SPATIAL PLANNING AND INTRASTATE CONFLICT
APPLYING TOOLS FROM GEOGRAPHY IN THE STUDY OF CIVIL WARS

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Empirical literature on civil war has demonstrated the benefits of using disaggregated data while exploring the influence of geography on intrastate conflicts. This paper goes further in exploring the border between political and geographical sciences by assessing the link between accessibility and the location of internal armed conflicts. Our work is aimed at finding whether poorly accessible parts of a country are more prone to civil war than any other part. To test this hypothesis, we deploy a three-step research design. First, regarding the pivotal role of the capital city previously demonstrated, we evaluate the importance of bringing a country's urban structure into analysis using Zipf's law as an indicator of urban hierarchy. Second, we model the influence of cities over space using a gravity model of spatial allocation. Finally, we use network analysis in order to assess the accessibility of cities by road and to evaluate whether this factor influences the location of civil conflicts. Our preliminary results suggest a link between multipolar urban hierarchies and separatism. This paper constitutes a good demonstration of how conflict studies can benefit from an interdisciplinary approach. Finally, this research highlights the conflict-resolution potential of a rather politically-insensitive issue such as spatial planning.

Introduction

Social networks analysis (SNA) is a good example of a promising new research field based on a solid, long-established knowledge rooted in other disciplines such as graph theory. The quick development of SNA as respected sub-field of International relations (IR) shows how much IR can benefit from theories, methods and concepts imported from other disciplines. This paper demonstrates the richness of models elaborated in the field of geography and transposed into IR to study the spatial dynamics of civil wars. This article argues that geographical models transported into security studies allow scholars to tackle the question of conflicts location from an original point of view.

In most cases, in countries where the government is struggling against an armed rebel organization, only a limited part of the state's territory is involved in the fighting. Therefore, one may ask what makes certain areas more prone to conflicts than others. Whether rebels are willing to secede or to control a safe haven, is the location of the combat zones determined by geography? One way of tackling these issues is to assess to what extent accessibility influences the location of civil wars. Focusing on accessibility constitutes a good way to benefits from two research areas, strategy/tactics and geography. However, since accessibility is a relative notion, one cannot use it without setting reference points from which the accessibility of any place within a country can be measured.

This paper starts by reviewing the literature about spatial models of civil wars. Then, using two geographical models, the rank-size rule and the gravity-based model of spatial allocation, it paves the way to an accessibility-based study of the spatial determinants of civil wars. It also shows how useful such models can be even though they were built within another discipline. Indeed, while the rank-size model of urban hierarchy reveals that countries where the population is distributed across several cities of roughly equal size are more likely to

experience secessions. The second model leads to the finding that internal conflicts should not be studied in isolation from factors located beyond the national boundaries.

Spatial approach to civil wars

Civil wars are typically defined as form of "armed conflict between the state and an organized rebel group" (Buhaug & Gates 2002: 421). According to its internal nature, this type of armed struggle is assumed to be confined to the territory of the state where it occurs. However, in the past two decades, internal conflicts have increasingly attracted the attention of IR scholars and especially in security studies. As a matter of fact, while the core of the scholarly IR literature still mostly deals with international conflicts, civil wars constitute the most frequent form of armed conflict around the world since the end of World War II (Figure 1). Although their scale and magnitude is generally lower than for a "classic" war, intrastate conflicts have undeniable international consequences that cannot be neglected: refugee flows, cross-border rebel movements or foreign involvement. The fact that 11 out of the 15 current United Nations peace operations take place in a post-civil war context clearly show the threat posed by these armed conflict to international peace and security (United Nations 2013).

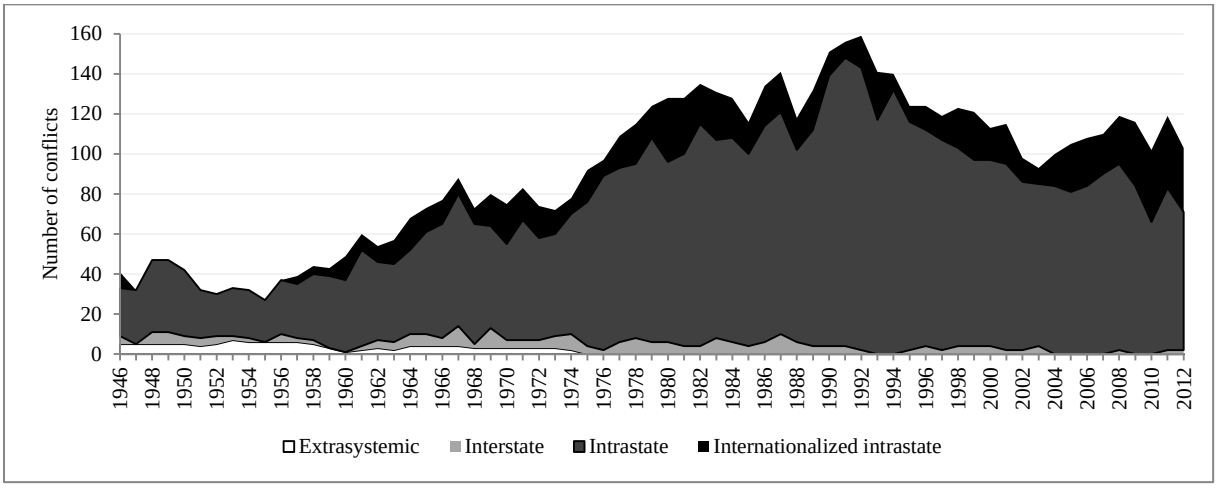

Figure 1 - Evolution of the number of conflicts by type since 1946 (UCDP/PRIO Armed Conflict Dataset)

Intrastate conflicts do not always affect a country's whole territory. They actually tend to be localized phenomena. While secessionist movements are restricted to the autonomy-seeking territory, rebel groups willing to overthrow the central government often establish sanctuaries in a particular area before expanding to the rest of the country. The protracted internal conflicts that have been affecting India for decades are exclusively located in the northern and northeastern parts of the country which account for at most 17.97% of the country's territory. In Russia, only 0.1% of the land was concerned by the Chechnya war. In central Africa, most of the security challenges to the government of Democratic Republic of the Congo originate or are located in the eastern part of the country. Finally, in Central African Republic, fighters from the *Séléka* rebel movement started by transforming the east of the country in a safe haven before seizing the capital Bangui in March 2013 (International Crisis Group 2013). These examples clearly illustrate the localized nature of civil wars. It can therefore be argued that the spatial pattern of these conflicts is influenced by geographic features located at a subnational scale.

