The Dynamics of Violence in the Bosnian War: A Local- level Quantitative Analysis

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1. Introduction.

The literature on civil wars has been rapidly expanding in recent years, becoming one of the major themes in contemporary political science and escaping the same boundaries of that discipline to occupy a central place in the social sciences. While sociology traditionally dedicates large space to various forms of social conflict, judging from the presence of the theme in economic journals, economists' interest in the subject of civil wars is rather new (or, better, renewed, as classical political economy held social conflict as a key subject of study), and has already increased exponentially. While this broadening of perspectives has certainly led to a rich – and constantly enriching – body of literature, it is difficult to find certainties and shared conclusions. This is also due to a plurality of approaches in the study of civil wars that gave rise to a large methodological debate and to a further proliferation of studies.

This paper emerges in such a context, and follows two guidelines. First, it tries to address one specific subject within the broad label of "civil war", the factors underlying the severity of violence in a specific civil war- the one occurred in Bosnia and Herzegovina between 1992 and 1995**.** It is an aspect of the war which has been less commonly studied and is still widely held to be one of the more fruitful in advancing knowledge on the broader theme. Second, in order to deal with the mentioned complexity, it tries "to keep it simple": rather than working on totally new, perhaps marginal, hypotheses, it deals with (at least some of) the major hypotheses laid out in the literature, and controls their validity in the Bosnian context. The element of novelty thus resides in the possibility of analysing the impact of "traditional" variables at the local level of within-country analysis, with all the advantages that this entails in terms of reduced heterogeneity and possibility of checking the context.

The paper proceeds as follows. The first section briefly sums up the empirical literature on civil wars. Without the aim of presenting a comprehensive review, the section summarizes the major sub-themes, approaches, and findings in the study of civil wars, thus providing a starting point and a framework for the present research. The second section is larger and includes the presentation of the hypotheses considered here and the analysis of the data. The analysis is divided in two parts. The first is a more static analysis that links a series of contextual variable to the severity of violence in the Bosnian civil war as a whole (1992-1995). The second part takes time into consideration, and looks at how the main explanatory variables change their salience through time. Such a strategy allows us to at least partially factor the course of the war into the study. This is accomplished through the use of panel

analysis, including all the years of the conflict and cross-sectional regressions realized on each single year of war. Our analysis shows how the ethnic composition of the population, dismissed by recent studies as a major cause for the onset of civil war, is instead extremely important when we deal with the determinants of the severity of violence. As far as the temporal dimension is concerned, it highlights that in the Bosnian civil war violence was not only marked by a significant spatial heterogeneity, but also by a remarkable variation through time. As time passes, the most important variables exert different effects and the severity of violence changes.

2.   *Violence and civil wars.*

Few subjects have received more attention in recent years than large-scale political violence and intra-state conflicts. It has been noted that these forms of conflict have replaced analyses of nuclear deterrence and conventional balance as the core subject of the studies on war after the end of the Cold War (Lacina 2004). Political realities, i.e. the changes in the international system, as well as specific American foreign policy decisions, contributed directly to this renewed and intense interest (internal strife is a classic theme of both political theory and political science). According to popular views, the end of the bipolar system has been – or should have been – followed by a new wave of internal conflicts (Kaplan 1994). While this view has been challenged in terms of empirical accuracy (Fearon and Laitin 2003), it assumed a prominent position in official documents on foreign and military policies. One only needs a glance at the American National Security Strategy of 2002 or at the European Security Strategy of 2003 to notice how intra-state conflict is perceived as one of the defining features of the new international system. Current US commitments in Afghanistan and Iraq have strengthened both public and academic interest in understanding origins and dynamics of civil wars.

The body of political science literature that emerged has focused extensively on the diverse "phases" of civil wars. Four somewhat separate themes can be identified: origins of civil wars; dynamics of violence in civil wars; conflict management/resolution, with frequent reference to the possibilities of external intervention; and the peace-building and reconstruction phase that follows the conflict. While the second theme is the specific object of this paper, the debate on the origins of war (arguably, the most developed field both from a theoretical and empirical standpoint) is also a rich source of insights and specific hypotheses.

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Although it is difficult to find a single valid criterion (a coherent *fundamentum division is*) to classify the studies on the origins and dynamics of civil wars, it is useful – at least for the purposes of this study – to look at three different subsets of studies based on diverse approaches in terms of levels of analysis. Macro-level studies have mostly focused on quantitative analysis of the structural variables associated with the emergence onset of civil wars. While there is no definitive consensus on which variables are more often associated with the onset of war, most scholars agree on two fundamental points. First, violence is characterized by its persistence: whatever its "causes", it tends to be strongly dependent on previous violence (specifically, the previous occurrence of civil wars explains well the beginning of a civil war). Second, income levels are negatively associated with violence. Here, though, different studies share the idea that low income *per capita* is related to a higher probability of onset of war, but not the causal mechanisms that should explain the relation. According to some, income stands for a measure of poverty, thus constituting the opportunity cost to join insurgencies (Collier *et al.* 2003, Besley and Persson 2008). For others, notably James Fearon and David Laitin (2003), income is a proxy of state capacities, particularly of the ability of the state to control the territory and of its coercive agencies to curb insurgencies before they have a chance to grow and become stronger. Along this line of thought, the structure of opportunities (the absence of strong institutions and a mountainous terrain that is ideal for the "technique" of insurgency), more than specific grievances, is at the roots of the insurgency itself.

Literature is divided on the impact of "identity" factors on civil wars. At one extreme, for instance, social constructivists argue that identity is just the creation of a conscious strategy of elites manipulating masses, thus depriving such issue of any independent impact (for a review, Brubaker 2004, Fearon and Laitin 2000). Fearon and Laitin (2003), in what is probably the most cited study on the subject, have noticed how variables such as ethnic and religious fragmentation are not associated with the onset of war, contrary to a popular belief. Others have replied that the result may also depend on an unreliable index (Posner 2004) or on underlining the fundamental difference between ethnic and non-ethnic conflicts, with ethnic fragmentation mattering only in the first category of wars (Sambanis 2001).

