Transnational Dimensions of Civil War[1]

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Abstract

Most existing research has related civil war to various factors processes within individual states. Many cases of civil wars, however, appear to have a transnational character, where the risk of conflict in one state is influenced by wars in other states as well as actors and events spanning national boundaries. In this paper, I examine how interaction and processes between states influence the likelihood of conflict within states. Previous research has shown that the risk of conflict is strongly influenced by conflicts in its regional context. These models, however, do not distinguish between different aspects of regional conflict and fail to consider the potential influence of domestic attributes. In this paper, I evaluate a series of hypothesis on how transnational contagion and regional factors may influence both the risk of conflict and the prospect for maintaining peace. I evaluate these external influences in a model with various country specific factors often associated with civil wars. The empirical findings indicate that many such linkages between states and regional factors strongly influence the risk of conflict. Some of the commonly inferred effects of attributes of individual states on conflict appear to change once linkages between states are considered. The proposed model is successfully at classifying conflicts in the estimation sample, and displays good predictive ability in an out of sample forecast.

1 Introduction

Many of the contemporary conflicts in the international system involve combinations of formally recognized states and less clearcut types on non-state actors. Consider, for example, the conflict in Bosnia. This was nominally a civil war between ethnic Serbs and Croats and the central government of the newly independent Republic of Bosnia-Hercegovina. The conflict nonetheless had a clear transnational character, as the Serb and Croat units fighting in Bosnia received various kinds of support from ethnic kin in the remaining Republic of Yugoslavia as well as the Republic of Croatia. The conflict emerged over concerns among the different ethnic groups on the status of an independent Bosnia and their desires to secede or to be unified with neighboring national states. The influence of actors outside the boundaries of Bosnia itself strongly influenced outcomes on the battlefield and the relative powers of the actors.

Researchers have tended to draw a sharp distinction between conflict among states and conflict within states, and the two types of conflict have generally been studied in separation of one another. Cases such as Bosnia, however, attest to the problems involved in imposing a strict separation between "civil" wars within states and interstate wars. The international implications of such transnational conflicts highlight how research on international violence cannot ignore wars where the two main antagonists are not nation states. Similarly, studies of civil war cannot limit themselves exclusively to factors contained within individual states, but must consider how influences from other states alter the likelihood that antagonistic groups will resort to violence.

In this paper, I examine how interaction and processes between states influence the likelihood of conflict within states. Consistent with arguments about transnational contagion between states, I find that the presence of conflict in other states strongly influences the risk of civil war. I examine a number of linkages between states that have been hypothesized to increase both the risk of conflict and prospect for peace, and provide empirical support for that many of such linkages between states alter the risk of conflict. Finally, many of the commonly inferred effects of attributes of individual states appear to change once we include linkages between states in an empirical model of conflict.

2 Civil and transnational wars

The field of international relations has tended to focus almost exclusively on interstate conflict or disputes taking place among parties that are formally sovereign states. That states constitute the principal actors has been taken as somewhat of an article of faith in the field of international relations. Relations between states are sometimes held to be fundamentally different from relations within formally sovereign states due to the condition of anarchy and absence of formal authority in the international system. In this perspective, it is sometimes simply assumed that sovereignty is effective within nations, thereby making civil war qualitatively different from interstate conflict. Yet, sovereignty is obviously less than fully effective within many existing states, and similar problems of enforcement and contracting under anarchy could obtain within states as well. When relating "Warre" to anarchy, Hobbes had relations within states in mind, not the international system.

Empirically, conflict between states is in many ways a relatively limited share of the

armed conflict involving nation states in the contemporary international system. According to one account (Wallensteen and Sollenberg 1999), only six out of 103 armed conflicts in the period 1989-97 were interstate conflicts (see also Holsti 1996: 22). Many argue that the ratio of "international" to "civil" conflict has been increasing over the 20th century (Pfetsch and Rohloff 2000). Even though the reliability of such conflict proportions over time is questionable - coding biases and media exposure probably understate the amount of civil war and conflict outside the Central European state system in earlier time periods - this result still seems to run counter to what one would expect given the large increase in sovereign nations states over the period. More states should increase the opportunities for interstate wars that previously would have been considered "civil wars."

Although it is possible that internal and external conflicts are analytically distinct, it is in practice often problematic to restrict analyses to conflicts classified as interstate wars only. Upon closer scrutiny, most lists of interstate wars appear to cover only a subset of what observers typically perceive as armed conflict and war, or the phenomenon researchers seek to make some generalizations about. To actually determine whether a given conflict is "interstate" or not is often less straightforward than might be assumed.

The Correlates of War has tried to classify civil and interstate conflict as mutually exclusive categories (provides the most recent discussion of the COW war data Sarkees 2000). This distinction is in practice often difficult to apply when classifying conflicts. Some conflicts have switched categories between updates of the COW war data.[1] Similar ambiguities are found in applied research. Mansfield and Snyder's (1995) work on democratization and war, for example, repeatedly invokes conflicts in the former Soviet Union and the Balkans to illustrate their argument. However, conflicts such as Chechnya and Bosnia are not considered international wars and not included in the empirical data they rely on in their analyses. More generally, as a conflict could include many antagonists, civil and interstate wars need not be mutually exclusive. Many wars that occur fully within states have participation by "external" actors outside a state's border. The conflict in Kashmir has a transnational dimension even if the Pakistani government is not directly involved at a particular point in time. Similarly, the conflict does not cease to become a civil war if forces associated with the Pakistani government intervene directly in the conflict.