Since the beginning of the last decade, the development of geo-localized databases, their wider access and the democratization of geographic information systems allowed IR scholars to investigate the spatial determinants of civil wars at a disaggregated level. In a seminal article, Buhaug and Gates (2002) demonstrated the pivotal role of the capital in the location of civil wars. They showed that the objectives of the rebels constitute a variable of primary importance: while secessionist conflicts tend to affect relatively territories located far away from the capital, rebels aimed at overthrowing the government operate closer to the capital (Buhaug & Gates 2002: 426). This article paved the way to a renewed discussion on civil wars which involved spatially disaggregated data and a closer look at geography as a driving force for conflicts rather than as a mere context. In the subsequent years, several features in this domain have been studied as exemplified by the following articles. Raleigh & Hegre (2009), using the *Armed Conflict Location and Events Dataset* (Raleigh e.a 2010), demonstrated the peripheral nature of civil wars and showed that these conflicts are less likely in countries where population is concentrated near the capital. Focusing on the "rough terrain" variable, Hendrix (2011) measured that mountainous countries are more prone to civil conflicts because mountains weaken state capacity and provide safe havens for rebel groups. In an article focusing on Africa, Buhaug & Rød (2006) considered several geographical variables and established the peripheral nature of secessions while governmental conflicts tend to occur in urban areas. Raleigh (2010) nuanced these findings by showing that the strategic of the disputed territory should be taken into account as rebels tend to target valuable areas where the state cannot afford to lose control. Finally, scholars were able to link the influence of geography to political and socio-economic variables. Buhaug (2006) showed that poor economic performances are likely to lead to internal armed conflict. He also demonstrated that political regimes located somewhere between autocracy and democracy have the highest probability of being overthrown by a rebel organization, while democracies tend to experience mostly secessionist conflicts.

This renewed attention to the geographical determinants of civil wars had the effect of bringing back on stage Kenneth Boulding's (1962) model of state power projection and its side-notion of "*loss of strength gradient*" (LSG). This concept, closely related to Clausewitz's (1832/1918b: 62-75) "*culminating point of the offensive*", was elaborated by Boulding in an attempt to model the spatial dynamics of interstate wars. For Clausewitz (1832/1918b: 67-68), "[a] *conquering army is like the light of a lamp* […]*; the more the oil which feeds it sinks in the reservoir and recedes from the focus of light, the smaller the light becomes, until at length it is quite extinguished*". This idea is reflected in Boulding's LSG that can be defined as the speed with which a state's military capability declines with the distance from its base. Indeed, according to Boulding's "*law of diminishing power*", a state's military strength culminates at its home base and the farther its army is projected, the lesser its power (Boulding 1962: 230-231). As this law applies for each belligerent, it is possible to delineate the location where both sides possess an equal strength and are no more able to subjugate each other, thus leading to the clausewitzian culminating point of the offensive and a situation of equilibrium that permits identifying the territory under the control of both actors.

Although tailored for international conflicts, this spatial model was fruitfully transposed to the study of civil wars by Buhaug (2010) who found that the stronger the rebels, the closer to the country's capital they are able to operate. The strong effect of the distance to the capital in the location of civil wars hence suggested that a country's capital would be the best candidate for the role of governmental home base in Boulding's model (Buhaug 2010: 109; Geyer & Pickering 2011: 21). However, Boulding himself gave no definition of what should be considered a country's home base, especially in the case of civil wars. While this model does justice to the pivotal role of the capital that has been noticed in most of the spatial studies of civil war, it comes with two shortcomings. On the one hand, as pointed out by Raleigh (2010: 407), are capitals that important in all countries? What about multi-capital states? Is this model still relevant in countries where the capital is not the most populated neither the richest city? Indeed, during the 2012 civil unrest in Côte d'Ivoire, the decisive battle took place in Abidjan and not in Yamoussoukro, the capital (Rouppert 2012). On the other hand, this model is also limited by its over-linearity (Geyer & Pickering 2011). How do secondary cities affect a sate's LSG? Do they act as regional relays enhancing the government's power projection, or are they possible strongholds for peripheral rebel groups? What about foreign cities located close to the border where insurgents can find supplies, rest and recruits? In its current capital-centered fashion, Boulding's model applied to the study of civil wars still offers room for significant improvements.

Boulding's model as well as the whole literature on the location on civil war could benefit from a thorough analysis of the accessibility variable. Strategists and guerrilla practitioners have underlined the importance of terrain as both an obstacle and an opportunity in the conduct of war. For most of them, accessibility was the key variable influenced by geography. Sun Tzu dedicated a whole chapter to the classification of terrain in six categories based on its accessibility to the armies (Sun Tzu VIth c. ACN/2008: 213-222). For Clausewitz, physical geography was so important that it is the topic of no less than 18 out of 115 chapters of its treaty (Clausewitz 1832/1918), leading the famous French geographer Yves Lacoste to speak of a this piece as "*a true book of 'active geography'*" (Lacoste 1985: 17), my translation). Later on, famous insurgents like Mao Tse-Tung, Vo Nguyen Giap or Ernesto Guevara highlighted the tactical advantage offered by mountainous or other kinds of so-called inaccessible areas which provide cover while reducing the mobility of the attacker.

Despite being widely referred to in the military sphere (Collins 1998), accessibility is fundamentally a spatial notion that has long been studied by geographers. Although there is no consensus on a definition, it can be defined as "*the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)*" (Geurs & Van Wee 2004: 128). This definition reveals the four components of accessibility: transport network, land-use, time or ease to move, and individuals (Vandenbulcke e.a. 2009: 40). On this basis, it is possible to tailor different measures of accessibility focused on four perspectives (Geurs & Van Wee 2004: 128-129): infrastructures (e.g.: locate the busiest road), locations (e.g.: the number of hospitals within 30 minutes from an individual's home), people (e.g.: the activities reachable by an individual at a given time), and services (e.g.: identify the closest hospital). To study the relationship

between accessibility and the location of civil wars, the location-based perspective constitutes an appropriate way to approach the issue because it involves measuring how hard it is to reach any area of a country from a given reference point.