Meso-level studies look at organized groups, their structures, incentives, and strategies, arguing that the macro-level leaves ample space for indeterminacy and cannot grasp "mechanisms and processes" of phenomena such as violence. An example of this tendency is represented by the study of Jeremy Weinstein (2007) on how the "political economy" of rebel groups shapes their strategies: Weinstein convincingly argues that groups that are dependent

from external support or those which are able to loot resources in the territory will be more prone to exercise violence against civilians. Such a line of research, which escapes the boundaries of the analysis presented here, is deeply rooted in the tradition of studies on political development (Huntington 1968).

Analyses at the micro-level often abandoned cross-country comparisons to focus on the local context where violence occurs. This approach has followed two major paths. First, following the work of Stathis Kalyvas (2006), research has focused on the micro-foundations of violence in civil wars, looking at violence at the local level with thorough within-case analysis (Kalyvas 2008). The major contributions of these type of studies are embodied in the recognition that civil wars are a complex phenomenon and thus should be somewhat "unpacked" and studied "internally"; the choice to look at how local contexts influence the strategies of actors and outcomes in terms of violence; and the thick descriptions of the contexts in which violence occurs (De la Calle Robles 2007, Kalyvas 2006). A second path has focused more specifically on agency and on the reasons underlying of individuals' choices to join the insurgency. Even if rational choice theorists had the lion's share in this area of studies (Bates, Greif and Singh 2002), arguably the most interesting insights have come from scholars that "relaxed" rational choice's assumptions and tried to provide a more nuanced view both of individuals and of the social contexts that shape their actions (Petersen 2002).

While this paper does not address the latter set of issues, it tries to contribute to the literature by focusing on the micro-foundations of civil war violence, as well as providing specific insights on the broader issue of the impact of ethnicity. Having briefly laid out the foundations of the key debates on violence in civil war and having mentioned the major variables utilized in those studies, it is possible to specify the ones that will be used here.

3. Hypotheses.

What's missing, then? Among the several possible directions that can be undertaken in the light of the mentioned field of research, we picked one where studies have been scarce and which aims at blending analysis at the local level with a quantitative approach. The objective of this paper is to contribute to this strand of literature by analysing violence in the Bosnian War, starting with 1992 – when hostilities and sporadic conflict escalated to a full-fledged civil war- and ending in 1995 (the year of the Dayton agreements).[1] Due to the availability of new
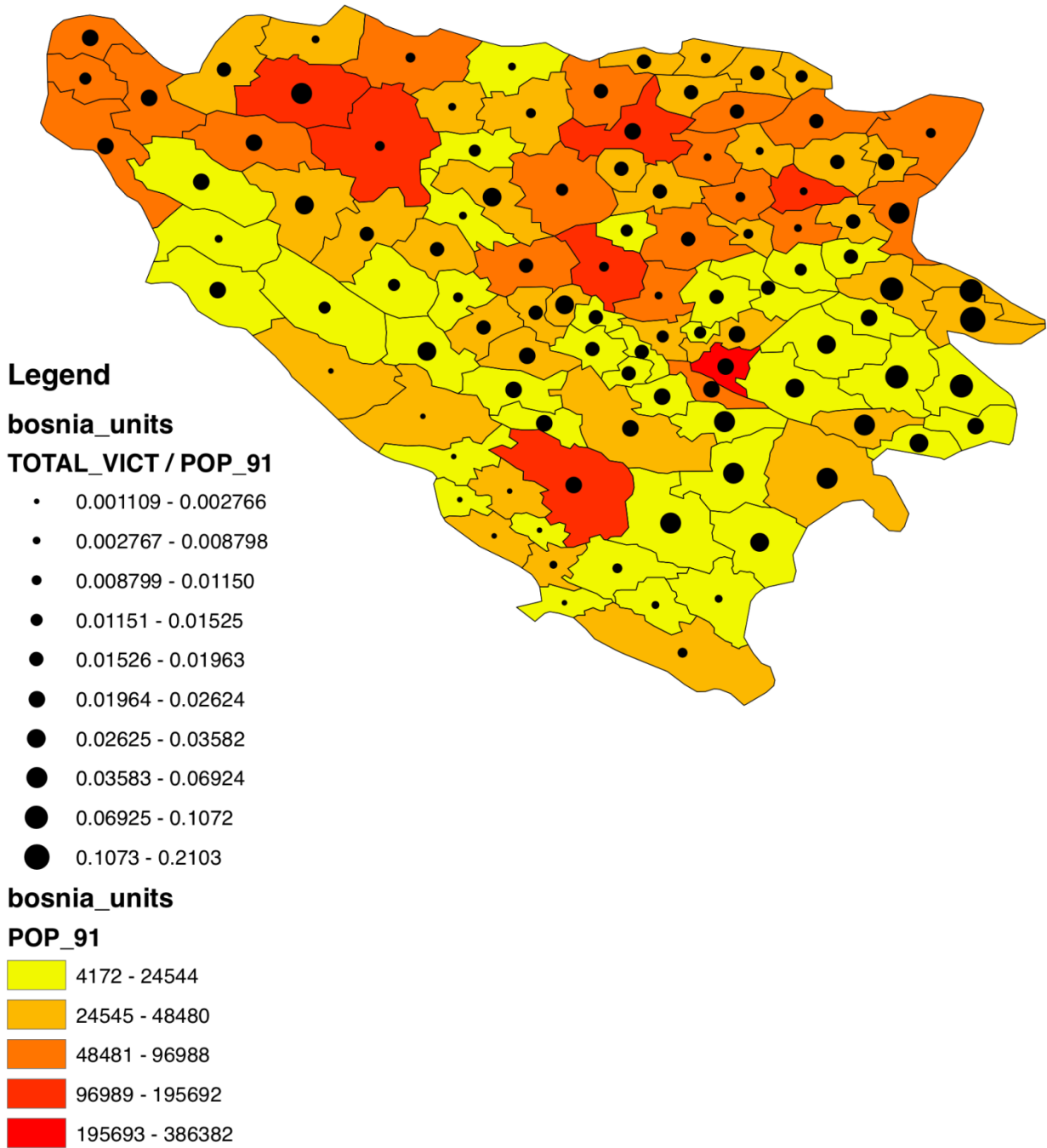
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[1] The year 1995 is entirely included in our dataset.