3 International dimensions of civil war

Whereas research on interstate war has tended to disregard the transnational aspects of wars between states and non-state actors, most empirical studies of civil war have focused on how economic and social attributes of individual states make states more prone to civil wars and largely neglected the role of actors outside the boundaries of the individual state. This is problematic as the risk of civil war of may be influenced by the participants and processes outside the boundaries of the nation state.

In this section, I first discuss some of the broader empirical evidence suggesting that forms of dependence and interaction between states influence the risk of conflict. In the

[1] The First Kashmir war was classified as an extra-systemic war in India in the 1994 release of the COW war data, without any Pakistani participation, but is now considered an interstate war between India and Pakistan. Nagorno-Karabakh was initaly classified as an interstate war, but has now been reclassified as a civil war in Azerbaijan.

subsequent section, I will examine in more detail some of the relevant linkages between states and how these may affect the risk of civil war.

A wealth of empirical evidence attests to the importance of diffusion for interstate wars (Siverson and Starr 1991). Spatial proximity increases the opportunity for conflictual and cooperative interactions between states as well as the willingness of leaders to engage in interactions. Most wars are fought between neighboring states. Similarly, trade tends to be high between geographically proximate states.

Whereas the importance of geographical diffusion for interstate war is well established, it has in practice received little attention in research on intrastate conflict. Recent work, however, indicates that spatial patterns of spill over and contagion appear to obtain for civil wars as well. Ward and Gleditsch (2002) examined conflict as an autologistic process, where the likelihood of conflict in one country is held to be conditional on the presence of conflict on other states. Their empirical results – based primarily on civil wars – indicated that the risk of war in an individual country is strongly influenced by the presence of wars in other countries. Whereas most models of conflict are unable to predict conflict with a probability above 0.5, the autologistic model of conflict examined in Ward and Gleditsch produced predicted probabilities above 0.5 and successfully postdicts many of the conflicts in a sample of data from 1988. Moreover, their model displayed good performance in an out of sample prediction test. A forecast based on the empirical results for 1988 yielded predicted probabilities that identified about half of the wars in the subsequent decade. Moreover, the model did not predict too many conflicts that failed to occur and missed a reasonably small number of actual conflicts.

The good predictive results for model indicate that a conditional model of conflict appears to pick up structural factors influencing the likelihood of conflict, and do not simply reflect idiosyncratic features of the sample used to estimate the model. However, the autologistic model in Ward and Gleditsch was based only on data for a single year (1988) and was almost entirely spatial. The model did not include any internal country specific covariates other than level of democracy, and essentially ignored many other domestic factors commonly thought to influence the likelihood of civil war (see the comprehensive review in Sambanis 2002). Gleditsch and Ward (2002) moreover did not try to identify what specific linkages may underlie geographical contagion of conflict between states in any detail.

Hence, even though the Ward and Gleditsch (2002) study suggests strong international influences on the likelihood of civil conflict, there is a risk that the empirical results may reflect the effects of spatially clustered country attributes that influence the likelihood of war rather than processes and interaction between countries *per se*. I have shown elsewhere that many of the economic and political country attributes which existing research has related civil war such as GDP per capita and democracy also displays geographical clustering (Gleditsch 2002*a*).

In this paper, I develop an empirical model that examines both the role of a larger number of internal country specific attributes as well as differentiates between the various international factors that may influence the risk of civil war.

4 Civil war and international linkages

In this section, I develop hypotheses on various external factors that can increase the likelihood of a state experiencing a conflict within its boundaries. Before looking at the different types of external factors, I first need to identify the relations that tie states together and where we may see such external factors exerting an influence on conflict.

The basic argument advanced in this paper is that the likelihood that a state i will be involved in a conflict at time t is very much dependent on the processes taking place in the other states. This dependence stems from interaction between states and differences in their relations. Assuming that all states are connected to one another tends, however, provides little indication of why some regions appear to be more conflict prone than others, and tends to lead to intractable empirical models.

Although a single state i may interact with all of the remaining $N - i$ states in the international system, not all of these possible relationships between states are likely to be equally relevant. Since distance is such a powerful modifier of the opportunities and feasibility of interactions, closer states can be assumed to be more relevant. We can get a handle on the most important relationships between states by assuming that most of the dependence between states is of a regional character or determined by geographically proximate actors.

One useful simple spatial dependence structure is to assume a local Markov random field. A Markov chain specifies the probability distribution of some discrete variable $y_{i,t}$ at time t as a function of the state of observation i at previous time periods and a $J \times J$ matrix of transition probabilities between the various J possible states that the variable y_i may acquire. A chain is said to be first-order Markov if the transition probabilities depend only on the state at the preceding time period $y_{i,t-1}$ and are independent of the state at previous T time periods $y_{i,t-2}, y_{i,t-2}, ..., y_{i,t-T}$ (Harary, Norman and Cartright 1965). A Markov random field can be seen as a spatial analogy to a first order Markov property in time. For a set of N spatial units, $Pr(y_i \mid y_j, j \neq i)$ depends only on x_j if and only if j is a neighbor of i (Ripley 1988). The structure of dependence or influences among units can be modeled through a matrix specification of dependence based on the geographical distance among units, where the entries $w_{i,j}$ of a $N \times N$ connectivity matrix $\mathbf{W}$ acquire non-zero entries if the units i and j are connected or geographical "neighbors" (Harary, Norman and Cartright 1965).

