The Geography of Inter-State Resource Wars*

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Abstract

We establish a theoretical as well as empirical framework to assess the role of resource endowments and their geographic location for inter-State conflict. The main predictions of the theory are that conflict is more likely when at least one country has natural resources; when the resources in the resource-endowed country are closer to the border; and, in the case where both countries have natural resources, when the resources are located asymmetrically vis-a-vis the border. We test these predictions on a novel dataset featuring oilfield distances from bilateral borders. The empirical

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analysis shows that the presence and location of oil are significant and quantitatively important predictors of inter-State conflicts after WW2.

1 Introduction

Natural riches have often been identified as triggers for inter-state war in the public debate and in the historical literature.[1] The contemporary consciousness is well aware, of course, of the alleged role of natural resources in the Iran-Iraq war, Iraq's invasion of Kuwait, and the Falklands war. At the moment of writing, militarized tensions involving territorial claims over areas known, or thought, to be mineral-rich exist in the South China Sea, the East China Sea, the border between Sudan and South-Sudan, and other locations. But the historical and political science literatures have identified a potential role for natural resources in dozens of cases of wars and (often militarized) border disputes, such as those between Bolivia and Peru (Chaco War, oil, though subsequently not found), Nigeria and Cameroon (Bakassi peninsula, oil), Ecuador and Peru (Cordillera del Condor, oil and other minerals), Argentina and Uruguay (Rio de la Plata, minerals), Algeria and Morocco (Western Sahara, phosphate and possibly oil), Argentina and Chile (Beagle Channel, fisheries and oil), China and Vietnam (Paracel Islands, oil), Bolivia, Chile, and Peru (War of the Pacific, minerals and sea access).[2]

However, beyond individual case studies there is only very limited systematic formal and empirical analysis of the *causal* role of resources in inter-state conflict, and of the

[1] E.g. Bakeless, 1921; Wright, 1942; Westing, 1986; Klare 2002; Kaldor et al., 2007; De Soysa et al., 2011; and Acemoglu et al., 2012.

[2] References for these conflicts include: Price (2005) for Nigeria-Cameroon, Franco (1997) for Ecuador and Peru, Kocs (1995), for Argentina and Uruguay and Algeria and Morocco, BBC (2011) for Algeria and Morocco, Anderson (1999) for China and Vietnam, Carter Center (2010) for the War of the Pacific. Other examples of (militarized) border disputes over areas (thought to be) rich in oil and other resources include Guyana-Suriname, Nicaragua-Honduras, Guinea-Gabon, Chad-Libya, Bangladesh-Myanmar, Oman-Saudi Arabia, Algeria-Tunisia, Eritrea-Yemen, Guyana-Venezuela, Congo-Gabon, Equatorial Guinea-Gabon, Greece-Turkey, Colombia-Venezuela, Southern and Northern Sudan (see Mandel, 1980; McLaughlin Mitchell and Prins, 1999; Carter Center, 2010).

underlying mechanisms. This paper aims to begin to fill this gap.

The key idea of the paper is to relate the likelihood of conflict between two countries to the *geographical location* of natural-resource deposits vis-a-vis the two countries' bilateral border. The reasoning is simple: reaching, seizing, and holding on to areas belonging to another country is progressively more difficult and costly the further away these areas are from the border. The further an advancing army has to go, the more opportunities the defender has to stop the advance, the longer and more stretched the supply lines become, the greater the likelihood that the local population will be hostile, etc. Therefore, if countries do indeed engage in military confrontations in order to seize each other's mineral reserves, as hypothesized in the case-study literature, they should be relatively more tempted when these reserves are located near the border. Accordingly, we ask whether countries are more likely to find themselves in conflict with countries with mineral deposits near the border than with neighbors with minerals far away from the border.

As a preliminary check on the plausibility of this, Figure 1 presents a simple scatterplot which suggests that the geographic location of oil deposits could be related to cross-country conflict. Each point in the graph is a pair of contiguous countries. On the vertical axis we plot the fraction of years that the pair has been in conflict since World War II, while on the horizontal axis we measure the (time average of) the distance to the bilateral border of the closest oil field. (Clearly only country pairs where at least one country has oil fields are included).[3] The graph clearly shows that country pairs with oil near the border appear to engage in conflict more often than country pairs with oil far away from the border [the correlation coefficient is -.11 (p-value: 0.01)].

The crude correlation in Figure 1 could of course be driven by unobserved heterogeneity and omitted variables. For example, it could be that some countries that have oil near the border just happen to be more belligerent, so that country-pairs including such countries spuriously fight more often. Hence, the rest of the paper engages in a more careful, model-based empirical investigation that controls for omitted factors, including country fixed

[3] Note that for visual convenience we have trimmed both axes, removing the 1% outliers with highest levels on the axes. The data in the figure is described in detail in Section 3.1.