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data (par. 4), it has been possible to disaggregate violence both spatially at the level of municipalities (109 local institutions) and by time (the 4 years of war). Figure 1 below shows the variation of violence at the local level (the dots represent the municipalities aggregated by geographical area). It thus confirms an important finding in recent literature on civil wars regarding the extreme heterogeneity in the levels of violence registered *within* a civil war (Kalyvas 2006).

While most of the literature mentioned above focuses on the origins of war, this study explores the dynamics of the conflict and does not tackle the causes of its onset. We believe that this represents a new promising field of research to improve the understanding of violence, in line with the mentioned path-breaking studies of Kalyvas and Weinstein. The availability of new datasets that offer disaggregated data on violence (in time and space) of the Peace Research Institute in Oslo (PRIO)[2] are also an indication of the increasing interest for thoroughly researching the local context in which violence actually happens. In this paper, we first look at the severity of violence across space (in the different municipalities). Second, we analyse its variation over time. This approach allows us to more closely observe the contexts in which violence emerges and to reduce the heterogeneity of the observations typical of cross-country comparisons. In other words, this reduction in scale addresses at least some of the critiques of qualitative scholars by controlling for national differences and by going closer to the phenomena the analysis focuses on. Although this study does not directly explore mechanisms and processes, it should at least provide a good framework in which such analyses can take place.

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[2] See in particular the ACLED (Armed Conflict Location and Event Data) on the website: http://www.acleddata.com/

Legend

bosnia_units
TOTAL_VICT / POP_91

- ·   0.001109 - 0.002766
- ·   0.002767 - 0.008798
- •   0.008799 - 0.01150
- •   0.01151 - 0.01525
- •   0.01526 - 0.01963
- •   0.01964 - 0.02624
- •   0.02625 - 0.03582
- •   0.03583 - 0.06924
- •   0.06925 - 0.1072
- •   0.1073 - 0.2103

bosnia_units
POP_91

	4172 - 24544
	24545 - 48480
	48481 - 96988
	96989 - 195692
	195693 - 386382

Source: Authors' elaboration of data provided by the Sarajevo Research and Documentation Center (2008).

3.1 The ethnic dimension.[3]

One of the major problems in cross-country studies is the previously mentioned indeterminacy about the role played by ethnicity. The war in Bosnia is a good case to consider: whatever the "real cause" of the war, it is widely acknowledged that the ethnic dimension is salient (at least once the war starts). Now, if ethnic fragmentation has often been found to be irrelevant in explaining the emergence of violence, it is important to test if it is connected with the severity of violence. In the quasi-anarchic system that war creates, (one of) the logics according to which ethnic groups should behave is to try to create ethnically homogeneous areas (Posen 1993). The index of ethnic fragmentation used here is the most widely used in the relevant literature (Alesina et al. 2003). It measures the number of groups on a given territory (see also below, par. 8). Local stalemates and agreements would also be less likely, as the fragmentation makes encounters and clashes more frequent, and as strategic calculations become more difficult. In areas characterized by high fragmentation, then, there should be higher levels of violence.

Besides fragmentation, an index that has been frequently used in recent studies is that of ethnic polarization (Reynal-Querol 2002, Montalvo and Reynal-Querol 2005). This index measures the relative size of the ethnic groups in an area, which, according to a classic study of Donald Horowitz, should be a better predictor of violence than fragmentation: Violence should emerge (and in our case, *mutatis mutandis*, should be higher) in presence of two groups of similar size, that is in a situation of high polarization (Horowitz 1985).[4] This relationship between polarization and severity is also linked to the expected harshness of clashes due to the attempts of groups to establish numerical superiority (homogeneity) on the territory: other things being equal, in such circumstances, each faction has to fight against relatively strong enemies and engage in tough clashes to reach its goals.

An opposite condition to that of high polarization is one of "ethnic dominance". In this case, the population on a territory is relatively homogeneous, with a large majority belonging to the same ethnic group. This leads to a logically opposite hypotheses on the severity of violence. The level of violence should be relatively low for two major reasons. First, the large group has an established supremacy and its armed groups do not need to engage in bloody clashes to reach their objective (which has either already been reached or is easy to reach

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[3] As religious and ethnic identities overlap in Bosnia, we do not explicitly consider religious fragmentation as a separate variable here. The results of some models where we included religious indicators instead of ethnic ones did not show any relevant difference.

[4] For a formal definition of "fragmentation" and "polarization" see footnote 9, page 15.

without large scale violence). This is clearly linked to a second point: In a very Clausewitzian way, violence is the result of the interaction of the two parties' will to prevail. But the smaller group cannot reasonably expect to subvert the *status quo*, operating in a situation where the unbalance of forces would lead to suicidal and probably unsuccessful acts. Thus, the small group will have incentives for accepting the other's dominance. The assumption here, consistent with mainstream literature, is that even in conflicts characterized by primordial hatreds, the choice of groups to resort to violence cannot totally escape a somewhat rational calculation of means and ends (Kuperman 2005, for a critique, Petersen 2002). In other words, there may be grievances, but there is no opportunity (Ellingsen 2000). For these reasons, we expect that levels of violence will be lower in cases where a group is dominant.

Hp. 1: The levels of ethnic fragmentation and polarization should be positively related with the severity of violence, while in a context of "ethnic dominance" violence should be lower.

If we take time into account, the picture should somewhat change. As time passes and violence continues, two different processes are at work. First, ethnic cleansing leads to higher ethnic homogeneity and therefore the mechanisms linked to ethnicity should become less relevant as determinants of violence. Second, it is possible to assume that the diminished impact of ethnic fragmentation on violence is also partly due to the fact that the "military" dimension of the war becomes increasingly important over time (see also paragraph below). To our knowledge, there are no reliable data on population after 1991, therefore our data do not allow us to evaluate the exact extent and impact of such phenomenon. However, it should still be possible to check if available the data allow us to show this kind of change.[5] We dare to perform this analysis because of the particular type of limitation that affects our data: in fact, due to the process of ethnic cleansing that took place during the war, the level of fragmentation we use in table 2 rather clearly overestimates the real degree of fragmentation in the years after 1992. Nonetheless, this feature of our data does not work in favour of our hypothesis, but rather it makes it more difficult to show such phenomenon. Therefore, we will be able to achieve some significant results in our analysis only if the shift from violence based on ethnic divisions to violence based on non-ethnic logics has been a particularly evident trend along the years.