4.1 Intrastate conflict linkages

The likelihood of civil war is directly increased by the presence of wars in neighboring states. The consequences of conflict in one state can induce spill-over effects and alter the prospects for violent conflict in other states. There are multiple different mechanisms by which this may occur.

Many civil wars become internationalized through direct intervention from neighboring states. Third parties may intervene directly in civil wars. Gartzke and Gleditsch (2001) suggest that third parties may intervene to *bandwagon* or shorten an ongoing conflict through increasing the likelihood of victory or settlement, or to they may intervene to *balance* to promote outcomes or settlement that are relatively more favorable to one of the parties.

States may also intervene in indirect ways by providing support to one of the parties in a conflict that may escalate to violence. The presence of conflict in one state may also decrease the relative costs for insurgents in other states, as arms and sources of material support become more available at a lower price (Collier and Hoeffler 1998).

It is difficult to discriminate between the different causal linkages that may underlie cross border contagion of conflict without more disaggregated data. If such linkages apply, however, we would expect to observe a higher likelihood of conflict in state if neighboring states are involved in either civil or interstate wars.

4.2 Intrastate political linkages

Although leaders may have many incentives to intervene directly or indirectly in ongoing conflicts in neighboring states they may face potential constraints on their opportunities to do so from other institutions. Research on the democratic peace suggest that leaders in political institutions with a high degree of popular participation may face greater difficulties in intervening if involvement is opposed by other political actors (see, for example, Gleditsch 2002*a*; Tures 2001; Schultz 1998).

The political context prevailing in a region contains information both about the incentives for violent conflict in adjacent states as well as the prospects for leaders to become involved. Democracy is often defined in terms of institutions that have potential power to constrain executives. The more constrained political leaders in a region, then stronger the expected barriers against direct involvement in civil wars in neighboring states (Gleditsch 2002*a*). Accordingly, we would expect that more democratic regions surrounding a state should decrease the risk that conflicts will escalate to violence.

4.3 Intrastate ethnic linkages

Many civil wars involve ethnic groups who try to attain autonomy or secede from existing states. External intervention in conflicts are often motivated by states seeking to support members of similar ethnic groups in adjacent states. Similar, ethnic kin and diasporas in other states have often played an important role in financing insurgencies. Collier and Hoeffler (1998) demonstrate a positive relationships between the size of diasporas and the risk of civil conflict. All else equal, we would expect that the risk of civil wars would be higher in a situation where many of the same ethnic groups are found on both sides of international borders.

4.4 Intrastate economic linkages

A wealth of recent research suggest that higher economic interdependence between states decreased the likelihood of interstate war. Greater levels of interdependence between states may lead to greater costs of conflict, since conflicts would disrupt economic relations between states (Russett and Oneal 2001). Alternatively, interdependence may provide states with avenues to substitute military forms of conflict with non-military types (Gartzke, Li and Boehmer 2001).

Interdependence can similarly have a limiting effect on conflict between states. Actors in more integrated and complex economies have greater interests in maintaining peaceful

relations and face greater costs in resorting to conflict. Economic interdependence may exert a conflict dampening role even when potential rebel groups are only marginally integrated in the formal economy or distribution of labor. In a situation where levels of interdependence are high and conflict would be disruptive to many actors, these affected interest will have an incentive to lobby governments to find solutions to accommodate aggrevieved groups. Such pressure for finding settlements for non-violent conflict may occur both within states or between states.

The relevant actors that can exert influence in a particular situation are likely to be regionally confined. Although trade is not a perfect indicator of integration between states, it has the advantage that data are relatively easy to obtain. On the basis of these arguments I hypothesize that the more integration among actors in a region, the more avenues for mediation and settling conflicts in non-violent ways. In Gleditsch (2002*a*), I found that greater levels of trade integration between states in a region decreased the likelihood of civil conflict.

4.5 Central domestic factors in civil wars

To evaluate whether international influences exert some effect on the likelihood that a country will experience a civil war requires a reasonable baseline model of conflict taking into account domestic factors commonly thought to be associated with conflict.

Many researchers claim that level of development alters the prospects for civil war in an individual states (1998). Greater levels of material wealth may reduce the intensity of conflict between groups. Wealthier societies will tend to have more capable states that are better able to find political solutions to address grievances which may lead to conflict, or alternatively, have more means to effectively repress domestic dissent.

A large body of research has hypothesized that type of political system will exert an effect on the risk of civil war. Civil wars should be relatively less likely in democracies, as these provide greater opportunities for groups to pursue their objectives by peaceful means. However, the prospects for civil war are not necessarily high in strict autocracies. Despite a close political system, many autocratic states are sufficiently repressive that they can quite effectively deter political dissent. Many scholars have argued that the risk of civil war should be highest in anocracies that combine features of both autocracy and democracy. These states have a combination of sufficient grievances and opportunities that make resort to violence feasible and more attractive. The political system is sufficiently closed that groups may be unable to exert influence through other political means, yet not repressive enough successfully deter conflict. This is sometimes referred to as the inverted U-curve hypothesis.

5 Model, data, and estimation

In this section, I detail a model to test the hypotheses set forward in the previous sections, as well as the data and estimation techniques used to estimate the model.

5.1 Conflict and war data

By far the most frequently used data on civil war are the data compiled by the Correlates of War project. The Gleditsch and War (2002) paper relied on the COW war data, with updates from the conflict data compiled at the University of Uppsala (Wallensteen and Sollenberg 1999), which is available for the 1990s and late 1980s.

