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Surrounded by wars: quantifying the role of spatial conflict spillovers

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Abstract

We apply panel estimation methods to test how the incidence of war in neighbourhood countries affects the incidence of war in the domestic country. We find positive and significant evidence of “spatial conflict spillover”: higher incidence in the neighbourhood increases domestic country involvement in war. We also provide some new evidence on other correlates of war. Particularly interesting are the results concerning the effect of democracy. An increase in the level of democracy increases the incidence of interstate war and reduces the incidence of civil war. However, this latter effect kicks in only past a certain initial level of democracy.

Keywords: civil war, interstate war, neighbourhood effect, spillover, panel models

JEL Codes: D74, C23, N40

1. Introduction

The world is replete with instances of violent conflicts. From the genocide of the Khmer Rouge to long-running but low intensity conflicts in the Philippines and short, sharp sporadic clashes such as those witnessed in Grenada and Panama, it is clear that these events can differ significantly across countries and decades. Some are entirely domestic, others interstate, but rarely have any of these conflicts not impacted upon, or have been affected by, neighbouring countries. From direct military action crossing over to neighbouring countries to indirect negative impacts on their budgetary and fiscal positions due to having to care for refugees leaving conflict zones, the spillover costs of neighbourhood wars on an otherwise peaceful country can be significant. Given the costs visited upon neighbouring countries due to such spillovers, we argue that research into the direct and indirect impacts of conflict spillover has the potential to create a greater awareness of the issue and can guide policymakers when formulating strategies to end conflicts and promote peaceful transitions.

Yet the voluminous research dedicated to studying the determinants of wars and/or its impact on national incomes has largely been unable to test for the outcome of conflict spillover. This has been due to a lack of available data as well as a focus on other causes and consequences of war. Fortunately, there is now a recent but growing literature on conflict spillovers, which we utilise in order to expand our knowledge and understanding of this phenomenon. Specifically, in this paper we study how the incidence of war (civil and interstate) in neighbourhood countries affects the incidence of war in the domestic country. Our results can be summarised as follows. Firstly, we find that neighbourhood wars are significant predictors of spatial conflict spillovers, even after controlling for a number of geographic, economic, and institutional characteristics of the home country. Secondly, we find that democracy asymmetrically affects the incidence of different types of war: more democracy reduces the incidence of civil war and increases the incidence of interstate war. Thirdly, the effect of per-capita income on the incidence of war is inverted U-shaped; that is, an increase in income increases the incidence of war at initially early stages of economic development and then reduces the incidence of war once countries have reached a threshold stage of development. Finally, greater societal fractionalization, a rougher terrain, and less abundant natural resources tend to increase the incidence of war.

The rest of this paper is set up as follows. Section II presents an overview of the relevant literature that directly motivates our research question. Section III presents the econometric methodology and the datasets used to test our hypotheses. Section IV presents results and discussions, which is followed by concluding remarks (section V).

2. Background Motivation and Literature

Understanding the causes of large scale violence is central to the assessment of the costs of conflict and to the design of strategies for the stabilization of peace. It is therefore not surprising that a burgeoning literature has developed seeking to explain the determinants of the onset of war and/or its duration. A critical aspect emphasized in a small, but not insignificant number of studies concerns the “spatial” dimension of conflict. For one thing, there is evidence that the spatial distribution of conflict is non-random; that is, conflicts tend to be clustered in space (see, for instance, Gleditsch, 2007). For another, some conflicts have a tendency to spread geographically, while others do not (Braithwaite, 2006). These considerations raise the issue of “contagion effects”: to what extent does war in the geographical neighbourhood of country makes that country more (or less) likely to be at war? Our purpose here is to provide some empirical evidence to answer this question.

Theoretically, there are different potential mechanisms of contagion. With respect to interstate wars, alliance treaties between neighbours might implicate a country A into a war started by its neighbour B against a third party C. In the case of civil wars, contagion could result from demonstration and learning effects: individuals in a country might be more willing to rebel against their own government when they see a rebellion occurring in a neighbour country, or potential rebels in a country might learn tactics and strategies from rebels fighting in a proximate country. Inflow of refugees, arms markets, and diffusion of disease are externalities that might contribute to the spread of both civil and interstate wars.