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[5] Although imperfect, this approach is consistent with most studies on the impact of ethnicity, that maintain the value of ethnic fragmentation constant over time (see Fearon and Laitin 2003).

Hp. 2: The impact of ethnic fragmentation/polarization on violence should decrease over time.

3.2 The spatial and geographic dimension.

The geographic context of "military" operations also affects the likelihood of both the onset and dynamics of violence (Buhaug and Gates 2002; Fearon and Laitin 2003; Gleditsch 2007). In this study, we consider two sets of variables related to terrain and geography. The first set specifically concerns the nature of the terrain- the percentage of territory dedicated to agriculture and that of urbanized territory are considered. The first variable is a proxy of "open terrain": a terrain free from dense vegetation (such as forests) and one which is not mountainous, that would therefore provide better sheltering and space for action to insurgent-style operations. The second variable, instead, measures urbanization. The presence of more densely-built urban areas on one hand should affect violence by favouring guerilla activities and on the other by increasing the risk of military activities involving civilians. Civilian involvement and death can be both the result of precise intention and the outcome of unintended "collateral damage".

The second set of geographical variables is related to the issue of internal and external borders. Even when intra-state conflicts do not fully "internationalize", a transnational dimension is nonetheless often present (Gleditsch 2007) as contiguous states exert a direct or indirect influence on the dynamics of violence. If contiguous states decide to either intervene directly in order to "protect" co-ethnics, respond to incursions (or risks of) in their own territories, or expand their influence in a situation of crisis (Posen 1993), bordering areas should consequently be marked by high levels of violence. The same should happen if external states indirectly intervene in the conflict, providing support to one faction and relying on it to reach the aforementioned goals. In one of the few quantitative studies considering this dimension, Lacina (2006) argues that civil wars characterized by external intervention are more violent than "purely" internal ones. Lacina uses as a proxy the temporal collocation of the civil war in the Cold War (civil wars in that period, she argues, were very often characterized by external intervention), but we find such operationalisation unconvincing, and in any case it does not fit into our study. Here, we use a simple dichotomous variable to indicate if the municipality is on the border of Croatia or Serbia. Following the hypotheses already present in the literature and considering the interventions operated at least by Serbia in the Bosnian war, we assume that the bordering municipalities should show a higher intensity of violence. Moreover, we take into account if the municipality under scrutiny was on

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what then became the border between the Federation of Bosnia Herzegovina and the Republika Srpska. Because of the way in which the war developed, and since the peace negotiations recognized that the "situation on the field" was meant to be respected in any possible agreement (Daalder 2000, Freedman 1994/1995), we assume that harsh clashes could have taken place in such areas, giving rise to relatively higher levels of violence.

Hp. 3: The presence of open terrain should be negatively associated with the intensity of violence, while the presence of urban areas should be associated with higher levels of violence.

Hp. 4: Municipalities on the border with Serbia and Croatia as well as those on the internal border between the Federation of Bosnia Herzegovina and the Republika Srpska should be relatively more violent.

3.3 Military presence.

In his instant-classic study, Stathis Kalyvas has argued that rational calculations drive the choice to recur to violence. He analysed the degree of control exercised by the parties (incumbents and insurgents) over a territory and its population as the key explanatory variable (Kalyvas 2006). According to Kalyvas, who studies the dynamics of violence in the Greek Civil War, most studies on these types of conflicts have overlooked their military dimension. Instead, territorial control is to be considered a major objective of the parties in conflict. Where control is solidly in the hand of a group, little violence is to be expected: It will be relatively easy for the group in control to discover enemy's forces, block their actions before they reach higher intensity, and to distinguish between combatants and civilians (a key of every counterinsurgency operation). With specific reference to Bosnia, James Ron (2001) studied the situation of the Muslim population after 1992 and noticed how attacks of Serbian militias towards them have been considerably higher in the territory of Bosnia-Herzegovina (an area of "contested" control) than towards Bosnian-Muslims living in Serbia, where the Jugoslav National Army (JNA) had full control. As it has been noticed, violence would serve the "strategic" purpose of avoiding defection rather than representing the "primordial " desire of exterminating the enemy. In areas where the military presence is balanced, calculations should lead to more prudence. On one hand, a sort of offence-defence balance might exist, on the other, the actors know that indiscriminate violent actions would alienate the population and push them towards their enemy. In this paper, following Chaim Kaufmann (1996), we

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argue that the nature of ethnic conflicts might lead to a partial revision of this argument.[6] In these types of conflicts, the possibility for civilians to "change sides" is extremely limited. Instead, if they can, civilians, try to flee or to support their co-ethnic armed groups. If the control of an ethnically homogeneous territory is the basic aim of the parties in conflict, it is rather intuitive to suppose that areas where control is "split" will be those where there will be the harshest clashes. This idea, espoused recently by Macartan Humphreys and Jeremy Weinstein (2006) with specific reference to civilian victimization in civil wars, is inspired by a famous argument of Charles Tilly (1978) who contends that the areas where contestation is higher (the lack of clear control of one actor) are the most violent ones. In a way, the logic invoked here is similar to the one mentioned with reference to polarization, although there is a shift from the "potential level" before the war to the actual situation of the forces on the field. Our hypothesis, then, is that violence will be higher in areas where military control is balanced.

Hp. 5: Areas marked by a dominant military presence violence should be less violent, while in areas with balanced military presence violence should be higher.

3.4 The role of income.

As mentioned above, in their study on the origins of civil wars, Fearon and Laitin (2003) argue that per capita income is not only an indicator of the opportunity cost of individuals to join an insurgency, but also a proxy of the capabilities of a state to control its territory administratively and militarily. In the case under scrutiny, the latter function is performed by the presence of armed groups on the territory of a municipality: in a situation of collapse of the state, the only control that matters is the one exercised by the parties of the conflict. In this study, we are thus able to separate the two different mechanisms contained in Fearon and Laitin's interpretation of per capita income and we attribute a meaning to this variable which is more strictly related to its intrinsic nature. As a matter of fact, we adapt Paul Collier's hypothesis according to which there should be a trade-off between violence and income: at high levels of income there should be fewer incentives to join the "rebels". Several recent studies have focused on the role of natural or lootable resources in civil wars (e.g. Fearon 2005, Weinstein 2007) and one main hypothesis assumes a higher level of violence in primary

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[6] Kalyvas restates his argument in a paper dedicated specifically to ethnic defection (2008). Kalyvas' argument is richer and it is not our aim to refute it in full, as our empirical references are substantially different.

goods-rich areas, but the territory of Bosnia does not provide such resources. Therefore, very briefly:

Hp. 6: Income should be negatively associated with the intensity of violence.