The Correlates of War project requires that a conflict must involve at least 1000 battle deaths in a given calender year to be counted as a civil war. This is a relatively high threshold, which may exclude many major civil conflicts. The dates for conflicts can become somewhat arbitrary, as wars with lover intensity may drop in and out the sample depending on whether they claim one thousand casualties in any given year.

A new version of the Uppsala conflict data has coded a larger set of conflicts back to 1945 (Gleditsch, Strand, Sollenberg and Wallensteen 2001). In addition to wars with at least 1000 casualties, the new data includes minor armed conflicts with more than 25 deaths in a year as well as an intermediate conflict category. For this study, I will rely on the conflict indicator in these data. The main dependent variable will be a dichotomous indicator of whether a state experiences a conflict in any given year. I will also use a dichotomous conflict indicator restricted to conflicts that reach 1000 battle deaths. The first variable will be denoted y and the latter will be indicated with the superscript y^+.

For the purposes of this paper conflict is not necessarily relevant depending on whether it is classified as intrastate or interstate. In the empirical analysis below, I will use both a composite conflict variable, including both interstate and "civil" conflicts, denoted $y_{i,t}$, as well as more restricted civil conflict variable $y_{i,t}^{cw}$ not including the observations defined as interstate by war by the Uppsala data project. Since there are relatively few intrastate conflicts, the civil wars vastly dominate in the composite variable $y_{i,t}$. It turns out to make little difference for the empirical results whether the full composite variable or the more restrictive civil war variable.

5.2 Country specific covariates

I include a measure of a states real GDP capita, measured in constant 1985 dollars, based on the Penn World Tables (PWT). Since the PWT does not contain data for many developing and socialists states, these figures have been expanded by figures based on other available sources such as the CIA world factbook (Gleditsch 2002*b*). The effect of GDP per capita of conflict is unlikely to be fully linear but matter more when states are relatively poor. I thus use the natural logarithm of real GDP per capita in 1985 prices. This variable will be denoted g^r.

The type of political system is here operationalized using the composite Polity democracy, which ranges from -10 to 10. This variable will be denoted d. Values closer to -10 indicate more autocratic polities, whereas a score closer to 10 indicates more democratic polities. Gurr and Jaggers (1995) suggest a tri-partite typology of democracies (a score of six or above on the composite scale), anocracies (between -5 and 5), and autocracies (minus six or below), which can be used to test the U-curve hypothesis.

Much of the literature on conflict has argued that ethnic heterogeneity increases the risk of war within societies. There is little concensus on what aspects of heterogeneity would matter most. Whereas some focus on fragmentation between many groups, other argues

that the likelihood of conflict is greater when a dominant majority suppresses minorities. I address the potential for conflict in ethnic heterogeneity by a variable indicating the size of the largest minority based on Vanhanen (2001). This will be denoted $e_{i,t}$.

5.3 Regional covariates

I measure regional linkages between states by a new data set indicating the minimum distances between the outer boundaries of states (Gleditsch and Ward 2001). I use a threshold of 950 km to determine whether states are connected to one another. Given the linkages between states in the connectivity matrix $\mathbf{W}$, we can define a variety of regional covariates reflecting the factors hypothesized to increase the likelihood of conflict in a given state.

The first set of factors are conflict in other proximate states. Given the distribution of civil and interstate wars y_t^c we can define an indicator of presence of a conflict in a connected states as $r_{i,t}^c = \left(w_{(i,\cdot)} y_t^c\right)\#$, where # indicates the Boolean product. This variable c_i will acquire a value of 1 if one (or more) of the neighbors j of i are involved in a civil or interstate war at time t.[2]

The second set of regional factors hypothesized to influence the likelihood of conflict pertains to the regime types of other connected state. We can define a variable indicating average level of democracy among states in a region surrounding a country i at time t as $d_{i,t}^r = w_{i,\cdot}^s d_t$, where the superscript i indicates a row-standardized connectivity matrix $\mathbf{W}^s$ where all the entries in each row sum to 1.

The third set of regional factors hypothesized to affect the likelihood of civil war are levels of economic integration. This is defined as $i_{i,t} = \frac{W_{i,t} T_{i,j,t}}{g^{cp}} \forall j = \{1, ..., N\}$ or the sum of country i's trade T with all adjacent countries J as defined by $\mathbf{W}$, relative to a country's GDP g^{cp}. Since trade figures are indicated in current prices, I use GDP in current prices for the trade ratios, superscripted cp.

The fourth regional factor hypothesized to affect the risk of civil conflict is the number of ethnic groups across borders. I operationalize this using data from the Minorities at Risk project. More specifically, I rely on an indicator of the number of groups in a state that also exist in adjacent countries. This will be denoted e^r.

5.4 Dependence in time

The pooled structure of the data in time raises additional questions about the independence of the observations. Ward and Gleditsch (2002) estimated an autologistic model of conflict on data for a single year to avoid the added complications of dependence in time. Since conflict is a rare event, a sample based on a single year is unlikely to include many conflicts, and samples from different years may differ considerably. More information is generally better than less, and it would seem advantageous to include observations from as many years as possible.

[2]It would also be possible to condition on civil war and interstate and war separately. It is difficult to apply a Gibbs sampler to this model, however, since the model does not predict a separate civil war vector y_t^{cw} and a separate interstate war vector y_t^{iw}. Since there are relatively few interstate events in the sample the two approaches do not give dramatically different results when estimated by the maximum pseudolikelihood approach.

