are able to explain the onset of domestic conflict on a sub-national scale. In the following section, we discuss a few relevant conjectures and propose hypotheses that explicitly relate to a local level. We then present an innovative research design where artificial grid cells constitute the units of observation. Through the use of Geographical Information Systems (GIS), we divide the spatial domain of our analysis – Africa – into grids with a resolution of 100x100 km. The sample of conflicts is based on a GIS version of the Uppsala/PRIO dataset (Gleditsch et al. 2002), where the conflicts are represented by polygons to reflect the geographical area of the battle zones. Grid cells that overlap with a conflict polygon are thus coded as having a civil war onset in the initial year of the conflict. Each unit is further assigned specific values on a number of space-varying and potentially conflict-promoting variables, including relative location, share of rough terrain, population density, proximity to resource production, level of infrastructure, and language. The results from a statistical analysis of African cells, 1970–2001, differ markedly between the territorial and governmental conflict models. In the former case, we find considerable evidence that geography matters. The risk of separatist conflict is highest in regions with low population density, limited rough terrain, distant from the capital city and near the state border. In contrast, the local risk of governmental conflict is highest in urban regions and near the state border.

6.2. *A Disaggregated Theory of Civil War*

6.1.1. Why the country level may be inappropriate

Although the quantitative literature has been successful in identifying a handful of factors that, in general, co-vary with the occurrence of civil war, there is still more we do not know about the origins of these conflicts than the statistical models are able to explain. To some extent, this is because each conflict has an element of uniqueness – features that are impossible to operationalize and measure across space and time. However, the suboptimal performance of previous empirical investigations is also due to data limitations and unrealistic assumptions. One such imperfection is the default procedure to let the country be the unit of observation. Whereas that setup (in addition to a dyadic structure) certainly makes sense in studies of international processes, where the state can be assumed to constitute a unitary actor, civil conflicts by definition involve at least two actors *within* the boundaries of the nation-state. So why do scholars continue to study civil war at the level of the country? We can think of at least three reasons.

First, the most widely used datasets in empirical studies of civil war lack information on the location of the various conflicts beneath the level of the state. Without conflict data on a finer resolution, disaggregation simply is no option. Moreover, despite the recent release of the Uppsala/PRIO Armed Conflict Dataset (henceforth ACD), which contains reasonably accurate data on the location of the conflict zones, most scholars continue to use other sources of conflict data. As far as we know, there are no plans to add spatial information to these other civil war datasets, which clearly indicates the unawareness in the community of the theory-empirics incompatibility.

Second, almost all proposed conflict-promoting factors, including economic, political, cultural, and demographic attributes, are measured at the state level. Admittedly, some of these factors only make sense when we treat the country as a single entity. Even though a country may contain regions with varying degrees of autonomy, it can only have one type of political system and one official regime at any given time. Studies that focus primarily on the government side may not benefit from a disaggregated research design. However, most aforementioned factors, including level of development, population characteristics, and type of terrain, vary quite extensively across space. You will not find a single country where the inhabitants are evenly

distributed throughout its territory.ⁱ Moreover, ethnic groups in fragmented societies tend to cluster in specific areas, rather than being scattered around. Therefore, an aggregated measure of ethnic fractionalization says little about what might really be important: the composition of ethnic groups in specific regions. See Buhaug & Lujala (2005) for a more comprehensive discussion of this subject.

Third, analyses of risk of conflict need to include null cases; that is, units without conflict. In this regard, the country might appear to be the only suitable unit of observation. There are alternatives, though. What we propose in this investigation is to let artificial geometric units, or grid cells, be the units of analysis. The spatial domain – the African continent in this case – is thus divided into grids of equal size, whereby each country is represented by at least one grid cell. Another option might be to study the first-order administrative region, although we have some reservations against that design. See the data section for further details. First, however, we review a few popular theories on the causes of civil war, and discuss these with a disaggregated approach in mind.

6.1.2. Hypotheses

An important factor that in fact lies implicit in much of the theorizing on civil war is location, or more specifically, periphery. “The fundamental problem facing state-builders in Africa”, Herbst (2000: 11) writes, “[...] has been to project authority over inhospitable territories that contain relatively low densities of people.” A major advantage of rebel groups vis-à-vis the governments is that they can choose the area of operation. Guerrilla tactics are designed to minimize the possible damage inflicted by government forces. This means exploiting remote and generally inaccessible areas. This is consistent with Fearon & Laitin (2003), who note that the main factors determining civil violence are conditions that favor insurgency. Insurgency is here understood as a “technology of military conflict characterized by small, lightly armed bands practicing guerrilla warfare from rural bases” (p. 75). Along the same line of reasoning, Collier & Hoeffler (2004) surmise that low population density, low urbanization, and a dispersed population inhibit government capability and thus facilitate rebellion. A government is less able to maintain control of the hinterlands because of the sheer distance from the center of state power, because of inferior knowledge of local conditions, and often because of lack of support from the local population.ⁱⁱ A related argument concerns cross-border sanctuaries. In several recent wars, including the ones in Rwanda, Burundi,

DRC, and Liberia, the main rebel groups operate from bases beyond the national boundaries, often with the tacit or spoken support of the neighboring regime. Access to foreign soil not only eases access to important trade markets but also acts as a safeguard against government intrusion. Hence, we propose the following hypotheses:

- H1: *Distance from the capital is positively associated with the risk of civil war.*
- H2: *Proximity to the state border is positively associated with the risk of civil war.*
- H3: *Local population density is negatively associated with the risk of civil war.*

The most prominent and robust factor associated with the occurrence of civil war is poverty (Collier & Hoeffler 2002, 2004; Collier et al. 2003; de Soysa 2002; Fearon & Laitin 2003; Hegre et al. 2001).ⁱⁱⁱ The mechanisms through which wealth prevents conflict are less established, though. Some argue that poverty lowers the opportunity costs of rebellion. When wages are low and unemployment rates are high, in particular among young males, income forgone by joining a rebel group is comparably low (Collier & Hoeffler 2004; see also Gates 2002a). Others maintain that per capita income is a proxy for state strength, meaning that richer regimes are better able to monitor the population and conduct effective counterinsurgencies (Fearon & Laitin).