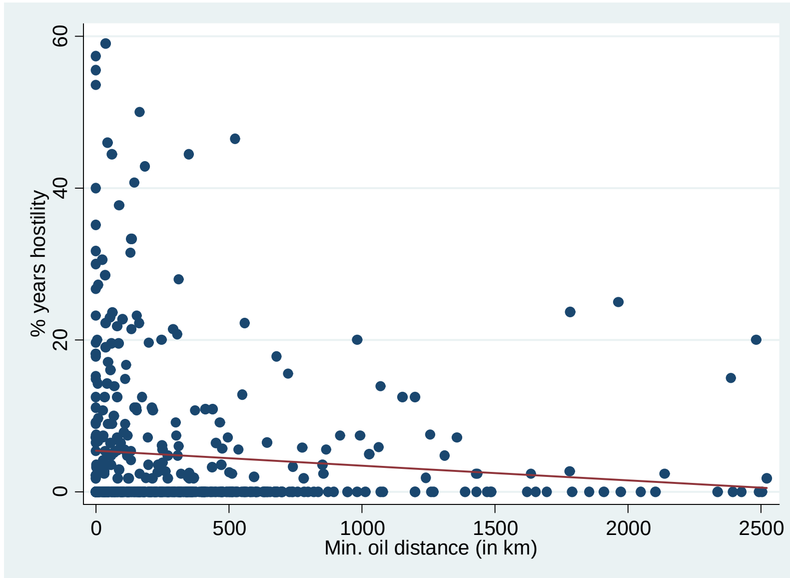


Figure 1: Oil distance from the border and bilateral conflict

effects, and is sensitive to the issue of border endogeneity.

To see the benefit of focusing on the geographical location of resource deposits, contrast our approach with the (simpler) strategy of asking whether countries are more likely to find themselves in conflict with neighbors who have natural resources than with neighbors that are resource-less. There are two shortcomings of this strategy. First, it tells us little about the mechanism by which resource abundance affects conflict. For example, it could just be that resource-abundant countries can buy more weapons. Second, the potential for spurious correlation between being resource-rich and other characteristics that may make a country (or a region) more likely to be involved in conflict is non-trivial. For both reasons, while we do look at the effects of resource abundance per se, we think it is crucial to focus most of the analysis on the geographic distribution of resource deposits.

To the best of our knowledge, there is no theoretical model that places conflict (whether over resources or otherwise motivated) inside a geographical setting. Given the prominence of the concept of territorial war, this omission may seem surprising. Hence, we begin the paper by developing a simple but novel two-country model with a well-defined geography, where each country controls some portion of this geography, so there is a meaningful notion of a border, and where the two countries can engage in conflict to alter the location of the border. This provides a simple formalization of territorial war (which could have applications well beyond the present focus on resource wars).

We use our model of territorial war to generate testable implications on the mapping from the geographical distribution of natural resources to the likelihood of conflict. We assume that each of the two countries may or may not have a resource deposit (henceforth oil, for short). The one(s) that have oil have the oil at a particular distance from the initial bilateral border. If a war leads one of the two countries to capture a portion of territory that includes an oil field, the control over the oil field shifts as well.

We obtain rich testable implications which go well beyond the simple intuition with which we have opened this Introduction. The model belongs to a much more general class of models of conflict where one player's gain (gross of the cost of engaging in conflict) equals the other player's loss. We remark that in such games, under very general conditions, the likelihood of conflict is increasing in the asymmetry of payoffs. Increases in payoff asymmetry make the player which is expected to win more aggressive, and the one that is expected to lose less aggressive. Since one party can initiate conflict unilaterally, the former effect tends to dominate.

Hence, the presence and geographic distribution of natural-resource deposits increases conflict if it increases payoff asymmetry. Compared to the situation where neither country has oil, the appearance of oil in one country clearly increases payoff asymmetry: the heightened incentive of the resource-less country to seek conflict to capture the other's oil tends to dominate the reduced conflict incentive of the resource-rich country (which fears losing the oil). Similarly, ceteris paribus, payoff asymmetry increases with the proximity of the oil to the border: as the oil moves towards the border the incentive of the oil-less country to fight increases more than the incentive for the oil-rich one is reduced. When both countries have oil, conflict is less likely than when only one does, but more likely than when there is no oil at all. More importantly, conditional on both countries having oil, the key geographic determinant of conflict is the oil fields' asymmetric location: the more asymmetrically distributed the oil fields are vis-a-vis the border the more likely it is that two oil-rich countries will enter into conflict. The overall message is that *asymmetries in endowments and location* of natural resources translate into asymmetries in payoffs and are thus potentially important determinants of territorial conflict.

While our theory applies to any type of resource endowment, our empirical work focuses on oil, for which we were able to find detailed location information (and which is the resource most commonly conjectured to trigger conflict). We test the model's predictions using a novel dataset which, for each country pair with a common border (or whose coastlines are relatively near each other), records the minimum distance of oil wells in each of the two countries from the international border (from the other country's coastline), as well as episodes of conflict between the countries in the pair over the period since World War II.

We find that indeed having oil in one or both countries of a country pair increases the average dispute risk relative to the baseline scenario of no oil. However, this effect depends almost entirely on the geographical location of the oil. When only one country has oil, and this oil is very near the border, the probability of conflict is more than three times as large as when neither country has oil. In contrast, when the oil is very far from the border, the probability of conflict is not significantly higher than in pairs with no oil. Similarly, when both countries have oil, the probability of conflict increases very markedly with the asymmetry in the two countries' oil locations relative to the border.