In empirical terms, however, the extent of contagion is very much an open issue. While some studies uncover evidence that is consistent with the above mentioned mechanisms (see for instance Benson *et al.* 2013, Danneman and Ritter, 2013; Choi and Salehyan, 2013; Salehyan and Gleditsch, 2006), others emphasize that conflicts cluster in space because the factors that increase the likelihood of conflict also cluster spatially (Gleditsch, 2007 and Buhaug and Gleditsch, 2008). This would imply that the spread of conflicts is not much the result of contagion, but rather of geographical factors (e.g. geo-morphological characteristics of the territory, endowment of natural resources, etc.) or eventually historical-political factors. Evidence recently reported by Braithwaite (2010) also seems to confirm this point.

Hence, the debate on whether contagion effects or geographical factors lead to conflicts spiralling across neighbouring borders remains unresolved. Indeed, the likelihood that both contagion effects and geographical factors play a role in conflict spillover cannot be discounted either. As this paper takes no pre-determined position on the contagion or geographical factors debate, both arguments are incorporated into our econometric model. This matter is dealt with in greater detail below.

3. Empirical model and data

Our analysis is based on a panel data set spanning five decades (1960-2010). The incidence of war in a generic country i in decade t ($w_{i,t}$) is defined as the number of months the country was at war divided by the total number of months in a decade (i.e. 120). The variable therefore measures the proportion of time in a decade that the country spent at war and is therefore bounded between 0 (no war in the decade) and 1 (120 months of war in a decade). The incidence of war in the neighbourhood of country i in decade t ($\tilde{w}_{i,t}$) is defined as the weighted average of the incidence of war in each country that shares a land border with country i , with weights determined by the length of the land border of each neighbour. This variable is therefore also a proportion. Weighting by length of the land border is consistent with previous work in contiguous areas of research (see Murdoch and Sandler, 2002) and reflects the idea that a longer border increases the intensity of the potential spatial spillover (for instance, by making it easier for refugees to move from one country to the other).¹

To determine the impact of war in the neighbourhood we estimate the following equation:

$$w_{i,t} = \rho w_{i,t-1} + \beta \tilde{w}_{i,t} + \alpha' \mathbf{X}_{i,t} + \varepsilon_{i,t} \quad (1)$$

where \mathbf{X} is a set of geographic, institutional, and economic factors affecting the incidence of war, ρ , β , and α are all coefficients to be estimated, ε is a random disturbance, and k is a non-negative integer. The spatial effect is captured by the estimate of β . The lagged dependent variable is introduced to capture for possible time dependence of conflict.

The PRIO database allows us to distinguish between two types of war: civil and interstate. This gives the option to compute $w_{i,t}$ and $\tilde{w}_{i,t}$ in three different ways:

- (i) including wars of any type,
- (ii) including only civil wars, or
- (iii) including only interstate wars.

In fact, it is difficult to definitively posit which way works best. On the one hand, the literature has traditionally addressed the two types of war separately (see Bleaney and Dimico, 2011). On the other hand, Gersowitz and Kirger (2013) argue that the literature has typically mislabelled some episodes of war as civil wars, thus creating some confusion about the very definition of what a civil war actually constitutes. More importantly, one could argue that the type of spatial conflict is irrelevant in its effect upon a neighbour. This is as both civil and international conflicts can have the same impact on its neighbours, in in the form of economic disruption, flow of refugees and ‘conflict creep’. In the absence of any strong theoretical preference, we take here a pragmatic approach and estimate equation (1) for all three definitions of the war variables.

¹ The information on conflicts required to construct the two variables is taken from the Peace Research Institute Oslo (PRIO). Land borders are identified using a GIS-based mapping recursively updated each decade.