Inevitably, poverty and wealth are spatially clustered within countries. Even in societies with low levels of inequalities, some regions are bound to be more prosperous than others. Drawing on the literature on inequality and instability (Alesina & Perotti 1996; Cramer 2001; Gurr 1970; Sen 1973), we expect groups in the underprivileged regions to be most prone to rise up to alter the status quo. This expectation is backed by Horowitz (1985: 233), who remarks “rich regions are not the leading secessionists. They are far outnumbered by regions poor in resources and productivity.” Unfortunately, we do not have good indicators of wealth or social and economic inequalities for our spatio-temporal domain so we cannot test this conjecture directly. Rather, we investigate the nexus between another aspect of development and domestic armed conflict. Infrastructure presumably follows the spatial pattern of health and unemployment in that the most inauspicious regions are also the regions with the least developed road network. Moreover, roads are essential to the projection of state authority, and nowhere more so than in Africa. This explains why, according to Herbst

(2000), colonial leaders who sought to physically extend their power were obsessed with roads. Roads provide the only form of access to most rural communities. Populated regions with few or no road connections to the capital are likely to be disadvantaged, politically as well as economically. Moreover, remote regions are harder to reach by government forces and are therefore ideal for organizing a rebellion. This compares well to Murshed & Gates (2005), who find that the Maoist insurgency has been particularly severe in the less developed Nepalese districts. Our fourth hypothesis, then, is:

H4: *Local road density is negatively associated with the risk of civil war.*

Another popular proposition relates to rough terrain. Mountainous and forested terrain is generally believed to facilitate rebel movements by providing shelter out of reach of government forces. For example, Fidel Castro's at first puny rebel movement had no other option than to hide in the *Sierra Maestra* mountains upon arrival in Cuba. Only when the revolutionary force grew stronger did it manage to conduct a more open warfare and push westwards toward Havana and, eventually, succeeded in its quest to expel General Batista (Pérez-Stable 1999). Thus, we propose:

H5: *Local extent of rough terrain is positively associated with the risk of civil war.*

A number of recent articles, quantitative as well as case-oriented, explore the relationship between abundance of natural resources and civil war (Addison et al. 2002; Berdal & Malone 2000; Collier & Hoeffler 2004; Fairhead 2000; Le Billon 2001b; Renner 2002; Olsson & Fors 2004; Ross 2004a, b; Smillie 2002).^{iv} Advocates of the 'greed' proposition claim that rebels are quasi-criminals with an economic, rather than a political objective, and argue that countries with an abundance of precious stones, minerals, and drugs are more at risk because they contain better financial opportunities for rebellion. Most quantitative investigations fail to demonstrate such a relationship, although the evidence is more supportive regarding duration of conflict. Oil dependence, usually proxied by a dummy for major oil exporters, appears to be more robustly associated with the risk of civil war.

According to Ross (2004a: 341–342), the lack of conformity among studies of the resource conflict nexus is due to different conflict data being analyzed and by using “overly broad” measures of primary commodities and civil war. While we agree with

this critique, we argue that there is a more fundamental problem with the applied measures, namely the lack of spatial reference. For the abundance argument to *really* hold up, we should find that rebel groups operate in the resource-rich regions, whenever such exists. Similar thoughts have been proposed by Le Billon (2001b: 566), who emphasized that “the spatial distribution and *lootability* [italics original] of resources are crucial with regard to the opportunities of belligerents to seize or retain control over resource revenues.” Unless the rebels control areas of extraction or transport routes, they cannot exploit the lootable commodity for financial gains. This explains why diamonds, not oil, was the prime source of revenue for UNITA (National Union for the Total Independence of Angola), whereas oil rather than diamonds is a major motivation for the separatist FLEC (Liberation Front of the Cabinda Enclave) movement in the Angolan enclave of Cabinda (see Le Billon 2001a).^v This leads to our penultimate hypothesis:

H6: *Proximity to valuable resource deposits is positively associated with the risk of civil war.*

A considerable number of contemporary civil wars involve fighting between members of different ethno-national groups. According to Sambanis (2001), roughly two-thirds of all civil wars between 1960 and 1999 are ‘identity conflicts’, i.e. they are rooted in ethnic or religious differences. Still, the empirical evidence linking country-level ethnic composition to civil conflict is actually quite weak. Some studies claim a parabolic relationship, where polarized societies are more at risk than homogenous and highly fractionalized countries (Collier & Hoeffler 2004; Elbadawi & Sambanis 2000; Ellingsen 2000). Easterly & Levine (1997) further find that ethnic fractionalization has adverse effects on economic policies, and thus indirectly on conflict. Others fail to find a systematic link between ethnicity and risk of conflict (Fearon & Laitin 2003; Fearon 2005). This lack of general support – which, of course, is strongly at odds with popular belief – has led some to consider conditions under which ethnicity might be linked to conflict. We agree with Sambanis (2004b) in that regional distribution of ethnic groups may be more important than the extent of ethnic fragmentation in the country as a whole. This corresponds well to Melander (1999), who finds that violent conflict is more likely if an ethnic minority makes up more than 70% of the population in its home region, and similar results are reported by Toft (2003). If this is indeed a general pattern, Africa should be particularly predisposed to identity conflict since African minority groups are more spatially concentrated than minorities in other regions (Herbst 2000).

According to Rokkan & Urwin (1983), the most significant determinant of an individual's identity is language. People with distinctly different native languages are less likely to share a strong feeling of common identity. Language and other cultural distinctions are prone to be amplified by political and rebel leaders in order to rally support and recruit soldiers. Minority language is further likely to be associated with political discrimination.