3.5 The "violence trap".

As mentioned above, civil wars have been erupting more frequently in countries that already had experienced a civil war. Does this imply that there is a vicious circle of violence within a civil war? Some studies support this view (e.g. Bussmann, Haer and Schneider 2009) and here we formulate a similar hypothesis taking the time dimension into account and assuming that a high level of violence in t_{-1} affects the level of violence in t_0.

Hp. 7: High levels of violence in t_{-1} should be positively related with the intensity of violence in t_0.

4. Data and methods.

In our study, the municipalities of Bosnia and Herzegovina represent the units of analysis, while our dependent variable is the severity of violence and it is expressed by the number of victims that have been recorded in each municipality. In the models of table 1, the number of victims refers to all four years of war, while in the models of tables 2, 3 and 4 the severity of violence is measured by the number of victims per year.[7] Data concerning the amount of victims derive from a recent research project that was carried out by the Research and Documentation Center of Sarajevo, for whicha recount was conducted of all of the dead and missing persons that resulted from the war. In the database , they included only the names of those for whom well-documented proof exists. For this reason, if the total number of victims recorded in the database (97207) turns out to be slightly smaller than those found in some other previous studies, it is nonetheless the product of a much more accurate work and thus, it is also more reliable. Considering that the hostilities came to an end fifteen years ago, in our study the missing persons are equated with the dead ones.[8] The data concerning population

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[7] Melander (2007) and Slack and Doyon (2001) represent similar efforts to study the local dimension of violence in Bosnia and Herzegovina, but they use very different research designs and no multivariate analysis.

[8] The data refer to the municipalities where the victims had their legal residence. The morphology of Bosnian terrain, the features of the road network and the ongoing war operations made travelling very difficult during the

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and its ethnic composition come from the archives of the Bosnian National Institute of Statistics (BNIS) and they refer to the last national survey that has been carried out in the country in 1991, just on the eve of the war. In the analyses that take into consideration the different years of the war (tables 2-3-4) the population of the municipalities in t_0 has been calculated, subtracting the number of victims occurred in t_{-1} from the population of each municipality in that year. Ethnic fragmentation is expressed by the index of fractionalisation proposed by Alesina *et al.* (2003), while ethnic polarization has been calculated according to the method used by Reynal-Querol (2002).[9] Ethnic dominance takes the form of a dummy variable which equals 1 when at least 75% of the population of a municipality belongs to a given ethnic group or when the largest group includes at least 70% of the population and the second largest one does not reach 20%. All our models also include the total population of the municipality under scrutiny, used as a control variable in order to avoid distortions in the evaluation of the effects exerted by other independent variables on the number of victims occurred in a given place. The variable that accounts for the open terrain is simply the percentage of cultivated land relative to the total surface of each municipality, while the variable that refers to urban areas is represented by the percentage of municipal soil occupied by buildings. Both these two variables and the income *per capita* derive from the statistics of the BNIS and they refer to 1991. In order to express the degree of control exerted by the various armed factions, we calculated the percentage of the combatants belonging to the armed forces of each ethnic group in every municipality (SIPRI 1993) and then we used the military presence of the fighting groups as a proxy for the control exerted by such groups on the municipalities at stake.[10] The balanced armed presence is expressed by a dummy variable which equals 1 if the difference between the most present armed faction and its largest adversary is less than 10%. We have instead defined the presence "dominant" in cases where more than 75% of the combatants on the field belong to the major group or when such group reaches at least 70% but the second largest group amounts to less than 20% of the total armed forces.

The functional form of all models is semi-logarithmic: the dependent variables and the independent continuous variables are expressed in logarithmic form, while the dummy

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war years. It is thus possible to equate the municipality of residence to the place of the death. The data we have at our disposal (Research and Documentation Centre, Sarajevo 2008) confirm this hypothesis.

[9] The fragmentation index can be expressed with the formula: FRAG = $1 - \sum s_{ij}^2$, where s stands for the percentage of the ethnic group i in the municipality j. The index of polarization is instead expressed by the formula: POLAR = $1 - \sum (0.5 - \pi_i)^2 \pi_i / 0.25$, where π_i represent the percentage of an ethnic group in a municipality.

[10] Humphreys and Weinstein (2006) use a definition of armed presence which is similar to the one used here.

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variables and the indexes that assume values between 0 and 1 are expressed in their original form. The first part of the quantitative analysis (table 1) consists of a series of cross-sectional OLS regressions where the units of analysis are embodied by the 109 municipalities of Bosnia.[11] Huber-White robust standard errors have been used to deal with eventual problems of heteroskedasticity, even though the White tests we have carried out did not show any relevant problem of the sort.

The second part of the quantitative analysis (tables 2-3) begins with another series of cross-sectional regressions, where we have tested the same models using the data pertaining to each year of war. The purpose of this strategy in different steps is coupling a static analysis of the main features that defined the context where the war took place with a study concerning the impact of time on the dynamics of violence, in order to evaluate if and how the main explanatory variables change their influence as the conflict goes on.[12] Ideally, we should use more disaggregated data on the time dimension to carefully evaluate the temporal dynamics of violence, but such data are still partially unavailable. Therefore, in this paper we investigate mainly the spatial dynamics of the conflict and we undertake a first assessment of the temporal development of the conflict, which can serve as a starting point for a more refined analysis. Since data on many variables are unavailable for the years of the war, most of our explanatory variables result to be time-invariant. If we wanted to use a time-series-cross-sectional approach, both theoretical reasons and the results of the Hausman test (to the extent that we could apply such test given the distributions of our data) would suggest to use a fixed-effect method, but so doing we would not be able to estimate the time-invariant variables, losing a remarkable part of information. For this reasons, we have decided to run several OLS cross-sectional regressions on each year of war separately and then confront the results with those stemming from time-series-cross-sectional analyses, that include all municipalities as well as all years, and have been performed with the GLS random-effect method. As in the previous set of cross-sections, the standard errors reported in table 2 have been calculated according to the Huber-White method, in order to take into account eventual problems of heteroskedasticity.