Many have pointed out the risk of conflict in an individual country may depend upon its prior history of conflict. The risk of recurrent civil war is high immediately after previous conflict, but the stability of peace between parties generally increases with additional years of peace between the parties.

Beck et al. (1998) and Raknerud and Hegre (1997) have suggested that the influence of a country's prior conflict history could be taken into account by including a count of the years a country has remained at peace py, either since its last conflict or since first being observed in the data. This is often referred to as a "peaceyears" variable. Since additional years are unlikely to contribute much to the stability of peace in countries that have remained at peace for an extended period of time, Beck et al. suggested modeling the impact of time through a non-parametric approach. Raknerud and Hegre suggested an exponential function where a country's time at peace decays relative to a half time parameter α, i.e., $e^{[-py/\alpha]}$. For models of conflict with cross-national data, the two approaches in practice tend to yield substantively similar In this paper I include such a function of py as a covariate in the model to control for the effects of time dependence, primarily because it is easier to interpret than a non-parametric approach. Trial and error suggest that $\alpha = 4$ provided a reasonable fit to these data. This implies that the risk of recurrent conflict is halved about every five years.

Another alternative is to estimate a transition model indicating how covariates influence transitions in and out of conflict (Beck, Epstein, Jackman and O'Halloran 2001). This is attractive on theoretical grounds, as the effects on conflict settlement may not be mirror images of those on conflict onset. Due to estimation problems I have not been able to consider this approach in the present version of the paper.

5.5 Domestic and regional factors in civil war

The model to be estimated hypothesizes that the presence of conflict for a given state i will be a function of the set of country specific attributes and the regional attributes discussed above.

$$y_{i,t} = f\Big(e^{(-py/\alpha)}, d_{i,t}, \Delta d_{i,t}, d^r_{i,t}, g^r_{i,t}, i_{i,t}, r^c_{i,t}\Big),$$

all the variables as defined above. The model can be assumed to be linear in the log-odds

$$z_{i,t} = \alpha + \beta_1 e^{(-py/\alpha)} + \beta_2 d_{i,t} + +\beta_3 d^r_{i,t} + \beta_4 g^r_{i,t} + \beta_5 i_{i,t} + \gamma r^c_{i,t}.$$

This model is similar a the standard Logit model, but conflict appears on both sides of the model in the sense that conflicts in adjacent states influence conflict in i through the γ parameter. The individual observations are treated as conditional on one another rather than independent. Given $z_{i,t}$ we can write the probability of conflict in a country i as

$$Pr\big(y_i = 1 | r^c_{i,t}\big) = \frac{e^z_{i,t}}{1 + e^z_{i,t}}.$$

5.6 Estimation methods

The model for $Pr(y_i = 1|r^c_{i,t}$)outlined above has a complicated likelihood function since the conflict observations y_i are conditionally dependent the value of y in other states.

Many techniques have been developed for estimating geographically conditional models with continuous dependent variables (Anselin 1988). However, the measure of conflict here is a discrete variable. Spatial statistical methods are much less developed for categorical variables.

The model can easily be estimated by the so-called maximum pseudolikelihood (MPL) approach, by considering a limited set of dependencies between observations and assuming all other observations are independent and exchangeable (see Ripley 1988). This has been shown to have reasonable asymptotic properties. The major disadvantage of the pseudolikelihood approach is that it tends to be inefficient, *especially* when the spatial interaction processes is strong (Huffer and Wu 1998).

Another alternative to address the intractable likelihood function is to use Markov Chain Monte Carlo (MCMC) simulation methods to approximate the full likelihood function (Besag 1974; Cressie 1991; Ward and Gleditsch 2002).

Geyer and Thompson (1992) suggest one approach to estimation based on importance sampling ideas. They demonstrate that their procedure recovers the maximum likelihood parameter estimates.

The autologistic model can be defined by the parameters $\theta = (\alpha, \beta_k, \gamma)$ and the sufficient statistics[3], $s(y) = \left(\sum_{i=1}^{n} y_i, \sum_{i=1}^{n} X_i y_i \right)$.

Given a set of a vector of parameter ψ as estimates for θ, one generates a large number of samples of y_i can by a Gibbs sampler and calculates the sufficient statistics for these samples. Note that since the term for conflict in other states, $r^c_{i,t}$, must be updated as the $\hat{y}$ generated by the model changes.

Based on these sufficient statistics, the Markov Chain Monte Carlo maximum likelihood estimates for θ can be found by solving the score equation by Newton-Raphson iteration

$$\frac{\sum_{j=1}^{m} s(y_m) e^{(\hat{\theta}-\psi)' s(y_m)}}{\sum_{j=1}^{m} e^{(\hat{\theta}-\psi)' s(y_m)}} = s(y),$$

where m is the number of sampled simulated maps and $s()$ is the vector of sufficient statistics. See Geyer and Thompson (1992) and Ward and Gleditsch (2002) for further details on estimation.

Normally, the MPL estimates are used as initial values ψ. In some cases, the MPL turn out to be a bad value for ψ, and lead to a Monte Carlo sample $s(y_1), s(y_2), , ..., s(y_1 000)$ which does not contain the observed s(y) within its convex hull. For these samples, the MCMC MLE do not exist, and Newton-Raphson iteration leads to a sequence $\theta_1, \theta_2, \theta_3 ...$ which drift towards infinity. Wu and Huffer note that this can happen when the spatial component γ is large. They suggest using the estimates θ_1 from the first iteration, and generate another Monte Carlo sample from these parameters. Although *ad hoc*, this approach normally leads to well behaved MCMC maximum likelihood estimates.