H7: *Local dominance of a minority language is positively associated with the risk of civil war.*

A final issue should be noted. Previous research has demonstrated that the impact of conflict-promoting factors often depend on the type of conflict (Buhaug 2005b; Sambanis 2001). Therefore, in the analysis below, we distinguish between conflicts over territory and conflicts over governance. Since all explanatory factors discussed here contain some element of geography, and since insurgency almost by definition falls into the territorial conflict category, we expect the covariates to be most successful in explaining this type of conflict. Nonetheless, given the exploratory nature of this study, we estimate the role of the explanatory variables on both types.

6.3. Data

A number of theories on the origins of civil war actually presuppose – if only implicitly – a disaggregated level of analysis. The purpose of this study, then, is to develop a more pertinent research design and conduct more precise tests of some of the most popular hypotheses in the literature. More specifically, we seek to uncover whether certain space-varying features, such as terrain, population, resources, and identity contribute to explaining where civil wars break out *on a sub-national level*. Such an undertaking requires a unit of observation below the scale of the country. In theory, one could think of a research design with the first-order administrative entity as the unit of observation. However, unlike international boundaries, which tend to be time-invariant when established and agreed upon, administrative regions frequently change in shape and composition as some units merge while others split. Besides, the function and size of regions vary extensively from country to country, so it might not be meaningful to divide all countries into smaller units.

As an alternative approach, we choose grid cells as the units of observation. In contrast to sub-national political regions, grids do not change in size or number over time. Also, a substantial portion of the relevant geo-referenced data are given as points, line, or polygon features or as raster data (e.g. coordinates of diamond sites, digital road maps, gridded population data), and are just as easily converted to the predefined grid structure as to the intuitively more sensible but less feasible administrative region approach.

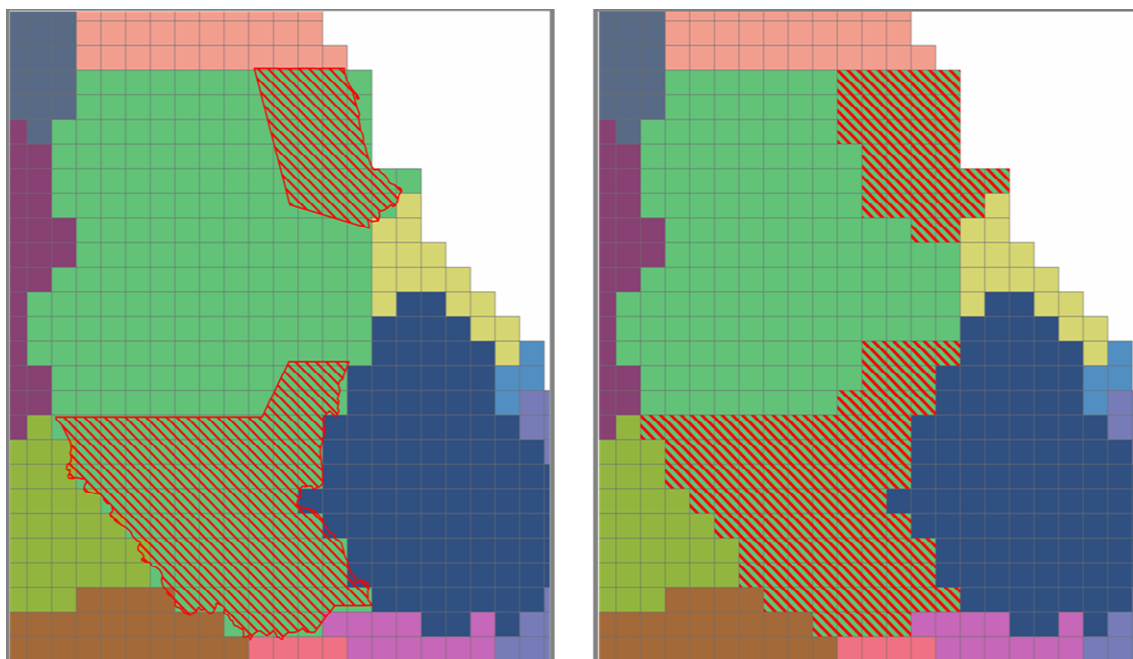
Determining the size of the pixels may not be a trivial task as it potentially has a substantial impact on the results (this is known as the Modifiable Areal Unit Problem, MAUP, see Wrigley et al. (1996)). Ultimately, we might want to test various resolutions and compare the results, though at this stage we have generated data for grids of 100x100 km size only. This choice of resolution is admittedly somewhat arbitrary. However, the selected size, resulting in 3,207 cross-sectional units, ensures that even the smallest countries on the African continent are represented by at least one cell. A larger resolution, such as 50 km or 10 km, implies a considerable increase in the number of observations but not necessarily a similar increase in the level of precision. Even though many of our input data sources have higher resolution than 100 km, the conflict location data are at best only accurate with a 50 km confidence interval. For conflicts that are sparsely documented, the coded areas of the conflict zones are little more than suggestive.

As indicated in Figure 6–1, each pixel is assigned to one country only. Grid cells that cover international boundaries and thus overlap several countries are defined as belonging to the country that lies at the center of the unit. Three years during our sample period (1970–2001) saw major changes to the outline of international boundaries: 1990, the separation of Namibia from South Africa; 1993, the separation of Eritrea from Ethiopia; and 1994, the return of the Walvis Bay area to Namibia. Accordingly, we need four grid representations of Africa. Figure 6–1 represents the final period, from 1994 to 2001.

Figure 6–1. African Countries Represented by 100 Km Grid Cells (1994–2001)



The conflict data are based on the Uppsala/PRIO ACD project (Gleditsch et al. 2002), and include every contestation between a state government and an organized opposition group that caused at least 25 battle-deaths per year. This dataset includes data on the spatial location of the battle zones (see Buhaug & Gates 2002), where each conflict is assigned a circular zone of conflict by means of a center point (latitude and longitude coordinates) and a radius variable. In this study we use a refined version of the conflict location data, where we relax the crude assumption of circular conflict zones and rather use polygons generated through GIS. These polygons can take on any shape and are thus better suited to represent the actual conflict zones. Moreover, we distinguish between conflicts over territory (secession) and conflicts over governance (coups, revolutions) since these types of conflicts are likely to be shaped partly by different conditions. The two dichotomous dependent variables measure the outbreak of territorial/governmental civil war. Any cell that overlaps with a conflict zone is coded as having a conflict in the given year (Figure 6–2).