In line with previous studies on the determinants of war, \mathbf{X} includes the log of per-capita GDP in country i to proxy for the stage of country's economic development, an index of democracy, measures of ethnic and religious fragmentation, a dummy variable that takes value 1 if country i is resource abundant and zero otherwise, the log of land area and the difference between the highest and lowest elevation point in the country to capture the geomorphological characteristics of the territory.² In the literature, questions arise on the potential linearity in the relationship between economic development and conflict. In fact, at sufficiently low levels of per-capita income, the opportunity cost of conflict might be low enough so as not to discourage war. In this case, marginal increases in income could foster (rather than discourage) war by increasing the potential benefit from conflict. Conversely, as income grows beyond a certain threshold, the opportunity cost is larger than the potential benefit and further increases in per-capita GDP reduce the incidence of war. To account for this possible non-linearity, per-capita GDP squared term on log per-capita GDP is added to the set of regressors.

The estimating equation is a dynamic panel with potentially endogenous variables on the right hand side. An obvious choice of estimator is then the sys-GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998). This involves (i) first-differencing the estimating equation to eliminate unobserved country fixed effects and (ii) jointly estimating the equation in levels and in first-differences using lagged first differences as instrument for levels and lagged levels as instruments for first-differences. The alternative to the sys-GMM would be a difference-GMM, whereby only the equation in first-differences is estimated using lagged levels as instruments. However, the inclusion of the equation in levels allows us to retain an estimated coefficient on the time-invariant variables (which automatically drop out from the first-differenced equation). The usual battery of diagnostics (reported at the bottom of each table with the estimation results) supports the identification strategies underlying the sys-GMM estimator. More specifically, the Arellano and Bond test for autocorrelation in first-differenced errors indicates that there is no second order autocorrelation. The Hansen test suggests the overidentifying restrictions implied by the selection of instruments are valid. The difference-in-Hansen test supports the choice of sys-GMM over the alternative difference-GMM estimator.

4. Results and Discussion

Column 1 of Table 1 reports our baseline estimates. The dependent variable includes both civil and interstate conflicts. Our key result is the positive and statistically significant

² Per-capita GDP is taken from the Penn World Tables. The index of democracy is taken from the Polity IV Database. Ethnic fragmentation is from La Porta *et al.* (1999), religious fragmentation information is extracted from Barro and McCleary (2003). The natural resources dummy is constructed from data in Norman (2009). Elevation difference is obtained from Fearon and Laitin (2003) and land area from the World Development Indicator. Per-capita GDP and polity are measured at the beginning of each decade. The other variables are time invariant.

coefficient of war in the neighbourhood: higher incidence of war in neighbourhood countries increase war incidence for the domestic country. In other words, there is strong evidence of a spatial spillover effect of conflict. Quantitatively, the estimated coefficient implies that if all neighbour countries are involved in one extra year of war, then the incidence of war in the domestic country will increase by three to four weeks.

Other interesting results emerge from the estimates in Column I. First, there is evidence of positive time dependence in war incidence: everything else being equal, an extra year of war in the previous decade translates into an extra seven months of war in the current decade. Therefore, after controlling for other determinants, war incidence appears to be a stationary process. Second, the relationship between war incidence and state of economic development is effectively inverted-U shaped. At initially earlier stages of development, an increase in per-capita income increases war incidence. It is only past a threshold level of development that richer countries experience less war. According to our estimates, this threshold point is located at around \$1,265 per-capita. Third, societal fractionalization increases war incidence. Interestingly, the effect is significant for both the ethnic and religious dimension of fractionalization. Fourth, the geo-morphological characteristics of the territory matter and countries with a rougher terrain, as represented by a wider elevation different, tend to experience more war. There is instead no evidence of a significant effect of natural resource endowments.

Table 1: The determinants of war incidence, baseline estimates

	1	2
Constant	-0.68***	-0.80***
War lagged	0.59***	0.58***
Quality of polity	0.0004	0.0001
Quality of polity squared		-0.0008***
Log GDP p.c. start of decade	0.10*	0.12***
Log GDP p.c. start of decade lagged	-0.007**	-0.007***
War in the neighbourhood	0.05***	0.04***
Log of land area	-0.0007	0.0009
Ethnic fractionalisation	0.08***	0.08***
Religious fractionalisation	0.11***	0.09***
Oil	-0.02	-0.04**
Log of elevation differences	0.03***	0.04***
Observations	414	414
Arellano and Bond test for order 2 autocorrelation (p-value in brackets)	-0.22 (0.83)	-0.30 (0.77)
Hansen test (p-value in brackets)	55.63 (0.49)	67.82 (0.48)
Difference in Hansen test (p-value in brackets)	38.96 (0.38)	46.52 (0.41)

Dependent variable is the incidence of war. ***,** and * denote statistical significance at the 1%, 5% and 10% levels of significance respectively.