Our results are robust to concerns with endogeneity of the location of the border, because they hold when focusing on subsamples of country pairs where the oil was discovered only after the border was set; in subsamples where the border looks "snaky," and hence likely to follow physical markers such as mountain ridges and rivers; and in subsamples where the distance of the oil is measured as distance to a coastline rather than to a land border. They are also robust to controlling for a large host of country and country-pair characteristics often thought to affect the likelihood of conflict. Since country fixed effects are included, they are also robust to unobservable factors that may make individual countries more prone to engage in conflict.

Most theoretical work on war onset in political science and economics takes the belligerents' motives as given. The objective is rather either to study the determinants of fighting effort (Hirshleifer, 1991, Skaperdas, 1992), or to identify impediments to bargaining to prevent costly fighting (Bueno de Mesquita and Lalman, 1992, Fearon, 1995, 1996, 1997, Powell, 1996, 2006, Jackson and Morelli, 2007, Beviá and Corchón, 2010).[4] Our approach is complementary: we assume that bargaining solutions are not feasible (for any of the reasons already identified in the literature), and study how the presence and location of natural resources affect the motives for war.

The paper is thus closer to other contributions that have focused on factors that enhance the incentives to engage in (inter-state) conflict. On this, the literature so far has emphasized the role of trade (e.g., Polachek, 1980; Skaperdas and Syropoulos, 2001; Martin et al., 2008; Rohner et al., 2013), domestic institutions (e.g., Maoz and Russett, 1993; Conconi et al., 2012), development (e.g., Gartzke, 2007; Gartzke and Rohner, 2011), and stocks of weapons (Chassang and Padró i Miquel, 2010). Natural resources have received surprisingly little systematic attention in terms of formal modelling or systematic empirical investigations. Acemoglu et al. (2012) build a dynamic theory of trade and war between a resource rich and a resource poor country, but their focus is on the interaction between extraction decisions and conflict, and they do not look at geography. De Soysa et al. (2011) cast doubt on the view that oil-rich countries are targeted by oil-poor ones, by pointing out that oil-rich countries are often protected by (oil-importing) superpowers.[5]

Unlike in the case of cross-country conflict, there is a lively theoretical and empirical literature, nicely summarized in van der Ploeg (2011), on the role of natural resources in civil conflict. The upshot of this literature is that natural-resource deposits are often implicated in civil and ethnic conflict.[6] Our paper complements this work by investigating

[4] These authors variously highlight imperfect information, commitment problems, and agency problems as potential sources of bargaining failure. See also Jackson and Morelli (2010) for an updated survey.

[5] De Soysa et al. (2011) also find that oil-rich countries are more likely to initiate bilateral conflict against oil-poor ones. Colgan (2010) shows that such results may be driven by spurious correlation between being oil rich and having a "revolutionary" government. In Appendix B we look at a similar "directed dyads" approach and find that, in our sample, oil-rich countries are relatively *less* prone to be (classified as) revisionist, attacker, or initiator of conflict, and that *their propensity to attack is decreasing in their oil proximity to the border*. This difference in results could be due to differences in sample (we only look at contiguous country pairs), or methods (we include a full set of country and time fixed effects and various additional controls).

[6] The vast majority of the civil-conflict literature focuses on total resource endowments at the country level (see, e.g. Michaels and Lei, 2011, Ross, 2012, van der Ploeg and Rohner, 2012, and Cotet and Tsui,

whether the same is true for international conflict.[7]

The remainder of the paper is organized as follows. Section 2 presents a simple model of inter-state conflict. Section 3 carries out the empirical analysis, and Section 4 concludes.

2 The Model

2.1 Preliminary Remarks: Asymmetric Payoffs and Conflict

Many conflict scenarios can be crudely captured by the following static, two-player game:

		Player B	
		Action 0	Action 1
Player A	Action 0	$0, 0$	$x + c_A, -x + c_B$
	Action 1	$x + c_A, -x + c_B$	$x + c_A, -x + c_B$

where x,c_A,c_B are real numbers. Action 0 is a "peace" action that, if played by both parties, maintains the "status quo," here normalized to $(0, 0)$. Action 1 is a "conflict"

2013, for recent examples and further references), but recently a few contributions have begun exploiting within-country distributional information. For example, Dube and Vargas (2013) and Harari and La Ferrara (2012) find that localities producing oil are more prone to civil violence; Esteban et al. (2012) find that groups whose ethnic homelands have larger endowments of oil are more prone to being victimized; Morelli and Rohner (2014) find that inter-group conflict is more likely when total resources are more concentrated in one of the ethnic groups' homelands. None of these studies make use of information on the distance of natural resource deposits from country/region/ethnic homeland borders. Needless to say, there are also several studies examining the effect of the spatial distribution of resources and geographic features on outcomes other than conflict (e.g. Caselli and Michaels, 2013, for corruption; Alesina et al., 2012, for development).