Figure 6–2. Conflict Polygons and Conflict Cells in Sudan, 1997–2001

In order to test the proposed hypotheses, we have generated a number of relevant covariates that have values specific (if not necessarily unique) to each particular cell. The first of these are indicators of relative location. Since neighboring territories might provide safe havens and access to vital trade markets, we calculated the logged distances (km) from the centroid of each cell to the nearest international boundary. For cells in Sao Tome and Principe, Comoros, and Madagascar, which lack contiguous neighbor states, we set the distance-to-border variable artificially at 1,000 km. Our second indicator of relative location gives the logged distance (km) from the centroids to the capital city.

Prevailing theories on insurgency further suggest that the conflicts occur predominantly in the rural countryside; hence, we include a population density indicator. The population data are taken from UNEP-GRID^{vi}, who has gathered gridded population data for Africa at a resolution of 2.5 arc minutes (approximately 5 km at equator). The data are available for every decade since 1960 and give estimates for the number of inhabitants in each cell (see Tobler et al. 1997). We aggregated the population data to the desired grid resolution and applied linear interpolation to fill in data for missing years. Population values for 2001 were copied from 2000. As usual, we take the natural logarithm of the measure (modified to population in 1,000s) to reduce outlier bias. Since all pixels are equally sized, the population variable is essentially a population density measure. The most populous unit in the sample – covering Cairo and

suburbs – contains about 15 million people, corresponding to an average density of 1,500 persons per km² (data for the year 2000).

Our next variable is designed to capture local level of infrastructure, which presumably is positively associated with the ability of the government to penetrate the society. Based on road data from ESRI's *Digital Chart of the World*^{viii}, we measured the logged total length (km) of major roads in each cell. Since road density is positively correlated with population density ($r=0.63$), we analyze these measures simultaneously in order to discern any effect of infrastructure that is not due to settlement characteristics. Admittedly, this is a suboptimal approximation of local development. When aggregated to the national level, the country average of logged road length per capita nevertheless correlates with logged GDP per capita at a respectable 0.56. Moreover, the lack of temporal variation in the road data is less problematic than initially feared, since Herbst (2000) reports a very strong positive correlation between density of roads at independence and density in 1997 among African states, meaning that the country rank order (as well as absolute length) of roads per square kilometer is largely constant throughout the investigated period.

As proxies for mountains and forests, we measured the logged percentage of each pixel covered by the given type of terrain. Gridded mountain data were received from UNEP (2002) and comparable forest data were downloaded from the web site of the Food and Agriculture Organization (FAO) of the UN (www.fao.org/forestry). The average African grid cell contains 19% forested terrain and about 14% mountains.

Several recent civil wars demonstrate that valuable commodities might serve as a source of finance for rebellion. Hence, we measured the logged distances (km) from the centroid of each cell to the nearest secondary diamond and petroleum deposit, respectively. The resource data have been collected in a joint project between NTNU and PRIO (see Gilmore et al. 2005), where each resource deposit is registered with location coordinates and dates of discovery and production. Grid cells in countries without diamonds/petroleum were assigned values similar to the largest recorded resource-centroid distance for the given resource type (1,500 km and 2,287 km, respectively).

A number of contemporary civil wars involve fighting between groups of different cultural origins. As a simple measure of cultural identity, we have generated a dummy variable signifying whether the majority of the population in each cell belongs to the same language family as the majority of the population in the capital city. Assuming that the language in the capital is the majority language in the country, we define deviating regions as having a minority language. The language variable is based

on maps from Ethnologue (Grimes 2000), which were digitalized and converted to the grid structure. This is evidently a crude operationalization of the measured concept, since the largest language group in the capital need not be the most powerful ethnic group. Moreover, it is probable that some groups belonging to the same language family still have very different identity ties. Still, this is, to our knowledge, the best and most consistent data available for the entire African continent.

The final model for each conflict type additionally controls for two potentially important country-level factors: economic development (log GDP per capita, from Gleditsch 2002a) and regime type (Polity IV democracy-autocracy index, from Gurr et al. 1989). Only a squared variant of the latter measure is included as previous research indicates a parabolic relationship between level of democracy and domestic conflict (Hegre et al. 2001).

6.4. Research Design

The empirical analysis consists of two parts. The first focuses solely on the association between relative location, terrain, resources, and language, and the two types of intrastate conflict. Since nearly all these factors are time invariant, a time-series approach is not desirable. Rather, we test the hypotheses using a collapsed dataset with only one observation for each of the 3,207 cells. The dependent variables (one for each conflict type) then simply distinguish between units that remained at peace from 1970 to 2001 (0) and units that hosted one or more conflict in the period (1). Covariates that do vary temporally, such as population density, are represented by their mean values. The second part of the analysis evaluates the robustness of the initial findings by using a time-series cross-sectional (TSCS) setup with country-level control variables. Here, each of the 3,207 units are observed annually from 1970 (or year of independence) to 2001, giving 101,425 observations, or ‘grid-years’. In these models, the dependent variables denote the outbreak of conflict, i.e. only the first year in conflict is coded ‘1’. Consecutive years of conflict are coded as missing, since units in conflict are not at risk of having a new onset.^{viii} Grid-years without conflict are coded ‘0’.

The units show very strong cross-sectional correlation – that is, the likelihood of conflict for any grid is largely conditional on the conflict involvement of contiguous units. To account for spatial autocorrelation, we test two types of spatially lagged dependent variables (see Anselin 1988). The most influential spatial lag measures the share of conflict among contiguous grids in the same country. In this context, we only

consider first-order neighbors to the east, west, north, and south as contiguous (a.k.a. rook contiguity). The units in the sample have between zero (islands) and four neighboring cells, and the lagged conflict terms (one for each conflict type) take on values between zero (no neighbor cells in conflict) and one (all neighbors in conflict). Since this measure is highly correlated with the dependent variable, it may potentially ‘wash out’ or bias even the most powerful independent effects. Hence, we also test a second, less deterministic lag, which simply indicates whether there is a conflict ongoing in any other part of the country at the time of the observation. In the tables below, we only report the results with the latter lag, except in (the few) cases where the choice of lag substantially affects the behavior of other covariates.