For the results presented in the subsequent section, ψ was not a good starting value. The Gibbs sampler was run with an initial burn in period of 100 samples, and 1000 subsequent samples, gathering sufficient statistics at every second sample. The initial MPL estimates ψ

[3] A sufficient statistic $T(X)$ for y contains all the information about y that is available in the observed data X.

were then replaced by the θ_1 from the first 1000 samples and used to generate an additional 5000 samples.

6 Empirical results

The results of the conditional model for all conflicts, irrespective of magnitude, are displayed in Table 1. The two leftmost column displays the MPL coefficient estimates and standard errors. The third displays the MCMC coefficient estimates. The fourth column display approximate "standard errors" for the MCMC estimates, based on the diagonal elements of the inverse of the Fisher information matrix to estimate the variances of the MCMC parameter estimates.

Table 1: Estimates for autologistic model

	MPL estimates		MCMC estimates	
Covariate	Coefficient estimate	Standard error	Coefficient estimate	Standard error
(Intercept)	-4.797	0.568	-4.288	0.482
Conflict history	4.702	0.161	4.719	0.139
Transborder groups	0.041	0.015	0.045	0.013
Democracy	0.012	0.009	0.009	0.008
Regional democracy	-0.030	0.016	-0.033	0.013
Share of largest minority	0.0074	0.0036	0.008	0.003
ln GDP per capita	-0.009	0.067	-0.033	0.057
Regional trade	–2.058	0.809	-1.928	0.683
Adjacent conflict	0.867	0.168	0.396	0.110
Model fit (MCMC estimates)	N = 5070		LR-χ^2= 2455.875, df=9	

The MPL estimates are generally consistent with the MCMC, but have a substantially higher estimate for the spatial conflict terms and generally lower coefficient estimates for the other parameters. I will first focus on the substantive implications of the MCMC estimates for the model and for the hypothesis on transnational dimensions of civil war. I will return to evaluate the relative merits of the MCMC and the MPL estimates in the subsequent section.

Most of the expectations are strongly borne out by the empirical results. Presence of either civil or interstate war in an adjacent country increases substantially the risk of conflict. This provides strong evidence for spatial clustering in conflict, and is consistent with what we would expect to see if conflict in one state has spill-over effects for other adjacent states.

The other hypothesized regional influences are consistent with the expectations. More democratic regions are less likely to experience conflict. Countries with higher interregional trade are also significantly less likely to experience civil wars. A higher number of ethnic groups that exist across state boundaries increase the risk of conflict.

The effects of the country specific variables are somewhat less consistent with expectations. Larger second minorities increase the likelihood of civil war. Larger GDP per capita decreases the risk of civil war, but the coefficient estimate is not statistically significant.

More surprising is the apparent positive effect of democracy.[4] Note, however, that the coefficient estimate for regional democracy is of substantially greater magnitude than that of country specific democracy.

Figure 1 displays the marginal effects of changes in the covariates holding other variables at their mean or median as appropriate, and assuming a case without conflict in adjacent countries. (In a case with conflict, the surface of predicted probabilities would have the same shape, but much higher absolute predicted probabilities). As can be seen, the effects of differences on the regional democracy variables seem to be of a greater magnitude than the differences following changes in country specific differences. Although these results suggests that democracies *ceteris paribus* are more likely to experience civil war, the risk of civil war is nonetheless very small for democracies located in more democratic regional contexts.

Trade integration seems to exert a larger effect on civil wars than do differences in GDP per capita. Thus, the regional effects seem to be of a magnitude at least as large as if not larger than country specific attributes. For the ethnic variables, differences in transborder linkages and heterogeneity seem to be of roughly comparable importance.

6.1 Model evaluation

Although the marginal impact of each of these variables cannot put a case where all the other variables have values around the mean or median, we would expect many of these variables to covary and go together in real world cases. In a heterogeneous world, undemocratic regions and low integration tend to go together, often in zones of protracted hostilities. The idea of integrated security communities as an avenue to stable peace similarly points to situations where many of these factors go together (for a more extended discussion, see Gleditsch 2002*a*). When the effects of a large number of variables increasing the likelihood of conflict are added together we see much more dramatic effects, and may push cases over the 0.5 level. The likelihood of civil war in an extremely unfavorable region would be several hundred percent higher than the risk of conflict in very favorable neighborhoods. The differences in the risk of civil war between a country in an "unfortunate" region and a relative benign region cannot be fully accounted for by attributes of the individual country. This provides strong evidence in support for that transnational linkages are important influences on the likelihood of civil wars.

It has often been noted that many empirical models fail to generate predicated probabilities above the 0.5 level (i.e., conflict more likely than peace). This model generates predicted probabilities above this threshold for many cases. Figure 2 displays a density plot of the predicted probabilities from the MCMC estimates given the observed data. This plot suggest that there are two broad types of groups. By far the highest density is observed around a cluster of observations with low predicted probabilities, indicating that most observations are predicted to be unlikely to experience conflict. However, the distribution also has a second peak, and a substantial number of country years have predicted probabilities

[4]Many argue that democracy does not have a linear effect on civil conflict, but that the relationship instead resembles an inverted u with intermediate types of regimes displaying the highest risk of conflict. The alternative specification a the tri-partite typology furthermore yielded no evidence for the hypothesized u-curve. The coefficient estimate for democracy was higher than that for anocracies and both were positive.