[11] Heger and Salehyan (2007) use a very similar strategy in a cross-national framework.

[12] Introducing the time dimension in our analysis makes more evident that from a theoretical point of view our dependent variable is a count variable, since basically it counts the number of victims in a municipality during a certain year. Nonetheless, at this level of time aggregation, the numbers are pretty large and the distribution of our variable does not acquire the typical features of count variables: to give a hint, we have only four zeros in more than 400 observations. On these grounds, we have decided to use OLS regressions instead of count models such as Poisson regressions. Bussmann, Haer and Schneider (2009) use a Poisson regression in a previous study of violence in Bosnia, but their data are much more disaggregated on the time dimension (day-by-day data) and include a higher percentage of zeros. The variable "victims" has mean = 208.872; std. dev. = 452.815; min. = 0; max. = 5770. Its logarithmic transformation has mean = 4.391; std. dev. = 1.433; min. = 0; max. = 8.660.

Concerning the panel analysis, instead, models 2a, 3a, 2b, 3b include the lagged dependent variable among the independent variables. Such choice is due both to theoretical and technical reasons. On the one hand, we wanted to confront the "spatial-geographic logic" (models 1a, 2a, 3a, 3b) with the "violence-loop logic" and we assume that the level of violence in t_{-1} can influence the severity of violence in t_0. This is also the reason why include the lagged dependent variable also in the cross-sections of table 2. On the other hand, the Wooldridge test for serial correlation in the panels shows that our data suffer of such problem, but modelling the time dynamics through the inclusion of the lagged dependent variable (Beck and Katz 1996) should allow us to manage it. The results of the post-estimation tests seem to confirm that such strategy is effective.[13] The robust standard errors are calculated clustering by municipality. We decided not to apply the nowadays widely used panel-corrected standard errors (Beck and Katz 1995) because the dimensions of our database, where N is much larger than T, do not fit the assumptions which are at the base of such method.

In order to study more carefully the impact of ethnic fragmentation on the severity of violence, model 3 in table 4 shows the results of a time-series-cross-section that includes the squared of the index of fragmentation. Such analysis allows us to check whether fragmentation has a non-linear effect on violence, and we find that this is the case. Finally, models 1 and 2 in table 4 split the panel analysis in two steps: in model 1 we performed a regression imposing the condition that values of the lagged dependent variable equal 0 (no previous violence), while in model 2 we imposed positive values on the lagged dependent variable, therefore selecting the observations where there was previous violence. This method is inspired by Beck *et al.* (2002) and it is meant to analyse separately the effect of the independent variables on the outbreak (model 1) and on the continuation of violence (model 2).[14]

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[13] Since we cannot use a complete fixed-effect model due to the many time-invariant variables and given that adding all dummy variables for the 109 municipalities and the four years would be inappropriate considering our number of observations, we have included the dummy variables for the years and a series of seven dummy variables corresponding to the geographic areas in which the Research and Documentation Center of Sarajevo divided Bosnia and Herzegovina to work on their project. This measure allows us to account for features of the municipalities that our model does not explicitly consider and that are common to all the towns and villages of the single area. Taking into account the relatively small dimension of the country, it could provide a fairly good step towards the logic of fixed-effects, compatible with the characteristics of our variables and the number of observations.

[14] The authors thank Andrea Ruggeri for his suggestions on this point.

TABLE.1: *SEVERITY OF VIOLENCE IN BOSNIA AND HERZEGOVINA. CROSS-SECTIONS ON THE WHOLE WAR*

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Ethnic Frag.	2.340*** (.599)			1.888*** (.532)			
Ethnic Polar.		2.493** (.379)				2.279*** (.418)	
Ethnic Dom.			-.791*** (.213)				-.580*** (.211)
Balanced Milit. Pres.					.682*** (.241)	.424** (.197)	
Dominant Milit. Pres.							-.605*** (.170)
Income *per capita*	-.001 (.000)	-.001 (.000)	-.001 (.000)	-.001 (.000)	-.001 (.000)	-.001 (.000)	-.001 (.000)
Population	.872*** (.123)	.927*** (.096)	.995*** (.109)	.897*** (.116)	1.023*** (.126)	.969*** (.092)	.886*** (.098)
Contiguity SRB				.820*** (.308)			
Contiguity CRO				-.589*** (.222)			
Urban Areas		206.373* (111.394)			-150.080 (162.729)		52.821 (120.718)
Open Terrain	-.390 (.368)		-.433 (.395)	.213 (.540)		-.522 (.373)	
Constant	-3.617*** (1.091)	-4.892*** (.932)	-3.655*** (1.063)	-3.630*** (1.020)	-4.234*** (1.210)	-5.116*** (.921)	-2.342*** (.943)
Observations	108	109	108	108	109	108	109
R^2	.585	.690	.582	.668	.505	.693	.621

Note: Huber-White robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$ *** $p < 0.01$.

TABLE.2: *SEVERITY OF VIOLENCE IN BOSNIA AND HERZEGOVINA. CROSS-SECTIONS ON DIFFERENT YEARS*

Variables	Model 1 1992	Model 2 1992	Model 1 1993	Model 2 1993	Model 1 1994	Model 2 1994	Model 1 1995	Model 2 1995
Ethnic Frag.	2.266***	2.273***	2.976***	2.560***	-.223	.433	.216	-.976
	(.773)	(.609)	(.571)	(.423)	(.898)	(.804)	(.380)	(.771)
Violence t_{-1}	-.022		.020		.405***		.686***	
	(.112)		(.081)		(.115)		(.086)	
Income *per capita*	.894	.031	-.143	-.210	-.088	-.169	-.659	-.740
	(.776)	(.511)	(.403)	(.387)	(.375)	(.404)	(.423)	(.494)
Population	.885***	.920***	.831***	.846***	.703***	1.046***	.327**	1.189***
	(.259)	(.193)	(.119)	(.116)	(.159)	(.155)	(.133)	(.164)
Contiguity SRB		1.588***		.006		-.261		.817*
		(.347)		(.266)		(.158)		(.482)
Contiguity CRO		-.377		-.817***		-.685**		-.860**
		(.294)		(.175)		(.324)		(.345)
Internal Border		.874***		-.262*		.145		.476***
		(.206)		(.151)		(.135)		(.174)
Open Terrain	.039	1.040	-1.544***	-.860*	.060	.166	.632	1.141
	(.648)	(.737)	(.474)	(.502)	(.555)	(.673)	(.390)	(.761)
Constant	-12.600*	-6.435	-4.115	-3.221	-4.298	-5.563*	3.314	-1.770
	(6.665)	(4.188)	(3.162)	(3.040)	(2.977)	(2.980)	(3.305)	(3.771)
Observ.	74	108	108	108	106	106	106	106
R^2	.457	.623	.597	.657	.573	.552	.539	.469

Note: Huber-White robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$ *** $p < 0.01$.