In the final, time-series analysis, the data are also likely to suffer from duration dependence, i.e. the conflict status of a unit at any time is related to its status in the previous time period. We reduce this problem by coding *onset* of conflict (only first year of each conflict coded as ‘1’) rather than incidence (all years in conflict coded as ‘1’) and dropping consecutive years of conflict from the analysis. However, periods of peace will still be correlated over time. Hence, we adopt the procedure of Beck et al. (1998) by adding a peace-years count variable (which gives the number of years since independence or the end of the previous conflict) as well as three natural cubic splines.^{ix}

Finally, although the units are assumed to be independent across countries, they are likely to show some level of dependence within countries. To account for cross-sectional heteroscedasticity, we cluster the units on countries (country-years in the TSCS analysis). We used ArcGIS 9 with ArcInfo level to generate grid-specific measures and create the maps, and StatTransfer 7 to convert the GIS data to Stata format. The logit regression models were estimated using Stata 8.

6.5. Results

What separates peaceful areas from those that provided grounds for armed hostilities in the period? Descriptive statistics of sample means (Table 6–1) show that grid cells with territorial conflict are, on average, closer to the border, further away from the capital, petroleum fields, and diamondiferous areas, they are less populated, less rugged, have less developed road network, and are more likely to contain a minority language than cells without conflict in the period. In addition, these conflict units are generally located in less economically advanced countries than the random African grid cell. Areas with governmental conflicts differ by being closer to the capital, further away from

neighboring countries, more densely populated, contain more rough terrain, are less likely to contain a minority population, and occur in more developed countries than the average unit of observation.

Table 6–1. Comparison of Sample Means: Conflict and No-Conflict Cells

	Territorial conflict		Governmental conflict	
	Yes	No	Yes	No
Distance to border ^a	155	204	202	194
Distance to capital ^a	883	646	645	700
Population (1,000s)	96	184	217	147
Road density ^a	305	404	482	342
Mountain ^b	13	15	20	13
Forest ^b	6	23	25	18
Distance to petroleum ^a	605	514	637	463
Distance to diamonds ^a	849	366	331	480
Minority language ^b	66	41	31	52
Democracy	–3.5	–4.4	–3.6	–4.6
GDP per capita (US \$)	1,748	2,316	2,350	2,170
<i>N</i>	484	2,723	1,075	2,132

Note: The table shows mean values of the covariates for cells that did and did not experience conflict in the period from 1970 to 2001. ^a Km; ^b %.

This simple comparison of means reveals two trends. Almost all covariates show a stronger association with one type of conflict than the other and the deviations between the no-conflict and conflict samples for the two types are often in opposite directions. This discovery adds strength to our notion that governmental and territorial conflicts should be studied separately. Additionally, the expected geography of civil war, inspired by theories of insurgency, corresponds best to the territorial conflict type. This suggests, not too surprisingly, that the technology of insurgency is mainly a characteristic of separatist wars.

Next, we evaluate the performance of the independent variables in a multivariate setting. The results from cross-sectional logit analyses of territorial and governmental conflicts are presented in Table 6–2 and Table 6–3, respectively. To maintain parsimony we estimate four models for each conflict type. The first model in each case (Models 1 and 5) include only the base variables, i.e. the spatial lag and two indicators of relative location. These variables are present in all models. In addition, Models 2 and 6 include population density, road density, and terrain; Models 3 and 7 explore the effect of proximity to oil fields and secondary diamonds, while Models 4 and 8 include the minority dummy.

Not surprisingly, the spatial lags are very powerful. If some other part of a country experienced a territorial conflict in the period, the risk of conflict is more than ten times higher than if all other grid cells in the country remained at peace. The governmental models indicate an even stronger spatial relationship. Accordingly, the onset of conflict shows clear evidence of clustering – at least at the selected level of analysis.

The models in Table 6–2 further show that location matters. In line with our predictions, the risk of a separatist war is positively associated with the distance from the capital. In fact, the marginal effect of capital distance exceeds an order of magnitude: all else being held at the median, cells located approximately 1,500 km from the capital city (95th percentile value) have a predicted risk of separatist conflict of 16.9%, compared to 0.93% for cells less than 120 km from the capital (5th percentile value). The distance to the border also shows the expected negative sign, but the estimate is not robust to models specification and the effect is quite weak.

Table 6–2 Logit Estimates of Onset of Territorial Conflict

	(1)	(2)	(3)	(4)
Spatial lag	11.949 (2.84) **	11.924 (3.08) **	11.280 (3.95) **	11.739 (2.90) **
Distance to border ^a	-0.109 (1.33)	-0.183 (2.42) *	-0.071 (0.72)	-0.096 (1.06)
Distance to capital ^a	1.258 (2.59) **	0.877 (1.82)	1.275 (2.94) **	1.176 (2.65) **
Population density ^a		0.040 (0.30)		
Road density ^a		-0.091 (0.91)		
Mountain ^a		-0.236 (0.98)		
Forest ^a		-0.409 (1.95)		
Distance to petroleum ^a			0.132 (0.32)	
Distance to diamonds ^a			1.404 (2.76) **	
Minority language				0.557 (0.77)
Intercept	-10.382 (3.37) **	-6.622 (2.09) *	-21.110 (2.92) **	-10.211 (3.35) **
<i>N</i>	3,207	3,207	3,207	3,207
Log pseudolikelihood	-738.2	-679.9	-652.3	-730.9

Note: Regression estimates with robust z scores in parenthesis (standard errors clustered on countries).

^a Logged; * p<.05; ** p<.01.