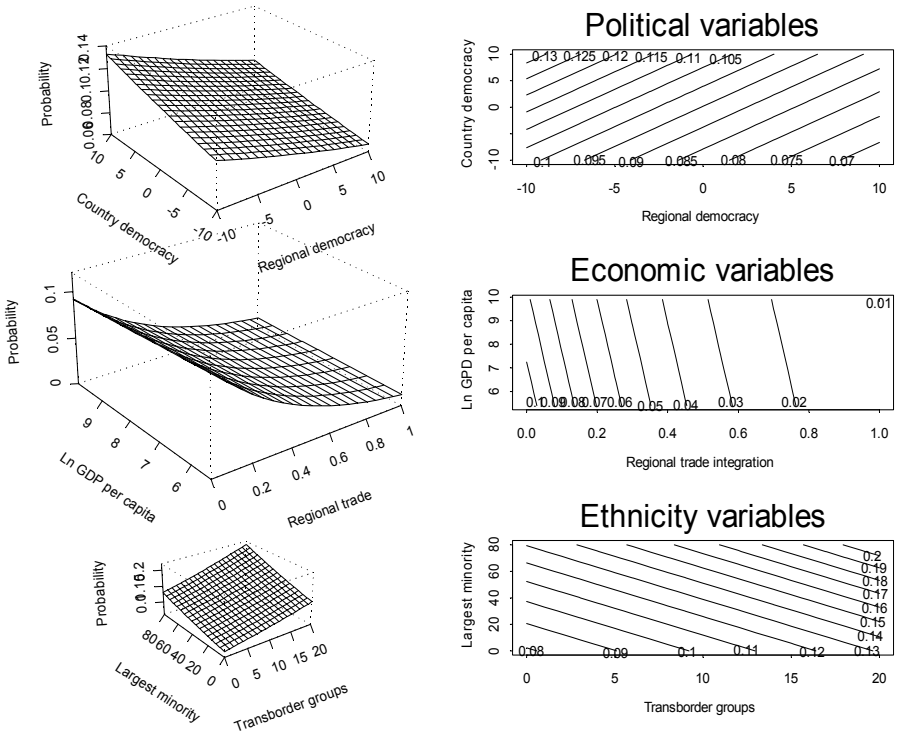

Figure 1: Marginal effect plots

of conflict that exceed the 0.5 threshold.

How accurate are the predictions from the model for the observed data? Do the MCMC estimates perform significantly better than the MPL estimates One way to examine this is to look at a simple classification table. This is displayed in Table 3.

Table 2: Model classification, annual observations

	MPL Predicted		MCMC Predicted	
Observed	No	Yes	No	Yes
No	3682	275	3687	270
Yes	231	882	209	904

As can be seen, the model is quite successful in postdicting conflict and peace for the annual observations. Of all the 1113 conflict years in the model, 904 are successfully predicted to have conflict with a probability greater than 0.5 based on the MCMC estimates. The MCMC estimates also successfully predicts peace in 3687 of the 3957 annual observations without conflict.

In addition to the correctly classified cases the MCMC estimates incorrectly predict

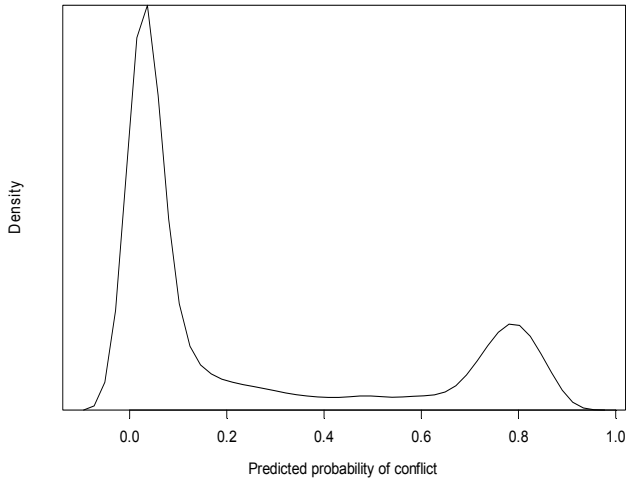

Figure 2: Density Function for Predicted Probability of Conflict. *The density plot of predicted probabilities suggest that there are two broad types of groups. As can be seen, most observations are predicted to have low probabilities of conflict. Nonetheless, a substantial number of country years have predicted probabilities of conflict exceeding 0.5*

conflict in 277 country years and miss 204 actual conflict years. Nonetheless, the model is quite successful in classifying cases of conflict and cases where conflicts do not occur. [5]

As can be seen, the MCMC yields better prediction than the MPL estimates. The MCMC coefficient estimates for the covariates tend to more consistent with the hypothesized effects. In general, the consistent coefficient estimates tend to be larger than the MPL estimates. The coefficient estimates that have unexpected signs, such as the positive term for country specific democracy, are generally closer to 0 for the MCMC estimates than in the MPL estimates.

The MCMC estimate for the spatial term is considerably smaller than the MPL estimate, indicating that the direct spatial contagion may be overestimated by the less efficient estimation method. Since the model is conditional the errors may propagate and induce bias in the other coefficient estimates.

6.2 Internal and external factors

Empirical studies of civil war have tended to focus on purely domestic attributes of states, and have generally ignored the international factors discussed here.