[7] Much as in the literature linking resources to domestic conflict, our results imply that the net gain from resource discoveries may be well below the gross market value of the discovered reserves. Aside from the risk of losing the oil to its neighbors, countries have to factor in the economic cost of fighting to protect it. Based on their review of the literature Bozzoli et al. (2010) conclude that mass conflict causes GDP growth to fall by between 1 and 3 percentage points. Using our preferred specification for the probability of conflict, these values imply that a country which finds oil right at its border (with a country that has no oil) should expect to lose between 1 and 3 percent of GDP to war every 9 years or so.

action, such as initiating a war. The parameter x $(-x)$ is the expected (gross) payoff of the conflict to player A (B). If $x > 0$ player A is the "expected winner." For example, x could represent the capture of a strategic location or a mineral resource deposit currently located in country B, weighted by the probability that A succeeds at capturing it. Finally, c is a country-specific cost (or benefit if positive) of undertaking the conflict action.[8]

The condition for observing peace, defined as neither player playing the conflict action, is that

$$c_B \leq x \leq -c_A.$$

Hence, if conflict is usually costly (i.e. most of the time $c_B < 0$, $c_A < 0$), we will typically see conflict unless x is relatively small in absolute value. The absolute value $|x|$ is a measure of *payoff asymmetry*: it captures both the extent of the expected gains of one player, and the extent of the expected losses of the other. Hence, *in conflict games we expect to observe conflict when payoffs are asymmetric.*

In real world situations the "prize" from conflict $|x|$ is often persistent over time. For example a strategic location often retains its value over years or decades. Yet conflict among two players is only observed some of the time. To capture this pattern, we can assume that the cost of the conflict action, c_i, is a random variable. The idea is that there are "good times" and "bad times" to fight. For example, the perceived cost of conflict may be particularly low during an economic boom, or if the opponent is going through a period of political upheaval.

While it is natural to think of c_i as being negative most of the time, we can also imagine situations where c_i is occasionally positive, reflecting the fact that sometimes countries have very compelling ideological or political reasons to fight wars. For example, governments facing a collapse in domestic support have been known to take their countries to war to shore up their position by riding nationalist sentiments. In other cases they have felt compelled (or at least justified) to take action to protect the interests of co-ethnic minorities living on the other side of the border. Hence, it makes sense to assume that c

[8] Needless to say, the applicability of this framework goes well beyond international (or civil) conflicts. It extends to, e.g., price wars over market share, industrial disputes, divorce, and many others.

is a random variable which takes values on the real line.

Suppose then that $h : R \rightarrow R^{+}$ is the probability density function of c_i, $i = A, B$, and H is the corresponding cumulative distribution function. Then the probability of observing peace is $H(x)H(-x)$. How does this probability change with changes in payoff asymmetry? By inspection, we have immediately the following

Remark 1. *The probability of peace is nonincreasing in* $|x|$ *if and only* $h(|x|)/H(|x|) \leq h(-|x|)/H(-|x|)$.

In other words, increases in payoff asymmetry always increase conflict if the Inverse Mills' Ratio of the "cost of conflict" distribution evaluated at a positive value of this cost is less than the Inverse Mills' Ratio evaluated at the symmetric negative value. Clearly $H(|x|) > H(-|x|)$ so we would expect this condition to hold much of the time. Indeed, it holds in all cases where h is symmetric and single peaked around a negative mode, or whenever H is log-concave. The vast majority of commonly-used distributions defined on $\mathbb{R}$ are either symmetric or log-concave (or both).

The intuition for this condition is straightforward. $H(-|x|)$ is the probability that the conflict's prospective winner chooses the peace action, and $h(-|x|)/H(-|x|)$ is the percentage *decrease* in this probability when payoff asymmetry $|x|$ increases. Similarly, $h(|x|)/H(|x|)$ is the percentage *increase* in the likelihood that the prospective loser will play the peace action. The Inverse Mills' ratio condition simply states that the former exceeds the latter. Now, because $H(-|x|) < H(|x|)$, it will "typically" be the case that the proportional increase in the bellicosity of the expected winner exceeds the proportional increase in the dovishness of the loser, causing an increase in conflict. A simple way to think about this is that the winner is the player responsible for most conflicts, so what happens to this player's incentive to engage in conflict matters more than what happens to the other player's incentives.

In the next subsection we set up a simple model of conflict over natural resources which fits squarely in this general setup. We will see how the existence and spatial distribution of natural resources affects payoff asymmetry, and hence the likelihood of conflict.

2.2 Territorial Conflict

The world has a linear geography, with space ordered continuously from $-\infty$ to $+\infty$. In this world there are two countries, A and B. Country A initially controls the $[-\infty, 0]$ region of the world, while country B controls $[0, +\infty]$. In other words the initial border is normalized to be the origin. Each country has a resource point (say an oil field) somewhere in the region that it controls. Hence, the geographic coordinates of the two resource points are two points on the real line, one negative and one positive. We call these points G_A and G_B, respectively. These resource points generate resource flows R_A and R_B, respectively. For simplicity the Rs can take only two values, $R_A, R_B \in \{0, \bar{R}\}$, where $\bar{R} > 0$. Without further loss of generality we normalize $\bar{R}$ to be equal to 1.[9]

The two countries play a game with two possible outcomes: war and peace. If a conflict has occurred, there is a new post-conflict boundary, Z. Intuitively, if $Z > 0$ country A has won the war and occupied a segment Z of country B. If $Z < 0$ country B has won. The implicit assumption here is that in a war the winner will appropriate a contiguous region that begins at the initial border.

We make the following assumptions on the distribution of Z:

Assumption 1 *Z is a continuous random variable with domain $\mathbb{R}$, density f, and cumulative distribution function F.*

In sum, the innovation of the model is to see war as a random draw of a new border between two countries: this makes the model suitable for the study of territorial wars. Note that the distribution f need not be symmetric, much less symmetric around 0. The position in space of the distribution will depend on the relative strength of the two countries. If most of the mass point is over the positive real numbers, then a potential war is expected to result in territorial gains for country A (the more so the more "to the right" is the mass of the distribution), so country A can be said to be stronger. Needless to say, since Z is defined on $\mathbb{R}$, it is possible for the (expected) weaker country to win.