In the second model, we introduce four additional explanatory variables: population density, road density, and mountainous and forested terrain. Popular views on insurgency predict that such conflicts are more probable in sparsely populated and underdeveloped regions and in areas with considerable rough terrain. Model 2 offers scant support to this conjecture. Only one of the variables, forested terrain, produces a significant estimate, and it shows the opposite sign of expected. Road density, too, shows an unexpected positive estimate, but its marginal impact on the model is diminutive. However, these four variables are obviously correlated (e.g. people settle along roads and roads are developed in populated areas). Both population density and road density have negative and significant effects on the likelihood of separatist conflict if they are included individually and without the terrain proxies. The mountain and forest variables, however, always suggest a negative association with territorial conflict. This counters the so-called rough terrain argument and also questions the credibility of country-level studies that claim a hazardous effect of terrain (see Fearon & Laitin 2003). We speculated whether this finding could be a consequence of the negative correlation between extent of rough terrain and country size. Larger African countries, on average, have relatively less rough terrain, and civil wars in larger countries usually cover larger areas (and thus a higher number of cells). Could it be that the negative impact of terrain on the risk of conflict is biased by the overrepresentation of conflict units in a few large countries? Apparently not. When we tested alternative terrain variables that are standardized by the country average of rough terrain, we found similar negative relationships. Accordingly, separatist conflicts are not only associated with less-than-average extent of rough terrain, compared to the random African cell; the conflicts also tend to occur in the least forested and mountainous regions of the conflict-ridden countries. While intuitively surprising, Buhaug & Lujala (2005) report a similar discovery. This does not necessarily mean that the rough terrain proposition should be discarded for good. With better data, we might be able to evaluate whether rebel *bases* tend to be located in high and forested grounds, which is what a stripped version of the proposition would predict.^x Moreover, the reader should keep in mind that the undertaken study only covers Africa, and the results may not necessarily represent the circumstances in other part of the world very well.

Model 3 tests the opportunity (or ‘greed’) proposition that proximity to valuable commodities raises the motivation for, and hence the risk of, rebellion. Again, the results are mostly unsupportive. The petroleum proxy shows a weak positive effect, suggesting that aggrieved people in oil-rich regions are slightly less likely to seek secession than groups in other parts of the country. This finding does not differ if we

consider onshore (or offshore) oil fields only. However, if we add a dummy to mark off countries without oil, the petroleum distance measure assumes the predicted negative effect. This is because the baseline risk of territorial conflicts actually appears to be higher(!) among the non-producing African countries. Proximity to diamonds has a strong, deterrent effect on separatist conflict, and this finding is not biased by the resource-poor countries in the sample. This indicates that aggrieved people in diamond regions generally select another strategy to redress their grievance (see Model 7).

The deviating performance between petroleum and gemstones should not come as a big surprise, though. In contrast to alluvial diamonds, oil and gas are point resources that require skilled workers and specialized equipment to extract the commodity. Aside from sabotage and blackmailing, only a recognized state can gain revenues from oil. Therefore, groups in oil-rich regions that want to secure the benefits from the natural goods are likely to seek independence. Secondary diamonds, however, can be extracted single-handedly and without advanced technology, and the extremely high value-to-weight ratio make them ideal for smuggling and other quasi-criminal activities typically associated with warlordism (see Le Billon 2001b).

Finally, Model 4 indicates that cells with a marginalized language are about twice as likely to host a territorial rebellion in the period as the reference category, though the estimate is not statistically reliable even with a 10% level of uncertainty. In summary, Table 6–2 offers modest support to the theory on insurgency. African separatist conflicts occur predominantly in less developed regions at a distance from the center of state power, near neighboring states, adjacent to petroleum fields, but without access to secondary diamonds and with less-than-average mountainous and forested terrain. Table 6–3 presents a radically different picture. Most strikingly, the relative location indicators contribute little to the overall fit of the governmental models. However, the positive estimate for population density in Model 6 suggests that governmental conflicts are mainly urban events. The risk of a revolution or a coup is four times higher in the most densely populated areas than in the unpopulated parts of a country, all else held constant. Again, our proxy for local development, road density, fails to provide additional explanatory power. The sign of the estimate is now positive, however, as is the case for the terrain measures. Hence, it appears that the rough terrain proposition – at least for the case of Africa – is more in line with characteristics of governmental than separatist conflicts.

Table 6–3 Logit Estimates of Onset of Governmental Conflict

	(5)	(6)	(7)	(8)
Spatial lag	19.795 (5.34) **	19.823 (6.03) **	18.793 (5.59) **	19.744 (5.69) **
Distance to border ^a	-0.068 (0.42)	0.019 (0.13)	0.023 (0.14)	-0.094 (0.64)
Distance to capital ^a	-0.406 (1.54)	-0.160 (0.67)	-0.461 (1.85) *	-0.306 (1.14)
Population density ^a		0.221 (2.37) *		
Road density ^a		0.089 (0.90)		
Mountain ^a		0.098 (1.13)		
Forest ^a		0.274 (2.45) *		
Distance to petroleum ^a			0.199 (1.20)	
Distance to diamonds ^a			-0.369 (2.07)	
Minority language				-0.953 (2.88) **
Intercept	-0.050 (0.03)	-4.115 (2.11) *	0.937 (0.37)	-0.198 (0.11)
<i>N</i>	3,207	3,207	3,207	3,207
Log pseudolikelihood	-731.0	-666.8	-703.0	-711.6

Note: Regression estimates with robust z scores in parenthesis (standard errors clustered on countries).

^a Logged; * $p < .05$; ** $p < .01$.

Model 7 offers support to the notion of a resource curse, but only for the case of diamonds. Diamond-abundant areas have a significantly higher probability of hosting a governmental war than less affluent parts of the country. This contrasts the findings in Model 3 and suggests that Le Billon's (2001b) theorized link between diamonds and warlordism generally takes the form of (phony) claims to topple the regime. Proximity to petroleum fields does not affect the estimated risk of governmental conflict to any significant extent.