A large set of environmental and human variables can be taken into account to refine this measure of accessibility: quality of the transport network, type of terrain, topography, slope, and even climate. However, measuring accessibility supposes the definition of three parameters: an indicator of impedance (either "real" or Euclidean distance, travel time or actual cost of movement), a starting point and a destination. While the first parameter can be tailored according to the needs of the study, setting an origin and a destination exposes the model of accessibility to the same shortcomings that have been reported for Boulding's model of power projection.

Beyond the capital: the urban hierarchy variable

In many countries, the distribution of cities by population displays the following hierarchical pattern: one or two big cities which concentrate both population and economic power, a series of secondary centers of regional importance and a vast amount of minor agglomerations with at best a local relevance. Geographers, economists and statisticians have long been interested in measuring, theorizing and optimizing the distribution of cities within a country. A key contribution to the characterization of urban hierarchies across countries is the early work of Auerbach (1913) who demonstrated that when cities are ranked according to their population, their rank-size distribution can be approximated by a Pareto distribution (Cheshire 1999: 1342-1343; Soo 2005: 239). If p is the population of a given city, r the number of cities with higher population, S and α are constants, then the rank-size relationship can be expressed by equation [1], with [2] being its operational form (Soo 2005: 241).

$$r = S.p^{-\propto} \quad (S, \propto > 0) \quad [1]$$

$$\ln(r) = \ln(S) - \propto . \ln(p) \quad [2]$$

This model, known in geography as the rank-size rule, was further developed by Singer (1936), but most notably by Zipf (1949), who argued that not only the distribution of cities ranked by population follows a Pareto distribution, but the Pareto exponent should be equal to unity (Zipf 1949: 380). For what would eventually become the Zipf's law for cities, the S parameter corresponds to the size of the most populated city while α equals 1. However, although Zipf's law seems to hold for the specific case of the United States (Zipf 1949: 375; Rosen & Resnick 1980; Gabaix 1999; Ioannides & Overman 2003; Ioannides & Skouras 2013), it is not always verified in other countries, suggesting that Zipf's law at a cross-country level represents a particular case of a more general rank-size rule (Ioannides & Overman 2003: 128; Benguigui & Blumenfled-Lieberthal 2007: 649). In their study of the urban hierarchy of 44 states, Rosen and Resnick (1980: 166-167) measured a mean Pareto exponent of 1.136 (std. dev. = 0.196) with variations ranging from 0.809 (Morocco) to 1.963 (Australia). Renewing this exercise with new data, Soo (2005: 247) found that "*α is significantly greater than 1 for 39 of our 73 countries, while a further 14 observations are significantly less than one*", thus obtaining similar results as Moriconi-Ebrard (1993) who

carried on a comparable analysis with 78 countries. These three examples suggest that Zipf's law should be taken cautiously.

According to Zipf's law, in a country where the biggest city possesses a population *S*, the second most populated has a population of *S/2*, the third a population of *S/3* and so on. However, if for some reason the second and third biggest cities have smaller population than S/2 and S/3 respectively, then the Pareto exponent of the country's city-size distribution will be higher than unity: the larger the difference from a typical Zipfian distribution, the bigger the gap between the observed Pareto exponent and one. In order to build an index of urban hierarchy, it seems better to refer to the Lotka's (1941: 164) form of the Pareto equation. Lotka expressed the population of cities as function of their rank in the distribution rather than the opposite. According to Parr (1985), this form is better suited when working with data on individual cities and not classes of cities. In Lotka's form, a Pareto exponent higher than one indicates that the country's urban hierarchy is more unipolar than in Zipf's law, while an exponent smaller than one denotes a more even distribution of cities (Schaffar 2009: 4). Throughout these pages, the value of the Pareto exponent will be referred to according to Lotka's form.

Building on the previous literature, this paper explores the interplay between three variables: the type of civil war, of political regime and the level of urban hierarchy. The link between regime type and urban hierarchy has already been studied by Ades and Glaeser (1995) and Soo (2005) while Buhaug (2006) was able to show that the political regime variable is related to specific types of civil war. Still, the relationship between conflict type and the hierarchy of the urban system remains unexplored. Using the Pareto exponent as an index of urban hierarchy, this article investigates two main hypotheses and their associated extensions:

H1: Countries with different types of political regime display different levels of urban hierarchy.

H1a: Countries under authoritarian regimes have a higher level of urban hierarchy than countries with any other political regime.

H2: Countries experiencing different types of civil war (for governmental control or for secession) display different levels of urban hierarchy.

H2a: Countries experiencing a conflict in which rebels seek to overthrow the central government have a higher level of urban hierarchy than countries experiencing a secessionist conflict

The purpose of hypotheses *H1* and *H1a* is to replicate the results gathered by Ades and Glaeser (1995) and Soo (2005) using a new dataset. While the former focused on the most populated city in 85 countries, the latter used a composite index of governance. The present analysis therefore seeks to enlarge the scope of Ades and Glaeser's work while isolating the type of political regime that was present in Soo's contribution using the same polity measure as Buhaug (2006). The results should show higher levels of urban polarization in autocratic

regimes and conversely in more democratic ones. This step of the analysis is important to validate the data in order to test the second hypothesis. Hypotheses *H2* and *H2a* directly address the relationship between conflicts and urban hierarchy. Since autocracies tend to display a more polarized urban tissue than democratic regimes (Ades & Glaeser 1995: 216) and because autocracies are more likely to experience conflicts over government than secessions (Buhaug 2006: 700-701), this type of intrastate armed conflict is more likely to occur in countries with highly polarized urban systems.