What is perhaps most striking in Column 1 is the lack of significance of the coefficient on the democracy variable.³ While this finding is not without precedent (see Fearon and Laitin, 2003), it does suggest that democracy might affect war incidence non-linearly (see, for instance, Baliga et al. 2011). Accordingly, in Column 2 we re-estimate the model adding a quadratic term on democracy. The pattern of estimated coefficients confirms that the peace-stabilizing effect of democracy kicks in at sufficiently high values of democracy only. The turning point is located at a level of democracy slightly higher than 0. Since the variable is measured on a scale from -10 (perfect autocracy) to +10 (perfect democracy), 0 roughly corresponds to the point where a country turns from being autocratic to being democratic. The implication is that for countries that are initially heavily autocratic, the road towards less autocracy does not necessarily lead to more peace. However, once the democratic features of the polity start dominating over autocratic features, further democratisation reduces war. All the other results are qualitatively the same as in Column 1, the only difference being that resource abundance now seems to reduce the incidence of war.

Table 2 reports the determinants of war incidence for different types of war. In Column I, the dependent variable only includes civil wars. The central finding on the spatial spillover effect is confirmed: more civil war in the neighbourhood leads to more civil war at home. Most of the other results are also qualitatively similar to those reported in Table 1. In particular, democratization and economic development appears to contribute to peace only once sufficiently high levels of democracy and per-capita income have been reached. One way to rationalize this finding is to think of civil war as the inability of a socio-institutional system to handle disagreements within a political framework. Only at sufficiently high levels of democracy and economic development, institutions are strong and credible enough to channel contestation towards socio-political compromises and hence restrict their debates and arguments within an agreed adherence to a legal political framework (Amable and Lung, 2008).

Column 2 reports the estimated coefficients of the model with the dependent variable including only interstate wars. Again, the key result of our analysis does not change: the spatial conflict spillover is both positive and strongly significant, suggesting that when neighbouring countries engage in war (between themselves or with other non-neighbour countries), the domestic country tends to be dragged into the conflict. It is worth stressing that the quantitative strength of this neighbourhood effect is rather similar across the two types of war (civil and interstate). Other results are also qualitatively confirmed, including the non-linear effect of per-capita GDP, the impact of rough terrains and oil abundance, and the positive time dependence of war incidence.

³ The democratic peace theory would indeed suggest that democracies engage in violent conflict less than autocracies. See Rosato, 2003 and Rasler and Thompson, 2005 for a more detailed and critical analysis of this theory.

Table 2: The determinants of war incidence, different types of war

	1	2	3
Constant	-0.69***	-0.16***	-0.22***
Civil war lagged	0.56***	0.46***	0.47***
Quality of polity	-0.0004	0.0007***	0.0007***
Quality of polity squared	-0.0008***	0.00008***	
Log GDP p.c. start of decade	0.10***	0.02***	0.04***
Log GDP p.c. start of decade lagged	-0.006***	-0.001***	-0.002***
War in the neighbourhood	0.02**	0.03***	0.03***
Log of land area	0.002	0.002***	0.002***
Ethnic fractionalisation	0.07***	0.02***	0.02***
Religious fractionalisation	0.08***	0.01***	0.003
Oil	-0.03*	-0.02***	-0.02***
Log of elevation differences	0.04***	0.004***	0.004***
Observations	414	414	414
Arellano and Bond test for order 2 auto-correlation (p-value in brackets)	-0.33 (0.74)	0.29 (0.78)	0.29 (0.77)
Hansen test (p-value in brackets)	66.35 (0.53)	73.34 (0.31)	69.10 (0.11)
Difference in Hansen test (p-value in brackets)	39.97 (0.68)	40.16 (0.68)	40.00 (0.34)

Dependent variable is civil war incidence in Column 1 and interstate war incidence in Columns 2 and 3. ***, ** and * denote statistical significance at the 1%, 5% and 10% levels of significance respectively.