The direct spatial component is only one of the transnational dimensions of interests

[5] Given the relatively low violence threshold in the data, conflict is not such a rare even, and occurs in about 22 percent of all the country years in the sample. Alternative models focusing only on the major conflicts or wars with more than 1000 battledeaths are not shown here due to lack of space, but the results tend to be generally not dramatically different from those found with the more comprehensive conflict variable.

here. Although the transnational components taken as a whole appear to be statistically significant, the time component clearly emeerges as the single most important predictor. Hence, one might question whether the transnational dimensions improve notably on the model once the conflict history is taken into account. This issue can be evaluated by considering the Bayes Factors of the two model.

Raftery (1995) advocates evaluating two models corresponding to competing hypotheses through Bayes factors, or the ratio of the posterior odds for one of the models against the other. He develops a simple Bayesian Information Criterion (BIC) approximation to the Bayes factors that has gained widespread use. For some model Mk, the BIC can be found as

$$BIC_k^{'} = -\chi_{l0}^2 + p_k ln(n).$$

where χ_0^2 is the likelihood ratio test statistic likelihood ratio statistic for testing the null model M0 against Mk, p_k is the number of degrees of freedom, and n is the number of observations.

The Bayes factor approximation is simply the difference between the BIC for the two models. If we denote the smaller model with purely domestic covariates as model M1 and the larger model with the transnational dimensions as model M2, $BIC_{M1}^{'}$ = -4691.73 and $BIC_{M2}^{'}$ = 4852.032. The difference (160.302) is well above the threshold of 10 that Raftery (1995) characterizes as providing very strong evidence for the superiority of the model with the more negative BIC value.

This indicates that the model with the transnational characters is significantly better than the model with purely domestic covariates, and provides strong evidence of that the transnational dimensions are important. Even when prior history of conflict is taken into account, civil wars in one state cannot be fully accounted for by attributes of individual states, but are affected by transborder interactions and activities in adjacent states.

7 Forecasting conflict in 2000

The results in the previous section indicate that the model is quite successful in classifying conflict based on the observed data. This is stricly speaking a "postdiction" rather than a prediction, as it is based on coefficient estimates fitted to the same data which the model is subsequently used to predict. The classification may thus conceivably pick up on idiosyncracies in the estimation sample rather than any causal structure that have some degree of permance over space and time.

Applying these data yield quite accurate classifications may yield high success of classification, but this is not an entirely realistic assessment of the predictive ability of the model in an out of sample forecast. The problem lies in that we allow the model to use information about the actual occurence of conflict in all other states y_{-i} when making predictions about the risk of conflict for individual states i. In a real forecasting situation, we cannot assume knowledge about conflicts y in the international system when we make predictions for y_{-i}.

One way to examine whether the model reflects general relationships rather than sample features is to use the coefficient estimates to predict conflict out of sample, more specifically to the Uppsala conflict data for 2000 which now have become available.

Applying the coefficient then use these results to predict conflict out of sample for the 2000s indicates clear that the model is quite successful in identifying cases of wars out of sample As can be seen from Table 3 comparing predictions of the model compared to the actual events in 2000, the model correclty predicts 20 of the actual conflicts over the period. The model predicts conflicts in 4 states that failed to occur, and misses 12 cases of conflict.

Table 3: 2000 predictions based on 1999 data

	Civil war	
Predicted	No	Yes
No	113	12
Yes	4	20

Table 4 displays a list of the civil conflicts predicted by model based on the coefficient estimates and the 1999 data. Many of the cases in the column for the conflicts not predicted by the model appear to be cases where states participate in civil wars not ocurring on their core territory. Canada, for example, are held to be involved in a major civil war in 1998 and 1999. Without further information about the conflicts in the Uppsala data and it is difficult to ascertain whether individual conflicts such as this are appropriate or not. The rationale for spatial contagion is primarily dependent upon the location where conflict occurrs, not conflict participation. The Kosovo conflict may well have consequences for Macedonia, but we would not expect Candian participation in peacekeeping operations to increase the likelihood of civil war in the USA.

Most available measures conflict focus on participation in conflict rather than the location where conflict occur. States can choose whether to intervene in conflicts in far away location, but may not be able to insulate themselves from spill over effects from regional conflicts. In this sense, hypotheses about spatial contagion would be easier to evaluate with geogrpahical information about the conflict. Fortunately, a project is currently underway to code geographical information for the incidents in the Uppsala conflict data.

Table 4: Predicted and missed civil wars in 2000, based on 1999 data

Correct predictions	Missed conflict
Afghanistan	Iran
Algeria	Liberia
Angola	Russia
Burundi	Uzbekistan
Chad	
Colombia	
Ethiopia	
India	
Indonesia	
Israel	
Myanmar	
Pakistan	
Philipines	
Rwanada	
Senegal	
Sierra Leone	
Sri Lanka	
Sudan	
Turkmenistan	
Uganda	

8 Conclusion

Most research on civil wars has focused exclusively on attributes within states, and treated civil wars in one state as independent of conflicts in other states. The shortcomings of the model and data nonewithstanding, the relatively high rate of successful to unsuccessful predictions strongly indicates that the regional factors here examined here appear to reflect important aspects of civil war. The processes driving civil wars seem to be strongly influences by interactions and processes that cross national boundaries. This paper has shown how spatial statistical techniques can be used to capture linkages between states and differences in the regional environment different states face. A more comprehensive approach to civil conflict should consider consider potential causes both in processes within states and interaction between states.

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