Model

Data used to measure urban concentration was provided by the Center for International Earth Science Information Network (CIESIN 2011). For each of its 66,546 records, CIESIN's dataset provides geospatial information such as the name of the settlement, its latitude and longitude coordinates as well as the country and continent where it is located. Population estimates for each city are available for three years: 1990, 1995 and 2000. The index of urban concentration was calculated for each country in these three years. This index corresponds to the slope of the ordinary least square regression line (equation [3]). The choice of the cutoff number of cities for each regression is important because the Pareto exponent is sensitive to the size of the sample (Soo 2005: 241). For this reason, all the tests were performed using 20, 40, 50 and 100 cities as cutoff values and all the cities with at least 100,000 were included. In practice, the threshold of 50 cities, already used in Rosen & Resnick (1980: 172), proved a good compromise between a high number of countries and a reliable Pareto exponent.

$$\propto = -\frac{\sum_i \left(\ln(r)_i - \overline{\ln(r)}\right)\left(\ln(p)_i - \overline{\ln(p)}\right)}{\sum_i \left(\ln(r)_i - \overline{\ln(r)}\right)^2} \quad [3]$$

Regarding the dependent variables, data on armed conflicts came from UCDP/PRIO Armed Conflict Dataset (ACD) v.4-2012 (Gleditsch e.a. 2002) which defines a conflict as "*a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths*" (Themnér 2012: 1). Apart from being a reliable and widespread dataset in the field on conflict studies, its value resides in its incompatibility variable which allows to easily distinguishing conflicts over territory from those over government. For each country-year record, a categorical variable was built with four possible values indicating the absence of internal conflict and the presence of territorial, governmental or both types of conflict. Data on governance was provided by the Polity IV project (Gurr, Jaggers & Moor 1989). For each country-year observation between 1800 and 2010, this dataset contains the POLITY2 index of democracy ranging from -10 (institutionalized autocracy) to 10 for a full democracy (Marshall, Jaggers & Gurr 2011: 14). According to the authors, this ordinal variable can be converted into a three-level categorical indicator: autocracies (-10 to -6), anocracies (-5 to 5) and democracies (6 to 10) (Marshall & Cole 2011: 8-10). Acknowledging that pure democracy and autocracy constitute two clearly opposed ideal-types, they define anocracy as "*a middling category rather than a distinct form of governance* […] *governments are neither fully democratic nor fully autocratic but, rather, combine an, often, incoherent mix of democratic and autocratic traits and practices*" (Marshall & Cole 2011: 9).

Results

Table 1summarizes descriptive statistics for the three data series. It shows that 21% of the country-year observations experienced at least one civil war in 1990, 1995 or 2000. Territory is the issue at stake in about two third of the total number of intrastate conflicts. This result is partly due to the rebellions in India which account for 18 out of 56 territorial conflicts. Regarding data on governance, for the three years considered in this study, democracy represents the most common pattern of political regime, accounting for 59% of the observations, while autocracies and anocracies share almost equally the remaining records. However, great differences exist between the three years considered. From 1990 to 2000, the number of autocratic regimes has been divided by 2.75 while the amount of democracies increased by 1.32. The transitional nature of anocracies is clearly visible, as their number doubled between 1990 and 1995 then remained stable until 2000. While some new countries appeared during this period, there has been a transition from autocratic toward more democratic regimes in the meantime, the transitional form of governance being characterized as anocracy. The general pattern of regime change is a move toward a decline in the number or autocratic regimes. Only one fifth of them immediately became a democracy, the remainder experienced a transitional period of anocracy.

Data on conflicts			Data on governance		
Type	N	%	Regime	N	%
None	211	79	Democracy	142	59
Territorial	24	9	Anocracy	55	23
Governmental	24	9	Autocracy	43	18
Both	8	3	Total	240	100
Total	267	100			

Table 1 - Descriptive statistics on conflict and governance data

Table 2 presents some descriptive statistics for the index of urban hierarchy. The mean value of α in the dataset is 0.94, which implies that most of the countries display an urban system less hierarchical than predicted by Zipf's law, as a z-test confirms this value is significantly different from 1. This result is consistent with Rosen and Resnick (1980: 166) who also found a more even distribution of cities than implied by the Zipfian model. Overall, no less than 64% of the observations have a Pareto exponent smaller than 1.

Cities threshold	20	40	50	100
N	402	312	267	186
Mean	1.00	0.97	0.94	0.92
Std. dev.	0.24	0.20	0.19	0.18
Variance	0.06	0.04	0.04	0.03
Median	0.99	0.95	0.91	0.89
Minimum	0.37	0.53	0.57	0.66
Maximum	2.07	1.56	1.50	1.59

Table 2 - Descriptive statistics about urban hierarchy (values of the Pareto exponent)

To test the hypotheses, Student's t-tests were used to compare the distributions of the Pareto exponent sorted by type of political regime. In practice, the sample is divided into subsets corresponding to the three different modes of governance. T-tests compare the mean value of the Pareto exponent for each possible pair of regimes. The results presented in Table 3 show that the largest difference exists between autocracies and anocracies. The level of urban hierarchy in countries under autocratic rule ($\alpha = 0.99$) is significantly higher than in

anocracies (α = 0.91). Comparing democracies to autocracies, there still is a difference, but this result is less significant since the associated p-value is 10%. In this case, countries under democratic rule tend to have a more even urban tissue (α = 0.94) than autocracies. In neither case it was possible to significantly differentiate between democracies and anocracies. This can be explained by the fact that democracies greatly outnumber the two other forms of governance and thus encompass many different urban patterns. These results still remain consistent with Ades & Glaeser's (1995) conclusion that countries under authoritarian regimes tend to have their population concentrated in a small number of cities. Hypothesis *H1a* is thus validated while hypothesis *H1* is only partially verified.