We assume that each country's objective function is linearly increasing in the value of

[9] In Section 2.4.2 we allow for arbitrary values of R_A and R_B.

the natural resources located in the territory it controls (at the end of the game). This means that, *ceteris paribus*, a country would like to maximize the number of oil fields it controls.

Besides the oil, there is an additional cost or benefit from conflict, c_i, $i = A, B$, which is a catch-all term for all the other considerations that affect a country's decision to go to war. As in the previous subsection, we assume that c_i, $i = A, B$ is a continuous random variable defined on $\mathbb{R}$, with density h, cumulative distribution function H, and satisfying the Inverse Mills' Ratio condition $h(|c|)/H(|c|) < h(-|c|)/H(-|c|)$. This implies that increases in payoff asymmetry increase the likelihood of conflict.[10]

This discussion results in the following payoff functions. If the outcome is peace, the payoffs are simply R_A for country A and R_B for country B, as by definition there is no border change (and hence also no change in property rights over the oil fields). If there has been a war, the payoffs are:

$$\begin{aligned} U_A^C &= R_A I(Z > G_A) + R_B I(Z > G_B) + c_A, \\ U_B^C &= R_A I(Z < G_A) + R_B I(Z < G_B) + c_B, \end{aligned}$$

where U_i^C is the payoff for country i after a conflict, and $I(\cdot)$ is the indicator function. The first two terms in each payoff function are the oil fields controlled after the war. For example, country A has hung on its field if the new border is "to the right" of it, and similarly it has conquered B's oil if the new border is to the right of it. The last term represents the non-territorial costs or benefits from war. Note that implicitly (and for simplicity) we assume that countries are risk neutral.[11,12]

[10] We discuss relaxing the assumption that the two countries draw the cs from the same distribution in footnote 18 below.

[11] Our payoff functions implicitly assume that the value of the oil fields is the same in case of war or without. It would be trivial to allow for some losses in the value of the oil in case of conflict. For example we could assume that conquered oil only delivers δR to the conqueror, with $\delta \in (0, 1]$. The qualitative predictions would be unchanged.

[12] In order to use our framework to study other aspects of territorial war, it will typically make sense to assume that Z enters directly into the payoff functions, reflecting that countries may care about their territorial size *per se* (which in our model is equivalent to the measure of the real line it controls). For

The timing and actions of the model are as follows. First, each country i draws a cost of conflict c_i, $i = A, B$. Then each country decides whether or not to declare war, and does so to maximize expected payoffs. If at least one country declares war, war ensues. In case of war, nature draws the new boundary, Z. Then payoffs are collected.

2.3 Analysis

This game is readily seen to have the structure discussed in Section 2.1. Both countries prefer peace (conditional on their draw of c) if $E(U_A^C) \leq R_A$ and $E(U_B^C) \leq R_B$ (where the expectation is taken after observing c_i). Given assumption 1 these conditions can be rewritten as

$$c_B \leq -R_A F(G_A) + R_B [1 - F(G_B)] \leq -c_A. \tag{1}$$

Hence, the probability of peace is $H(x)H(-x)$, where $x = -R_A F(G_A) + R_B [1 - F(G_B)]$. Changes in R_A, R_B, G_A, and G_B increase the likelihood of conflict if they increase $|x|$.

The expression for x clearly conveys the basic trade-off countries face in deciding whether to initiate a conflict (over and above the trade-offs that are already subsumed in the c_i terms): conflict is an opportunity to seize the other country's oil, but also brings the risk of losing one's own. Crucially, the probabilities of these two events depend on the location of the oil fields. Consider the decision by country A [second inequality in (1)]. If its own oil is very far from the border (G_A, and hence $F(G_A)$, is small) then country A is relatively unlikely to lose its oil, which makes country A in turn less likely to choose peace. Similarly, if country B's oil is nearer the border (G_B small, so $1 - F(G_B)$ large), the prospects of capturing B's oil improve, and A once again is less likely to opt for peace.

Remark 2. *The case where $R_A = 0$ ($R_B = 0$) is isomorphic to the case where $G_A \to -\infty$ ($G_B \to \infty$).*

For the purposes of evaluating the likelihood of peace, it makes no difference if one

example, controlling more territory provides more agricultural land to exploit, or more people to tax. Indeed in a previous version of this paper we added the term $+Z$ $(-Z)$ to the expression for U_A^C (U_B^C). However this addition complicates the statements of our results, so we have dropped these terms in the current version to focus on the mechanism we are interested in.

country does not have oil, or if its oil is located infinitely far from the border. This observation, which follows directly from inspection of equations (1), simplifies slightly the presentation of the results, as it implies that the cases where only one or neither country have oil are limiting cases of the case where both countries have oil. In particular, we can denote the probability of peace as $P(G_A, G_B)$, i.e. simply as a function of the location of the oil fields. With some slight abuse of notation, we then denote the probability of peace when only country A has oil (no country has oil) as $P(G_A, \infty)$ ($P(-\infty, \infty)$).