However, there are also some interesting differences relative to the results in the previous column. The quantitative impact of societal fragmentation is much stronger in the civil war regression, as probably one would expect given that fragmentation is here measured within a country and not between countries.⁴ A wider land area increases the incidence of international wars, but not the incidence of civil wars. Perhaps more importantly, democratization now increases the incidence of war. Statistically, both the linear and the squared term are positive in Column II. This suggests some sort of exponential effect by which mature democracies tend to be more involved in interstate war than young democracies.⁵ This result could be rationalized by observing that in the post WWII era, highly democratic countries have sometimes engaged in interstate war in the attempt to “export” democracy. For instance, the broad international coalitions built around NATO and/or acting on UN mandate to intervene in localized conflict (e.g. Somalia, Yugoslavia,

⁴ The use of bilateral genetic distance measures in dyadic models of interstate war is an interesting avenue of future research.

⁵ In Column 3 of Table 2 we re-estimate the model using only a linear term for democracy. As can be seen, the estimated coefficient is highly significant and positive. So, while the exact functional form of the relationship (e.g. exponential vs. linear) might be ambiguous, the overall direction of the effect is rather clear-cut: more democracies increases the incidence of interstate conflict.

Middle-East) all classify as interstate war, thus increasing the incidence of this type of conflict for countries like the US and the EU members.

5. Conclusion

Understanding what causes war is important to stabilize peace. This paper offers some insights into spatial conflict effects. We find that higher incidences of war in the geographical neighbourhood of a country increase the incidence of war in that country. The result holds independently from the type of war (civil or international). This suggests that the risk of contagion across the borders is real and hence that localized conflicts, if not quickly pacified, can have a vast diffusion and eventually expand to the entire region.

Among the other results that we obtain, we highlight two in particular. One is that the relationship between economic development and war incidence to be U shaped, consistent with the idea that the opportunity cost of war is initially lower than its potential benefit, but then grows as development advances. The other is that democracy has a different impact on war depending on the type of conflict. At sufficiently high levels of democracy, the effect on the incidence of civil war is negative. Conversely, the effect of democracy on the incidence on international war is positive at all levels of democracy, possibly reflecting the attempt of democratic countries to export democracy by mean of conflict.

Our analysis leads to two related policy implications. First of all, when a neighbourhood country goes to war, then domestic authorities should act in a timely manner to reduce the risk of contagion. This mainly requires potential transmission channels to be identified and sterilized. Of course, this might not be an easy task. Our paper estimates a reduced form equation and hence does not provide much evidence on the potential transmission channels. However, it can be reasonably argued that the inflow of refugees is one such channel. There are obvious humanitarian reasons (in addition to purely logistics constraints) that prevent the domestic country from receiving refugees. The key is therefore to achieve a successful management of refugee camps and avert their militarization. To this purpose, domestic governments, in cooperation with the international community (and the United Nations High Commission for Refugees), should deploy security and monitoring personnel to refugee hosting areas to assess the risk of camps losing their humanitarian character. Furthermore, camps should be set up as distant as possible from the borders, with the presence of military protection officers, and organized in such way to limit their population density and overall size. Encouraging the integration of refugees among domestic country citizens might also help militarization by increasing the cost of using violence. In turn, integration might be facilitated by placing refugee camps in urban and rural settings rather than in isolated areas.

Second, when a country gets involved in a war, the other countries in the region should take a pro-active role in peace-keeping and peace-making. This can be achieved through the mandate of existing regional economic communities (REC). In fact, while originally born to foster intra-regional trade, some of these RECs, especially in Africa, now aim at fostering cooperation in a variety of areas, including diplomacy. In a few cases (e.g. Central African

Republic), these REC have played an active role in peace-keeping. With the support of the international community, this role can be strengthened and extended, thus creating the basis for a regional response to the risk of regional conflict spillovers.

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