Variables	Model 1a	Model 2a	Model 3a	Model 1b	Model 2b	Model 3b
Ethnic Frag.				1.228*** (.449)	1.304*** (.486)	.816** (.430)
Ethnic Polar.	1.490*** (.334)	1.717*** (.414)	1.406*** (.348)			
Violence t_{-1}		.100* (.059)	.063 (.065)		.174*** (.058)	.131** (.057)
Income *per capita*	-.322 (.285)	-.218 (.286)	-.300 (.271)	-.321 (.303)	-.142 (.295)	-.173 (.274)
Population	1.049*** (.089)	.930*** (.111)	.987*** (.105)	1.019*** (.110)	.824*** (.126)	.875*** (.114)
Contiguity SRB	.326 (.232)		.308 (.228)	.502** (.232)		.225 (.240)
Contiguity CRO	-.462** (.182)		-.429** (.177)	-.617*** (.193)		-.582*** (.183)
Internal Border	.319*** (.095)		.312*** (.093)	.371*** (.104)		.269*** (.097)
Open Terrain	.329 (.457)	-.191 (.339)	.351 (.436)	.434 (.482)	-.266 (.332)	.368 (.427)
Constant	-4.075* (2.158)	-3.512 (2.202)	-3.532 (2.169)	-3.316 (2.336)	-2.465 (2.325)	-2.707 (2.042)
Observations	428	394	394	428	394	394
R^2	.583	.585	.585	.560	.553	.588

Note: Clustered robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$ *** $p < 0.01$.

5. Results and comments.

Our analysis clearly shows the salience of the ethnic dimension. Contrarily to some important studies on the origins of civil wars, ethnic fragmentation and polarisation are strictly related to the severity of violence (and the result is consistent in different models). What our data cannot definitively say is whether a substantial difference between ethnic fragmentation and polarization exists (Hp.1) - the two variables are in fact strongly correlated[15] and for this reason they are never included in the same model - but they do tell us that the presence of relatively large groups on a territory is conducive to high levels of violence. However, a more fine-grained analysis using panels (table 4, model 3) shows that the effect of fragmentation on violence is not linear: violence, in fact, tends to increase up to a point (the positive coefficient of "Ethnic Frag.") and then to decrease after a certain level of fragmentation (the negative coefficient of "Ethnic Frag.^2"). This suggests that violence could be linked to a polarized

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[15] The index of correlation is 0.859.

rather than to an extremely fragmented situation: in other words, violence develops where there is a plurality of groups, but such groups must also be rather large. Our hypothesis on ethnic dominance confirms this pattern: areas where one group is much larger than others are less prone to violence. Thus, while it is difficult to empirically confirm the salience of single specific mechanisms that lead to violence, it is instead possible to confirm the widely-held (but quantitatively never demonstrated) beliefs that the war was conducted with the precise intention of ethnic homogenization and that somewhat similar sizes of the groups tend to bring about more violence.

TABLE.4 *SEVERITY OF VIOLENCE IN BOSNIA AND HERZEGOVINA. ADDITIONAL DYNAMICS.*

Variables	Model 1	Model 2	Model 3
Ethnic Frag.			4.022**
			(1.729)
Ethnic Frag.^2			-3.853**
			(1.839)
Ethnic Polar.	2.210***	1.490***	
	(.478)	(.335)	
Violence t_{-1}			.107*
			(.058)
Income *per capita*	.0998	-.326	-.109
	(.541)	(.285)	(.269)
Population	1.021***	1.049***	.943***
	(.182)	(.089)	(.123)
Contiguity SRB	1.285***	.326	.129
	(.359)	(232)	(.243)
Contiguity CRO	-.153	-.462**	-.500***
	(.257)	(.182)	(.187)
Internal Border	.862***	.319***	.265***
	(.222)	(.095)	(.097)
Open Terrain	.877	.329	.242
	(.711)	(.457)	(.447)
Constant	-8.480**	-4.075	-4.443**
	(4.241)	(2.158)	(2.184)
Observations	28	400	394
R^2	.709	.582	.595

Note: Clustered robust standard errors in parentheses. * $p < 0.10$; ** $p < 0.05$ *** $p < 0.01$.

Accounting for time, we can observe a few notable changes in the dynamics of violence and in the determinants of severity during the development of the war. As regards the general effect of time passing on the severity of violence, we have omitted the yearly dummies from the tables for reasons of parsimony, but the results show that the relationship between time and