Proposition 1

(i) $P(G_A, \infty) \leq P(-\infty, \infty)$;

(ii) $\partial P(G_A, \infty)/\partial G_A \leq 0$;

(iii) $P(G_A, G_B) \leq P(-\infty, \infty)$;

(iv) $P(G_A, \infty) \leq P(G_A, G_B)$ *if and only if* $1 - F(G_B) \leq 2F(G_A)$;

(v) $\partial P(G_A, G_B)/\partial G_A \leq 0$ *if and only if* $1 - F(G_A) - F(G_B) \leq 0$.

The proposition, which follows nearly directly from the Inverse Mills' Ratio condition, enumerates five testable implications about how the presence and location of oil affects the likelihood of conflict among two countries. Parts (i), (iii), and (iv) compare the likelihood of conflict when neither, only one, or both countries have oil. Parts (ii) and (v) look at how the likelihood varies with the location of the oil. In the rest of the section we discuss what these predictions say and how they come about within the logic of the model.

Part (i) of the proposition establishes that conflict is more likely when one country has oil than when neither country does. Recall that a discovery of oil in one country has opposite effects on each country's incentives to go to war. The country which found the oil becomes less likely to wish to get into a conflict because it has more to lose, while the other country has an additional potential prize from going to war. The proposition says that (as long as the Inverse Mills' Ratio of the distribution of c is well behaved) the latter effect systematically dominates, so the likelihood of conflict goes up. The reason is that the oil discovery in country A creates a payoff asymmetry.

Part (ii) says that when oil is only in one country the probability of conflict increases when oil moves closer to the border. The reason is that the movement of the oil towards the border increases the likelihood that country B (A) will capture (lose) the oil, thus exacerbating payoff asymmetry.

Part (iii) tells us that two countries both having oil are more likely to experience a conflict than two countries both not having oil. Oil always makes one country more aggressive, because with oil payoffs will always be more asymmetric than without oil, and this is enough to trigger more conflicts. In this sense under our assumptions the mere presence of oil is always a threat to peace.

Part (iv) compares the situation when both countries have oil to the situation when only country A has oil. It says that the discovery of oil in the second country will typically defuse tensions. The intuition of course is that when the second country finds oil payoff asymmetry declines. The country that would typically have been responsible for most conflict becomes less aggressive, as it becomes concerned with the possibility of losing its newly-found oil. Country A does become more aggressive, but this is typically insufficient to create a more belligerent atmosphere. The exception is when the oil in country A was initially much further away from the border than the new oil discovered in country B – which is the meaning of the conditioning statement in part (iv). In this case, the new discovery in country B can actually increase payoff asymmetry: from mildly asymmetric in favor of B to strongly asymmetric in favour of A. Unconditionally, however, i.e. without knowledge of the locations of the two countries' oil fields, we expect pairs where both countries have oil to engage in less conflict than pairs where only one does.

Finally, part (v) looks at the marginal effect of moving oil towards the border in one country, while leaving the other country's oil location unchanged. To better understand this part, it is useful to look at the following special case.

Corollary

If f is symmetric around 0, then $\partial P(G_A, G_B)/\partial G_A \leq 0$ if and only if $|G_A| \leq G_B$.

In other words, when both countries have oil, changes in distance that increase the *asymmetry of oil locations* tend to increase the asymmetry of payoffs. Consider starting from a situation of perfect symmetry, or $-G_A = G_B$. When f is symmetric around 0, the incentive to fight for the other country's oil exactly cancels out with the deterrent effect from fear of losing one's oil (see equations (1)). However, as soon as we break this symmetry, say by moving A's oil towards the border, country B becomes an expected winner. The conditioning statement in the proposition generalizes this intuition, as $F(G_A)$

will tend to be larger than $1 - F(G_B)$ when G_A is closer to border than G_B.[13]

The empirical part of the paper tests predictions (i)-(v).

2.4 Discussion and Extensions

2.4.1 Conflict and border changes

The key modelling choice we have made is to think of international wars as *potentially* border-changing events. The long (and very incomplete) list of examples of territorial wars and militarized border disputes in the Introduction supports this assumption. The International Relations literature provides further systematic evidence. Kocs (1995) has found that between 1945 and 1987 86% of all full-blown international wars were between neighboring states, and that in 72% of wars between contiguous states unresolved disputes over territory in the border area have been crucial drivers. The unstable nature of borders is well recognized. According to Anderson (1999) about a quarter of land borders and some two-thirds of maritime borders are unstable or need to be settled. Tir et al. (1998) identify, following restrictive criteria, 817 territorial changes between 1816 and 1996, many of which are the result of international conflicts. According to Tir et al. (1998) and Tir (2003) 27% of all territorial changes between 1816 and 1996 involve full-blown military conflict, and 47% of territorial transfers involve some level of violence. Weede (1973: 87) concludes that "the history of war and peace is largely identical with the history of territorial changes as results of war."

The data described in the next section also supports the existing evidence. In our panel of country pairs 0.4% of all observations feature border changes (corresponding to 90 cases of border change). Yet, conditional on the two countries being in conflict with each other, the incidence of border changes goes up to 7.4%. In other words the probability of a border change increases 19-fold in case of war.[14] In Appendix C we show that conflict

[13]However in the case where f is not symmetric $|G_A| \leq G_B$ is not sufficient for movements away from symmetry to generate more conflict. The prediction could be overturned if the country whose oil is moving towards the border is much stronger militarily (i.e. if f is very skewed in its favor).