	Mean Pareto exponent value (std. dev.)			
Cities threshold	20	40	50	100
N	359	282	240	179
Democracy	0.97 (0.19)	0.97 (0.20)	0.94 (0.19)	0.92 (0.20)
Anocracy	1.02 (0.26)	0.95 (0.21)	0.92 (0.19)	0.89 (0.13)
Autocracy	1.03 (0.22)	1.02 (0.15)	1.00 (0.14)	0.92 (0.11)
	Bilateral t-test p-values			
Autocracy – Anocracy	0.79	0.06	0.04	0.49
Democracy – Anocracy	0.06	0.57	0.42	0.45
Democracy - Autocracy	0.07	0.10	0.10	0.85

Table 3 - Results of Student's t-tests applied to assess the differences in levels of urban hierarchy between three patterns of governance

The same method was used to verify the hypotheses related to the type of civil war. This time, the tests compared the means of the Pareto exponent for four subsets indicating an absence of conflict or the occurrence of territorial, governmental or both forms of internal armed conflict. Regarding the level of urban hierarchy, t-tests summarized in Table 4 show a significant difference between the two types of civil wars under scrutiny. The value of the Pareto exponent in countries that experienced territorial conflicts (α = 0.91) during the three years considered appears lower than in countries affected by governmental conflicts (α = 1.03). Moreover, for states that endured the two forms of civil war simultaneously, the difference is even bigger in the direction of a very even urban hierarchy (α = 0.77). These results suggest a strong support to hypotheses *H2* and *H2a*. Conflicts over territory are more likely in countries where the urban system is characterized by important secondary cities. Civil wars over government tend to occur in states where the urban structure is dominated by a prime city which is also the capital in 149 out of 187 countries.

	Mean Pareto exponent value (std. dev.)			
Cities threshold	20	40	50	100
N	402	312	267	186
None	1.00 (0.24)	0.97 (0.20)	0.94 (0.19)	0.92 (0.19)
TER	1.02 (0.25)	0.93 (0.12)	0.92 (0.11)	0.89 (0.09)
GOV	1.08 (0.24)	1.01 (0.18)	1.03 (0.21)	0.95 (0.16)
TERGOV	0.84 (0.17)	0.78 (0.12)	0.78 (0.11)	0.77 (0.09)
	Bilateral t-test p-values			
TER – None	0.62	0.30	0.55	0.54
GOV – None	0.04	0.28	0.03	0.64
GOV - TER	0.28	0.12	0.04	0.43
TERGOV – None	0.05	0.01	0.01	0.04
TERGOV – TER	0.05	0.06	0.06	0.16
TERGOV – GOV	0.01	0.003	0.001	0.05

Table 4 - Results of Student's t-tests applied to assess the differences in levels of urban hierarchy between four modalities of civil war (None: no conflict recorded in 1990, 1995 or 2000; TER: at least one territorial conflict; GOV: at least one conflict over government; TERGOV: at least one territorial and one governmental conflict

In light of these elements, the following model can link urban hierarchy to the risk of civil conflict based on the effect of democratic transition. Let us consider a country under autocratic rule. In such a situation, power concentration and rent redistribution fostered the polarization of urban population in a few dominant agglomerations. At a given moment, because of external pressure or increasing lack of legitimacy, the regime starts a transition toward a more inclusive type of governance. However, "*autocratic countries do not become mature consolidated democracies overnight. They usually go through a rocky transition in which mass politics mixes with authoritarian elite politics in a volatile way*" (Hegre e.a. 2001: 34). A lower level of repression combined with increased opportunities for political participation can indeed incite some actors to seize power by force in order to take advantage from this period of uncertainty. At this stage, because the urban pattern has not had enough time to be modified by the regime change, the urban system is still dominated by a few cities. Therefore, for potential rebels, capturing political influence means taking control of them and thus overthrowing the government. As time goes by and democratic transition continues, the capital city tends to lose some of its privileges. Increased political openness means wider redistribution across the country and the demographic and economic growth of the capital moves to secondary cities under the action of decentralized political entrepreneurs. The statistical results indeed suggest, though with caution due to poor data, that democratization is characterized by a reduction of urban hierarchy. In the last stage of democratic transition, the country has thus become more democratic with a less hierarchical urban system. Potential insurgents gradually lost the legitimacy to impose constitutional changes by force (Buhaug 2006: 702) and thus resort to territorial claims which are enabled by secondary cities large enough to provide support to their organizations.

This model shows that these results are consistent with findings from Ades and Glaeser (1995), Soo (2005) and Buhaug (2006; 2010). It also shows how political transition from autocracy toward democracy generates different patterns of urban hierarchy which, in turn, can contribute to foster one type of insurgency upon another. Notwithstanding the importance of social, ethnic or economic factors on the risk of civil war, this paper was concerned with the specific issue of urban hierarchy. In this regard the answer to the initial question is that conflict research should not rely exclusively on capital-centered frameworks and investigate more closely the role of secondary cities in civil wars, especially in the case of secessionist conflicts.

Beyond the border: the external influence variable

After expanding the analysis to other cities than the country's capital, the next step is to assess the impact of foreign border settlements on the risk of civil war. These cities are the ones located close to the border of a state and that can increase the probability of intrastate armed conflict in this state because their influence is higher on their neighbor's territory than the one exerted by the central government. The notion of influence is understood here as the result of the attractiveness of a location. The more attractive a place, the higher the probability that people will interact with attributes of this location. As a corollary, it is possible to delineate the area of influence of a place, which is the territory over which the influence of this particular location is higher than the influence of any other place. The idea of an influence

of foreign border cities over internal conflicts is inspired by the peripheral nature of many civil wars and by the amenities offered by situations where the territory of a country is under foreign influence. Civil wars can erupt in such areas according to two mechanisms, one in the long run, to incite groups to rebel, and the other on the short term, to sustain the rebellion.