violence is markedly U-shaped. Violence is particularly intense in the first and in the last years of war, while in the central years, the level of violence results to be lower. Concerning the ethnic dimension, fragmentation and polarization seem to exert a remarkable impact during the first phases of the conflict, while they lose their relevance as time passes (table 2, years 1994 and 1995; table 4, models 1, 2). It is worth noting that due to data unavailability, the degrees of ethnic fragmentation and polarization in our dataset are constant in the years following 1991, a period in which it is widely acknowledged that the territory Bosnia-Herzegovina was undergoing a marked process of ethnic homogenization through killings, forced displacement and voluntary emigration. Nonetheless, such results obtained using a level of ethnic heterogeneity higher than it was "on the field" actually strengthen the idea of a shift from a logic of violence based on ethnic diversity to one in which ethnicity is less salient. With reference to spatial and geographic variables, the presence of "open terrain" or "urban areas" (Hp. 3) is generally not significant. On the contrary, the contiguity of the municipalities with neighbouring countries (Hp. 4) leads to rather interesting results and shows again how violence changes through time. Contiguity with Serbia is associated with intense violence. This is especially true at the very beginning of the war, but, to a lesser extent, it can be observed also the end of the war (table 2; table 4, models 1, 2). Contiguity with Croatia, instead, is "neutral" as regards severity of violence at the beginning of the war (table 2, year 1992; table 4, model 1), while it is consistently associated with relatively lower levels of violence after the outbreak of the conflict. This is, arguably, due the different behaviour of the two neighbouring states and especially to the less "active" conduct of Croatia, whose involvement in the following years is limited to specific areas of Bosnia (such as the area of Mostar, densely populated by Bosnian-Croats). On the whole the results of these two variables highlight the importance of the transnational dimension in civil wars and suggest further research on this issue. Even more important is the "internal border" dimension. Municipalities located on what have then become the internal boundaries between the Federation of Bosnia Herzegovina and the Republika Srpska have experienced high levels of violence (with a marked U-shaped movement: violence is very high in 1992 and 1995. See table 2). This confirms the idea that violence follows a precisely strategic pattern, and is high on contested and politically significant areas. As mentioned above, the actions of the international community during the course of the negotiations (with an inclination to recognize the situation "on the field" as a starting point for designing the new territorial arrangements) have arguably been a push towards the way violence developed (in 1995). The last observations strengthen the results of the dimension of "military presence". A balanced

military presence (Hp.5) is, in fact, significantly related to the severity of violence. In areas where one side enjoys clear military superiority, violence tends to be consistently low. Contestation *à la* Tilly seems actually to be a major catalyst for? violence.

What is also different from mainstream studies on civil wars is that income does not affect the levels of violence (Hp. 6). While this refutes a commonly-held hypothesis, it is not in contrast with the overall rationale of this study. On one hand, more broadly, it strengthens the idea that the origins *of* civil wars and the violence *in* civil wars are two distinct phenomena that thus require different types of analyses. On the other, if we consider income together with variables on the presence of groups on the territory, it is possible to better realize how income can be considered as a proxy for poverty (and not as a more indirect proxy for state capabilities). It is difficult to precisely assess if the lack of significant effects of income on violence levels is a specificity of Bosnia, of all "ethnic" conflicts, or if it applies to civil wars in general. However, a similar result is found in the cross-country analysis of Lacina (2006).

Lastly, with reference to the "violence trap" (Hp. 7): panel analysis shows how violence in t_{-1} is a good predictor of violence in t_0 in three out of the four models in which it is included. In the cross-section analysis per year, a clearer pattern emerges: violence in t_{-1} is not significant in the first two years of war, but becomes important in explaining violence in 1994 and 1995 (table 2). In the latter years, then, previous violence substitutes ethnic fragmentation as the key variable (in 1995, spatial and geographic variables share this salience) in explaining violence. Although it has often been found that the persistence of violence is a recurrent phenomenon, there is not a rich literature (at least in political science, as sociology and social psychology have given more attention to it) exploring theories and mechanisms on "why" this occurs. While it is reasonable to assume that a logic of "retaliation" (confirmed in the study of Bussmann, Haer and Schneider 2009) is at work, its dynamics and "rationale" should be a major source of study to deepen knowledge on violence in civil wars.

6. Conclusions: Between structure and "military needs".

In the very rich and burgeoning political science literature on civil wars, there are still relatively few attempts to quantitatively analyse the variation of internal violence in a country during a civil war. This study is an attempt to explore such a field by focusing on the war that ravaged Bosnia-Herzegovina in the early nineties. Whatever the "root cause" (or causes) of the war, the ethnic dimension results to be extremely relevant, at least in the first phase of the

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conflict. Here, it is reasonable to assume that "ethnic cleansing" was the major driver of violence. Adding military presence (organized along ethnic lines) to the picture strengthens this view that "contestation" is a major source of violence: areas where the groups have similar armed presence are likely to experience high levels of violence. As the war goes on, though, the logic of violence seems at least partially to change as the inclusion and the analysis of the time dimension highlights several remarkable variations in the course of the conflict. First, the severity of violence is not constant during the war and it is instead linked to time by an U-shaped relationship. Second, violence tends to be persistent, as previous violence becomes an important determinant of actual violence in 1994 and 1995, when the ethnic dimension loses much of its relevance. Third, what we might define as the "military dimension of the conflict" increases its *relative* importance: the massive external intervention of Serbia (so that the JNA could almost be considered an internal actor) and clashes over the definition of the "new" internal borders become major factors behind violence. Internal borders are actually significant as a source of violence across all the war, but they emerge as a key explanatory factor especially at the beginning and at the end of the war, showing another U-shaped relationship through time. On the whole, we can claim that the strategic and operational dimensions play a fundamental part in explaining the dynamics of violence in civil war, and that in conflicts such as the Bosnian war taking carefully into account the ethnic dimension is essential to locate different levels of violence in the space.

These latest observations open up to a few questions that should possibly lead to further research on the subject. As this study is an exploration in a relatively underdeveloped field, we think its findings (and a clear recognition of its limits) allows at least for reflections on "where to go" next. First, with reference to limits, we believe that the major one is the persistence of a certain level of indeterminacy on the mechanisms that underlie the relationships found through quantitative analysis. For sure, there are also noteworthy constraints due to the limited N, data availability, and to the statistical tools used. But while this second set of problems will be inarguably difficult to solve in studies that follow a similar approach, the first clearly calls for more thorough and theory-led case studies that look in-depth in the dynamics of internal violence of civil wars. Besides a few cases mentioned in part, this is still a pretty rare type of work, even in a case such as the Bosnian conflict that attracted so much attention (within the few exceptions, see Hoare 2004, Kalyvas e Sambanis 2005).

A second, and related question we should ask iswhat should these thorough studies focus on? There are, for sure, many possibilities. Still, what we found of particular interest is what can be labelled "the military dimension of civil wars". This clearly follows the path indicated by

Kalyvas, both in terms of approach and "content". Looking at the conflict from within would also permit a more fine-grained view of how military operations affect the severity of violence in a war, without overlooking the issues connected to the "ethnic dimension". However, including such topic within an approach which could be able to go beyond a "primordial hatred" view of violence in civil wars and focus on more traditional, but often forgotten, military considerations would be useful for understanding how armed groups act on the ground and looking at how external action (be it international peacekeeping or full-scale armed intervention) affect the patterns of "domestic" violence.

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