[14]Conversely, while only 6% of observed country pairs are in conflict, 30% of country pairs experiencing

remains a significant predictor of border changes after controlling for time and country fixed effects. Indeed we go further and show that the presence and location of oil fields has some predictive power for border changes, despite the very infrequent occurrence of such changes.

Having said that, it is also important to stress that the model emphatically does not predict that *all* conflicts will be associated with border changes. All of our results and calculations allow for the distribution of Z to have a mass point at 0. Indeed, a significant mass point at 0 appears likely in light of the figures above.

It is also important to point out that, strictly speaking, the distribution function f need not be the true distribution of post-conflict border locations Z. f is the distribution used by the decision-makers in the two countries, but this need not be the rational-expectations distribution. Anecdotal observation suggests that overoptimism is often a factor in war and peace decisions, so our guess is that the objective numbers cited above are probably lower bounds on the probabilities assigned by leaders to their chances of moving the border in case of war. For example, it seems likely that Saddam Hussein overstated his chances of permanently shifting the borders of Iraq with Iran (first) and Kuwait (later).

2.4.2 Allowing for Variation in R

With our assumption that $R \in \{0, 1\}$ we have normalized all non-zero oil endowments. It is trivial to relax this assumption to look at the effects of changes in R_A and R_B. In particular, as implied by our Remark above, an increase in R_A has identical qualitative effects of a movement of A's oil towards the border, while an increase in R_B is akin to a move of B's oil towards the border. Our propositions can therefore readily be reinterpreted in terms of changes in quantities.

Unfortunately, testing these predictions would require data on oil field-level endowments that we have no access to. Potentially, predictions for changes in the Rs might be tested using variation in oil prices, as an oil price increase is an equiproportional increase in both R_A and R_B. For example, for the case where only one country has oil, our theory

a border change are in conflict.

would predict that increases in oil prices tend to lead to an increase in the likelihood of conflict. However, ample anecdotal evidence suggests that short-term oil prices are very responsive to conflicts involving oil-producing countries, so it would be very difficult to sort out a credible causal path from oil prices to conflict.[15] Another issue is that what matters for war should be the long-term oil price: it is not clear that current oil prices are good forecasts of long-run ones.

2.4.3 Endogenous F

Oil as a source of military strength In our model the discovery of oil in one country tends to make this country less aggressive, as it fears losing the oil, and the other more aggressive, as it wishes to capture it. We may call this a "greed" effect. However, the discovery of oil may also provide the discoverer with financial resources that allow it to build stronger military capabilities. If oil rich countries are militarily stronger, they might also be more aggressive – as the odds of victory go up. Their neighbors may also be more easily deterred. Hence, there is a potential "strength" effect that goes in the opposite direction to the "greed" effect.[16]

However, while the fact of having oil may have some ambiguous implications through the opposing "strength" and "greed" effects, the geographical location of the oil should only

[15] Even interacting oil distance from the border with the World oil price would be difficult to interpret, as market participants' assessment of the disruption caused by a war to oil supplies might depend on the distance of the oil from the border. In particular, when the oil is close to the border the fighting is more likely to disrupt oil production and shipment.

[16] The "strength" effect could easily be added to our model by making F a decreasing function of R_A and an increasing function of R_B. However, this would not be enough to fully bring out the ambiguity discussed in the text. For example, it is easy to see that parts (i)-(iii) of our Proposition would still go through exactly unchanged. Hence, it would still be the case that, e.g., discovery of oil in one country unambiguously leads to greater likelihood of conflict. This is because in our model the only territorial benefit of conflict is oil – merely being stronger does not make country A more aggressive. In footnote 12 we have alluded to a previous version of the model where countries have territorial aspirations over and above the control of oil (i.e. Z enters the payoff function). In that model the "strength" effect is present and the empirical predictions are correspondingly a bit more ambiguous.

matter through greed. Oil will increase resources for fighting irrespective of its location, but the risk of losing it will be more severe if the oil is near the border. Hence, our predictions concerning the effect of oil location on conflict – which are the focus for our most distinctive empirical results – should be unaffected by the strength argument. As mentioned in the Introduction, this is one key reason to focus on the geographic distribution of the oil in the empirical work.

In any case, while we don't model the "strength" effect explicitly, in our empirical work we are able to fully control for it, by including various measures of each country's aggregate oil endowments.[17]

Other sources of asymmetric strength Having oil endowments is just one reason why one country may be militarily stronger than another. For example, a larger country, a richer country, or a more ethnically homogeneous country could also be expected to be stronger. The same mechanisms that may lead the "strength" effect to qualify the predictions of the "greed" effect are thus involved in thinking about these other reasons for military asymmetry, and lead to similar qualifications. For example, if it is the militarily stronger country which finds oil, it is no longer necessarily the case that payoffs become more asymmetric.