In the long run, a peripheral area bordered by an influential foreign city can appear closer to this city than to any other location in its own country. In such situations, economic ties and social networks are likely to overweight the links with the rest of the country. This can be fostered by an asymmetric accessibility of a territory, such as Kashmir which is easier to reach by road from Pakistan than from India (Racine J.-L. 2002: 29). In peripheral areas where transnational trade is essential for the region's economic sustainability, local interests can be endangered by central concerns related to the control of the cross-border trade, the fight against smuggling and more broadly the government's will to express its sovereignty by a tight hold on its boundaries. According to the "*greed*" motivation of civil wars advocated by Collier & Hoeffler (2004), boundaries with high levels of –potentially illegal– cross-border trade can incite actors to take arms in order to control this valuable resource, as is the case in the Kachin and Shan-controlled areas in northern and eastern Myanmar (Brown 1999; Grundy-Warr & Wong Siew Yin 2002; Dean 2005). Intensive cross-border trade can be the result of long-established transnational social ties. Ethnic communities spanning across boundaries can produce strong network of solidarity that can evolve into irredentist demands. Several recent conflicts display this pattern: Kachin autonomists in northern Myanmar (Dean 2005), Kurdish rebellion in eastern Turkey (Giraldi 2008), Muslims in Kashmir (Racine 2005; Tremblay 2009) as well as Tuaregs in the Sahara (Klute 1995; Storholt 2001). In these particular situations, populations from one side of the border can compare themselves to the other side as the intensity of the contacts offers them the experience of another form of governance. People in this situation can be prone to criticize the politics of their government and ask for autonomy, as is the case in northeastern India and eastern Turkey where governmental policies are often qualified as a form of colonial rule (Mentschel 2007: 3-4; Baruah 2009: 963; Vadlamannati 2011: 608; Mutlu 2001: 101).

In the short run, a high foreign influence provides tactic advantages to rebels in their struggle against their government. For the country that exerts this influence, it can be the sign that it lacks strategic depth. Therefore, as it is allegedly the case of Pakistan in Kashmir (Byman e.a. 2001: 9-40), this state can sustain rebel movements on the other side of the border in order to create a glacis. Refugees as well have long been considered as key factors in the diffusion and protraction of civil wars (Barber 1997; Byman e.a. 2001; Salehyan & Gleditsch 2006; Salehyan 2007; Salehyan 2008). When a conflict erupts close to an international boundary, civilians will seek asylum in the neighboring state. However, if the host country has several well-equipped cities in this area, refugees are more likely to set up there and the closer refugee camps are to the border, the higher the probability they will serve are rear bases for rebel fighters. Afghan refugees in northwestern Pakistan during the Soviet war in Afghanistan (Byman e.a. 2001: 62-65), Polisario Front-controlled refugee camps near Tindouf in Algeria (Boukhars 2013) or Hutu-controlled camps in eastern Democratic Republic of the Congo (Byman e.a. 2001: 66-67) are good examples of how refugee camps

settled close to the border of the country where the conflict has occurred can fuel war and lead to protracted or international conflicts. Finally, being under foreign influence sometimes offers the rebels easy access to recruits or supplies from the other side of the border. They can also hide, rest, and regroup in the foreign bordering cities.

In order to investigate the impact of foreign influence on the risk of civil war within a country, three hypotheses will be tested.

H3: internal armed conflicts are more likely in areas under foreign influence

H4: the higher the foreign influence over a territory, the higher the risk of internal armed conflict in this territory

H5: the lower the domestic influence, the higher the risk of internal armed conflict over territory

Model

The verification of these hypotheses was carried on with a gravity-based model. Very common in geography, it is a model of spatial allocation that assigns an area around each location considered. It consists in an analogy with the Newtonian theory of gravitation, where the influence of a mass is inversely proportional to the squared distance to this object. It can be regarded as a planar interpolation on the basis of points distributed across space. This model is popular in geography since the work of Von Thünen (1826/1910) because of its ability to reflect the area under the influence of a point location. Like the rank-size rule previously described, gravity-based models have long been studied by economic geographers. As a consequence, this model is built on solid logical and mathematical grounds.

In this paper, the point locations are cities and the influence of cities is measured as a function of their population in 1990, 1995, and 2000, using Ciesin's data. The choice of population as a measure of potential influence is motivated by two main reasons. On the one hand, since influence is understood as the capacity of a city to attract people and economic activity, population estimates appear less affected by complex variables such as gross domestic product per capita or individual income which are hard to compare at a global scale and are very sensitive to local political settings. On the other hand, there is no comprehensive dataset measuring the individual economic activity of cities around the globe. The dependent variable is the presence of internal armed conflict in the three given years. Again, data on civil wars was taken from ACD. The geographic extent of these conflicts was provided by PRIO-Grid and PRIO conflict sites datasets (Hallberg 2012; Tollefsen A.F., Strand H. & Buhaug H, 2012).

The surface of the Earth was divided into 6,480,000 square cells with sides of 0.1°. To fasten the analyses, this number was reduced to 1,505,453 cells by removing those located in the oceans. Because the analyses where performed on three years, the final dataset contains 4,516,359 records. The country to which each cell belonged in the given year was noted according to Weidemann, Kuse and Gleditsch's CShapes dataset (2010). For each cell-year observation, binary variables noticed the presence of a territorial or governmental civil war

(during the actual and the following years to avoid endogenous results). Influence from cities was measured on the basis of equation [4], where $I_{i,j}$ is the influence of city *i* in location *j*, P_i is the population of *I*, and $d_{i,j}$ is the distance between *i* and *j*. The value of the exponent *e* was calibrated using cross-country migration data from the World Bank (Ozden e.a. 2011) in 1990 (1.372) and 2000 (1.367) and the exponent for 1995 (1.370) was interpolated using these two values. To avoid scale biases, the analysis was run using three sets of cities with different population thresholds: 10,000, 50,000 and 100,000. Using custom C++ software, the most influent cities and the value of this influence was computed for each cell in the dataset. It was therefore possible to locate the cells under the influence of a city belonging to another state, and thus mapping areas under foreign influence.

$$I_{i,j} = \frac{P_i}{d_{i,j}^e} \text{ [4]}$$

Results

The results obtained tend to reject hypothesis 3: internal armed conflicts are not more likely in areas under foreign influence taken as a whole. While the likelihood of such events is 2.6% under foreign influence, this figure increases to 6.8% in sectors under domestic influence. Even when distinguished between governmental and territorial conflicts, conflicts remain more likely in domestic-influenced areas. The rejection of this hypothesis, regardless of the type of conflict, is not surprising. By construction from the gravity-based model, many areas under foreign influence are located in sparsely populated regions: Sahara, northern Canada or eastern Russia. Therefore, even if it appears as a foreign-influenced area, the value of this influence can be negligible. Not only deserts are rarely worth fighting for, they do not possess the demographic critical mass for a rebel movement to mobilize and recruit troops or to hide within the population. It is therefore necessary to take into account the actual weight of the foreign influence.