The final model in Table 6–3 again demonstrates that territorial and governmental conflicts differ substantially. Minority language, which is associated with a slight increase in the risk of secessionist rebellion (Model 4), lowers the probability of governmental conflict by a factor of 2.5. This is not surprising; even if a marginal group were to succeed in toppling the regime and see through political reforms, its numerical inferiority will be a serious impediment to sustained political influence. Realizing this, aggrieved minority groups are more likely to opt for the exit strategy as a means to redress their grievance.

The joint insight from Tables 6–2 and 6–3 supports our assumption that geography differs in its impact on territorial than governmental conflict. Yet, the reported analysis excludes important attributes of the countries involved, such as type of political system and economic level of development, that might potentially affect the estimated relationships. Since these factors often vary considerably over time, they must be represented by time-varying covariates and evaluated in a time-series analysis.

In Table 6–4, we re-estimate Models 2 and 6 (excluding the irrelevant road measure) with a TSCS dataset, controlling for squared level of democracy and log GDP per capita. In line with the results above, remote regions are more likely to host a separatist rebellion (Model 9) whereas distance from the capital has little impact on the risk of governmental conflict (Model 10). We also see that the distance to the border is now strongly negatively associated with secession. The models further strengthen the finding that populous regions are predisposed to governmental conflicts while separatist movements are most likely to emerge in sparsely inhabited areas. The terrain estimates are generally less robust, but substantiate our impression that the rough terrain argument is not applicable to the broad sample of domestic conflicts.^{xi}

Table 6–4 Logit Estimates of Onset of Intrastate Conflict, 1970–2001

	Territorial	Governmental
	(9)	(10)
Spatial lag	9.830 (12.66) **	8.640 (19.70) **
Distance to border ^a	-0.471 (5.22) **	-0.226 (3.26) **
Distance to capital ^a	1.624 (3.30) **	0.171 (1.04)
Population density ^a	-0.495 (5.94) **	0.177 (3.49) **
Mountain ^a	-0.433 (2.87) **	0.024 (0.56)
Forest ^a	0.067 (0.68)	0.163 (1.62)
Democracy squared ^{a, b}	-0.015 (1.65)	-0.023 (2.70) **
GDP per capita ^{a, b}	-2.391 (6.31) **	0.018 (0.05)
Intercept	1.754 (0.59)	-7.247 (2.83) **
<i>N</i>	85,136	86,065
Log pseudolikelihood	-652.8	-1,720.8

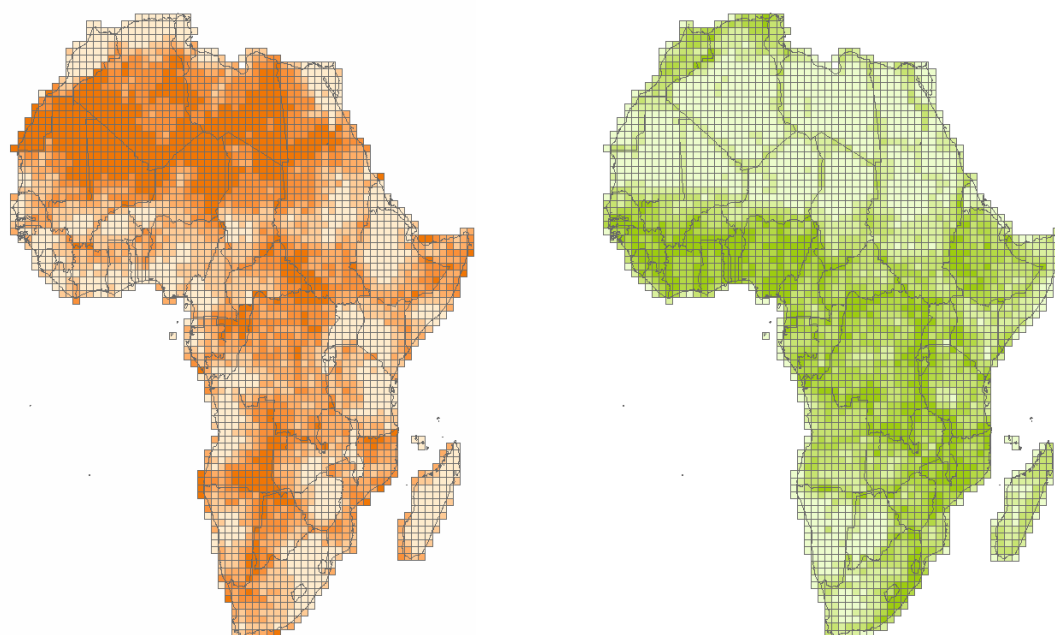
Note: Regression estimates with robust z scores in parenthesis (standard errors clustered on country years). Estimates for peace-years and three cubic splines not shown.

^a Logged; ^b lagged; * p<.05; ** p<.01.

In line with previous findings, we see that institutionally inconsistent regimes have a higher baseline risk of intrastate conflict than more democratic or autocratic systems. Moreover, the pacific effect of institutional consistency is largest with respect to governmental conflict. The marginal impact of democracy is nonetheless moderate compared to some of the geographic measures, in particular with respect to territorial conflict. This may be because Africa is a relatively homogenous continent when it comes to regime type, with a mean polity score of -3.9 (signifying somewhat autocratic) and a standard deviation that is smaller than that of any other continent in the world. GDP per capita also differs in its impact on the two models. Wealth apparently is a much better guarantee against a disintegration of the state boundaries than against violent attempts at regime change. This result, too, might well reflect a particular African effect as African countries are on the whole very poor. In fact, the least developed European country (in terms of GDP per capita income) in the sample period, Romania in 1970, has a higher development score than the mean value for African countries between 1970 and 2001.