Figure 2 shows this value for cells under foreign influence discretized by centiles. It shows that the probability of a territorial civil conflict is close to zero for the 40 first centiles, 25th centile in the case of governmental conflicts. After, the higher the centile, the higher the probability of internal conflict, even though significant fluctuations are noticeable in the case of governmental conflicts. Hypothesis 4 is therefore accepted. Regarding hypothesis 5, Figure 2 also displays a quasi-null probability of territorial conflicts under domestic influence until the 30th centile. Then, this probability increases to around 2% before diminishing very slowly and reaching values under 2% in the 92nd centile. Because of the concave shape of the curb, hypothesis 5 is accepted though with reserve. It can be noted that conflicts over government show are always more likely than those over territory across centiles. In addition, their probability increases between the 10th and 90th centiles, moving from around 5% to around 7%.

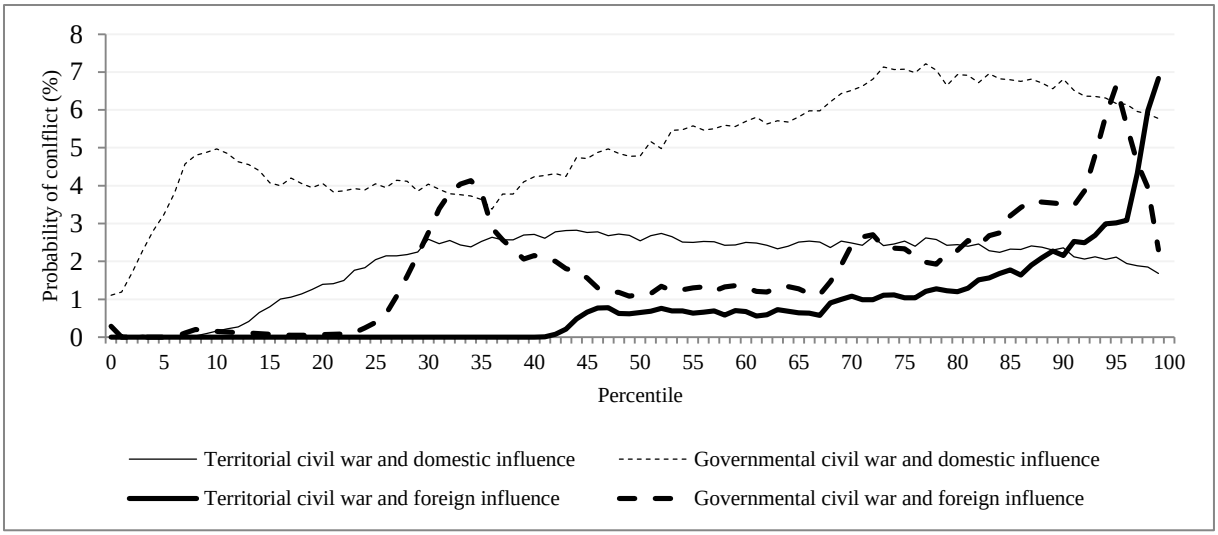

Figure 2 - Probability of civil conflict by type and by percentile for domestic and foreign influence

When the probability of both types conflicts are compared to the same values of foreign and domestic influence, another pattern emerges (Figure 3). For cells under foreign influence, the probability of territorial conflict quickly reaches 8%, then diminishes irregularly but is always above 5%. Governmental conflicts also reach fast the value of 6%, but quickly decrease to maintain themselves below 2%. In the case of cells under domestic influence, both types of conflicts rapidly reach their maximal probability and keep the same value for a long time (6 to 7% for governmental conflicts; 2 to 3% for territorial conflicts). Comparing cells under foreign and domestic influence provides the most striking results. Indeed, for a given value of influence, governmental conflicts are almost three times more likely in areas under domestic influence than in areas under foreign influence. For territorial conflicts, it is the exact opposite: territories under foreign influence are three times more likely to experience this type of conflict than territories under domestic influence. Cross-checks ensured that these results are not scale-dependent and are conserved when conflict records are lagged one year.

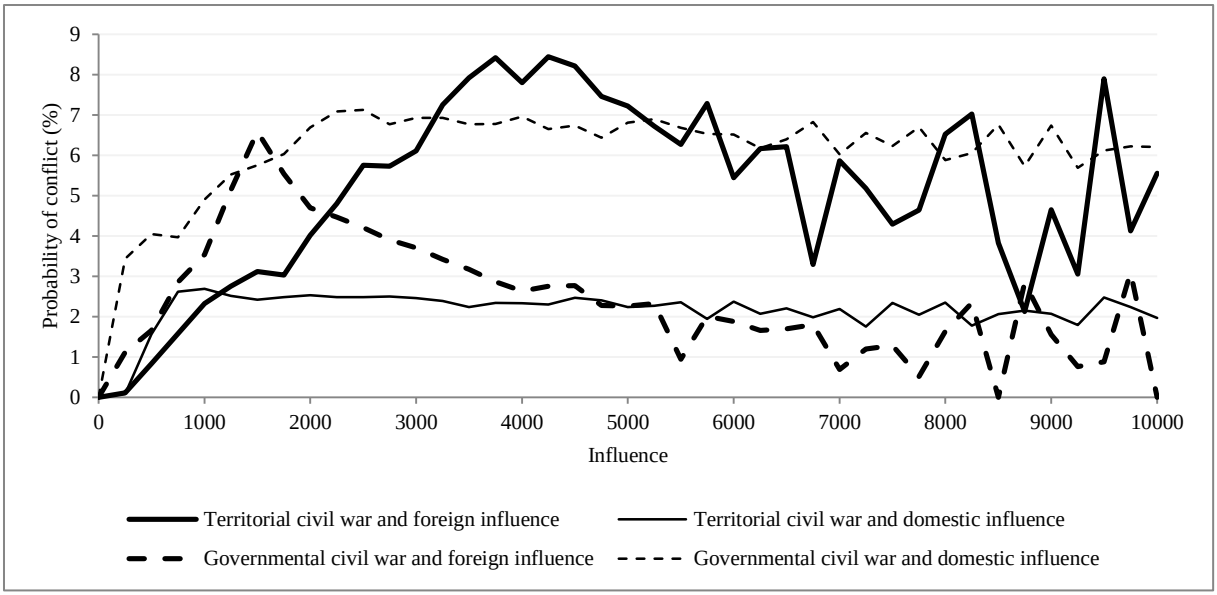

Figure 3 - Probability of civil conflict by type and by level of foreign or domestic influence

The results based on the gravity-based model bring three main conclusions. First, areas subject to low influence –either foreign or domestic– appear very unlikely to experience civil conflict. This can be explained by the lack of opportunities and capacities offered by such territories. By construction, low influence means large distances to significant settlements. Therefore, these relative deserts often lack economic resources that could represent an issue worth fighting for or help potential rebels sustain their combat against the government. In addition, sparsely populated areas may have relatively less political demands than more populous regions. Anyway, they can hardly reach a critical mass necessary to express and defend these demands before the central power. In the unlikely situation where a rebel organization was to emanate from this kind of area, this movement is very likely to quickly lack manpower and supplies. In the Sahara, the recurring Tuareg uprisings have often come to an end due to the exhaustion of the rebels' resources necessary to wage war against their governments (Storholt 2001: 335).

The second finding reveals that conflicts over government do not display a peripheral pattern. These conflicts have been found to be less likely in areas under foreign influence which are principally located close to the border. Instead, they mainly occur in territories under domestic influence and the higher the influence, the more likely they are. This is consistent with Buhaug & Gates (2002) that showed that governmental conflicts are urban events that occur close to the capital. However, one exception has been revealed in this analysis: in territories under low foreign influence the likelihood of armed conflict is surprisingly higher than in the rest of the distribution, even compared to zones under domestic influence. This observation does not appear to result from a bias as it refers to several conflicts around the world: southern Peru, northern Chad, eastern Angola and northeast Somalia. Looking back to Mao's conception of revolutionary warfare (Mao Zedong 1937-38/1955; McCuen 1966: 40-49), rebels aimed at toppling the government should alternate two phases in their combat. At the beginning of the insurgency, when the movement is still fragile, it should adopt a posture of strategic defense, taking advantage of remote and inaccessible

territories. When the rebellion becomes stronger and able to fight the regime's regular army, it should switch toward strategic offensive. While the first stage is characterized by irregular, low-intensity defensive warfare, the second step is a conventional war aimed at annihilating the central government military forces. In this context, the presence of governmental conflicts in areas under low influence can be linked to the first stage of Mao's model of revolutionary war. These territories could correspond to rear bases where insurgents regroup, train and reinforce before launching their struggle against the most important population centers and the capital.

The third and probably most striking finding is related to the confirmation of the peripheral nature of territorial civil wars. The fact that this kind of conflict is strongly influenced by the level of foreign influence reveals the importance of taking into account external factors to the study of this particular type of internal conflict such as the support from a neighboring state to locally destabilize the government, ethnic irredentism or the control of a lucrative cross-border trade.

In line with the conclusion of the first section based on the rank-size rule, this analysis conducted with the gravity-based model supports the idea of a double temporal dynamic that can lead to civil war. On the long run, a country's urban hierarchy and the geography of its periphery offer to potential rebels the opportunity to develop and express their political demands. In the short run, these features exert a strong impact on the conduct of an armed uprising. Finally, these two models borrowed from geography have proved useful to expand and refine Boulding's political-military model of power projection. Overall, they show that any measure of accessibility of a conflict-ridden territory within a country should be related not only to the capital, but also to the secondary cities inside and beyond the boundaries of the state.

Conclusion

The purpose of this paper was to demonstrate the benefits of a model-based interdisciplinary approach to IR, especially in the domain of security studies. This research made an intensive use of two very well-known spatial models in the field of geography. They proved useful and able to combine with sound theoretical constructions elaborated by political scientists and strategists. Models are very common in natural sciences, especially in geography. Because of the tremendous amount of variables they have to take into account, geographers rely on such theoretical constructions to abstract reality and grasp its main dynamics. This approach is very similar to social sciences, including IR, where dealing with human beings always comes with a number of contingencies related to the quasi-stochastic behavior of individuals. In this context, IR scholars should feel freer to borrow models from others disciplines.

As a theoretical tool, models offer at least four advantages. First, as previously stated, they abstract and simplify and otherwise complex reality. Civil wars are complex phenomena. Countless variables should be taken into account in order to fully understand them: history, politics, economy, geography, culture, climate, etc. Models focus on the main trends in these variable and offer probabilistic answers to complex issues. Second, when models are

extracted from other disciplines, them come with ancient solid logical and mathematical bases. The inception of the rank-size rule dates back to 1913. The Pareto distribution on which it relies was formulated more than a century ago (Pareto 1896) and has been subject to countless studies by mathematicians, economists and geographers. The gravity-based model, as its name suggests, can be traced back up to Newton's law of mutual attraction around 1666. Scholars in social sciences have fruitfully applied this reasoning to their fields for decades (Taylor 1975: 9). Third, when extracted from other disciplines, models can foster analogy-based reasoning. Indeed, using the gravity equation as a distance decay function to measure a city's is considerably easier to grasp when understood as a field of potential attraction. Finally, as fundamentally quantitative objects, models allow quantification, diagnostic and prediction with reference to an ideal-type.

On the other hand, they are not free from drawbacks: over-simplification, impossibility to adapt from one discipline to another (fundamentally, there is no natural reason why the distance-decay exponent of the gravity law should always be square), limited extension of the analogies or the risk of ignoring variables that were not taken into account in the original model. Inherent to any theoretical framework, these shortcomings appear particularly serious in the case of models imported from other disciplines.

Studying the spatial determinants of civil wars from an accessibility-based perspective opens a wide array of opportunities to create interdisciplinary dynamics. A natural extension of the research presented here is to take into account the location, characteristics and topology of road networks. This next step will greatly benefit from advances in the domains of graph theory, social network analysis and geography. These efforts can prove useful in the perspective of conflict resolution since making a territory more accessible can prove as efficient and yet less politically-sensitive than drawing a new border.

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