The conversion to a time-series structure with repeated observations and the introduction of regime controls did not cause radical changes but increased the estimated effects of most geographical variables in the direction suggested by the initial analysis.^{xii} All else being equal, the risk of separatist conflict is highest in remote regions with less-than-average mountainous terrain whereas governmental conflicts are most likely to occur in urban centers and along the borders (Figure 6–3). From this follows that rebellions in geographically larger countries tend to take the form of secession, whereas small countries offer better opportunities for capturing the state. These findings imply that Fearon & Laitin (2003) are only half right. Whereas most factors associated with insurgency are well able to explain the local onset of territorial conflict (exactly because most territorial conflicts fit Fearon & Laitin's definition of insurgency), they are either unrelated to the onset of governmental war or show an opposite effect. In fact, since most civil wars are governmental, not territorial, one might argue that “conditions that favor insurgency” (p. 75) only explain a minority subset of all domestic conflicts.^{xiii} Future work will determine if the findings reported here are universal or whether there is some kind of ‘Africa effect’ with respect to the local geography of civil war.

Figure 6–3. Zones at Risk of Territorial and Governmental Conflict



Note: The maps illustrate the relative risk of territorial (left) and governmental conflict as a function of distance to the capital city, distance to the state border, population density, and share of mountainous and forested terrain for the average African unit in 2000. Darker colors signify higher risk. Calculations are based on estimates in Table 6–4.

6.6. Conclusion

This study has presented an innovative research design where grid cells rather than countries constitute the cross-sectional units of analysis. We argued that this design is better suited to test theories of civil war that essentially relate to local conditions. Among these are theories on rough terrain, greed/opportunity, ethnic diversity, and center vs. periphery. The analysis, which was conducted separately for territorial and governmental conflicts and included both collapsed and time-series estimations, produced some promising findings. Territorial civil wars – that is, wars over autonomy and secession – are much more likely to occur in remote and sparsely populated regions. In contrast, governmental conflicts occur predominantly in urban and diamond-abundant areas. The analysis also uncovered an unexpected negative association between rough terrain and territorial conflict. Both proximity to oil fields and local dominance of a minority language appear to increase the risk of separatist wars, although these variables were sensitive to choice of spatial lags and other model specifications. Road density, our proxy for local development/government reachability,

failed to make an impact on the estimated risk of civil war. Overall, the territorial models correspond best to the broad theory of insurgency. Governmental conflicts are less determined by geographical attributes of the region but presumably more dependent on case-specific political events.

Several factors call for moderation when assessing the importance of the reported findings. First, the sample is limited to Africa since 1970, which calls into question the generalizability of the results. In fact, there are ample reasons to believe that Africa is a special case as it has the highest share of domestic conflict and is culturally more diverse than other continents. Also, since African conflicts more often are contests for state control, the relative scarcity of territorial conflicts might potentially produce biased results. This should not be a huge problem, though, as we separate between these two types of conflict in the analysis. Even so, the reader should be cautious about making too general statements from the reported findings.

Second, there is always a potential for producing misleading findings due to poor operationalizations and omitted variables. In particular, we need to develop better measures of local level of development and ethnic composition, as well as important factors that were excluded from this study (most notably economic inequality). While such data may be available on a sufficiently low level for the present time, it is obviously difficult to get good data for previous decades. That said, Miguel et al.'s (2004) procedure to use rainfall deviation as a proxy for economic shocks demonstrates the usefulness of instrument indicators.

Third, the radical research design introduces several complex correlation structures on multiple levels in both space and time that standard statistical packages are not designed to handle. Even so, we believe that the disaggregated approach has great potential and will prove invaluable as a supplement to conventional country-level analyses. When the researcher seeks to explore how attributes of governments and the political system affect the risk of domestic instability, countries constitute the natural units of analysis. If the researcher seeks to understand the role of local conditions, however, a disaggregated design should be employed. Consequently, a natural next step is to develop better sub-national measures of relevant conflict-promoting factors, as well as geo-referenced data on the location of the conflicts themselves.

Notes

- ⁱ See Herbst (2000) for some excellent maps of the population distribution in African countries.
- ⁱⁱ Recognizing this, several African state leaders have (unsuccessfully) attempted to redistribute the population by force through ‘villagization’ (Herbst 2000).
- ⁱⁱⁱ The relationship between poverty and conflict is most certainly a reciprocal one in that conflict might also lead to poverty (see Alesina & Perotti 1996).
- ^{iv} There is also a considerable literature focusing on the potential relationship between resource scarcity and conflict. That research focuses on depletion of renewable resources (water, soil) and is generally preoccupied with future scenarios, and therefore not immediately relevant to this assignment.
- ^v Whether oil can be considered lootable is an open question, although recent events in e.g. Nigeria show that the sabotage of pipelines, or threats thereof, can be a significant source of income.
- ^{vi} United Nations Environmental Programme – Global Resource Information Database, data available from: <http://grid2.cr.usgs.gov/datasets/datalist.php3#unep>.
- ^{vii} The Digital Chart of the World (DCW) is a comprehensive 1:1,000,000 scale vector base-map dataset of the world. It consists of spatial and textual data that can be accessed, queried, displayed, and manipulated with GIS software. The database was originally developed by the Environmental Systems Research Institute (ESRI) for military use, and then released for commercial use in the mid-1990s.
- ^{viii} Even though some large countries (e.g. Ethiopia and Sudan) occasionally experience multiple simultaneous conflicts, these generally occur in different parts of the country.
- ^{ix} We tested several alternative specifications where we altered the number and shape of the splines. Although some of these alternative models proved to be marginally superior, they did not affect the reported estimates in any substantial manner.
- ^x See Raleigh & Hegre (2005) for a data-collecting project along this line.
- ^{xi} We also assessed the effect of the resource proxies with the TSCS data. These models reproduced previous findings in that proximity to diamonds is associated with governmental conflict while proximity to petroleum increases the risk of separatist conflict. The size and significance of the latter estimate was sensitive to choice of spatial lag, though.
- ^{xii} These models were also tested in a multilevel analysis, using MLwiN. This did not lead to dramatically different results. Due to computational limitations, more conventional multilevel applications, such as gllamm for Stata, were unable to analyze the data.
- ^{xiii} Both the Uppsala/PRIO list of Armed Conflicts and Fearon & Laitin’s sample of civil wars include a higher number of governmental wars (65%) than wars over territorial control (35%). For the spatio-temporal domain of this investigation, Africa since 1970, the ratio of governmental to territorial conflicts is even more striking: 48–11.

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