Endogenous arming decisions In the discussion so far, we have assumed that the two countries take their relative strength, represented by the function F, as given. As we show in the Online Appendix, a similar line of reasoning applies if each country can make military investments to improve its odds of success in case of conflict. Consider, for example, an increase in G_A when country B does not have oil. In the baseline model, this has only a *direct* positive effect on country B's chances of capturing the oil, and unambiguously leads to more payoff asymmetry and hence more conflict. In the extended model, however, the

[17] Note that while we do not have data on oil-field-level oil endowments, we do have data on country-level endowments. The former would be required to test the comparative statics of the model with respect to R_A and R_B, i.e. the effect of endowments through the "greed" effect. The latter are sufficient to test for the "strength" effect, which depends only on aggregate endowments, and not on their spatial distribution.

shift of the oil towards the origin can cause the two countries to change their armaments. If country A responds by arming much more than B, it is conceivable that this *indirect* effect will dominate over the direct effect, resulting in a decline of country B's prospects of capturing country A's oil. This may reduce payoff asymmetry, and hence, unlike in the baseline model, an increase in G_A no longer unambiguously increases conflict. Having said this, the scenario where the likelihood of conflict declines seems very implausible. Specifically, it is not at all clear why A should respond to the increase in G_A with a greater arming effort than B, much less that the disparity in response should be so large as to more than negate the direct effect.[18]

3 Empirical Implementation

3.1 Data and Empirical Strategy

3.1.1 Sample

We work with a panel dataset, where an observation corresponds to a country pair in a given year, e.g. Sudan-Chad in 1990. Country pairs are included if they satisfy Stinnett et al. (2002)'s "direct contiguity" criterion: the two countries must either share a land (or river) border, or be separated by no more than 400 miles of water. There are 606 pairs of countries satisfying this criterion.[19] The dataset covers the years 1946-2008.

All variables are described in detail in Appendix A, which also contains Table 6 with summary descriptive statistics. Here we focus on the key dependent variable and the independent variables of interest.

[18] Much the same style of argument applies if we relax the assumption that c_A and c_B are drawn from identical distributions. For example, a natural extension would be to assume that c_A (c_B) is positively (negatively) related to the mean of the distribution of Z, i.e. that the country that expects the largest territorial gains also expects the largest non-territorial ones (or to pay a less devastating non-territorial cost for the conflict). For example, if the oil is found (or moves towards the border) in the country with higher mean c – i.e. the country responsible for most conflicts – the deterrence effect on the country with oil may dominate over the greed effect experienced by the country without oil.

[19] Approximately 60% of the country pairs in the sample are separated by a land or river border.

3.1.2 Dependent Variables

Our main dependent variable is a measure of inter-state disputes, from the "Dyadic Militarized Interstate Disputes" (MID) data set of Maoz (2005). The MID data is the most widely used data on interstate hostilities.[20] Compared to alternative (and less widely used) data sets – such as the UCDP/PRIO Armed Conflict Dataset (Uppsala Conflict Data Program, 2011) – it has the advantage of not only including the very rare full-blown wars between states, but also smaller scale conflicts, and to provide a relatively precise scale of conflict intensity.

In Maoz (2005) interstate disputes are reported on a 0-5 scale. The highest value, 5, is reserved for "sustained combat, involving organized armed forces, resulting in a minimum of 1,000 battle-related combatant fatalities within a twelve month period." This extremely violent form of confrontation, which we will refer to as "War", is rare: only 0.4% of our observations meet this criterion. The next highest value, 4, is for "Blockade, Occupation of territory, Seizure, Attack, Clash, Declaration of war, or Use of Chemical, Biological, or Radioactive weapons." While still very violent, this type of confrontation, which is labelled "Use of Force," is much more frequent, occurring in as many as 5.2% of our observations. Accordingly, we construct our main dependent variable, which we call "Hostility" by combining all episodes of War and Use of Force.[21] We also present robustness checks using War only,[22] including disputes receiving a value of 3 in Maoz (2005) - Hostility+,[23] and even specifications relating the intensity of conflict to the presence and geographic location

[20] MID data, as well as the Stinnett et al.'s contiguity variable, are accessible through the *Correlates of War* project. Related papers in economics using this data include for example Martin et al. (2008), Besley and Persson (2009), Glick and Taylor (2010), Baliga et al. (2011) and Conconi et al. (2012).

[21] It is standard practice in the empirical literature on international conflict to aggregate over more than one of the Maoz (2005) categories. For example, Martin et al. (2008) and Conconi et al. (2012) code a country pair to experience conflict when hostility levels 3, 4 or 5 are reached.

[22] The dataset from Maoz (2005) only runs until 2001. As alternative data on full-blown wars is readily available, when we check the results using "War" we update this variable using the UCDP/PRIO Armed Conflict Dataset (Uppsala Conflict Data Program, 2011).

[23] Disputes receive a mark of 3 when they meet the criterion of "Display use of force", which is reserved for "Show of force, Alert, Nuclear alert, Mobilization, Fortify border, Border violation".

of oil.

An alternative approach is to investigate data which identifies the aggressor in a bilateral conflict (as in Colgan (2010) and De Soysa et al. (2011)). However, in many cases, identification of the aggressor requires subjective and possibly unreliable judgments. Furthermore, if a country perceives a potential threat, it may choose to attack first, and it is not clear that data focusing on the direction of attack are always able to account for such preemptive strikes.[24] We submit that our approach based on distance of the oil from the border offers a more robust strategy. Having said this, in Appendix B we use additional data from Maoz (2005) to look at how the presence and the distance of the oil from the border differentially affect the likelihood that the oil rich or the oil poor country is classified as "revisionist", "attacker" or "initiator of conflict".

3.1.3 Explanatory Variables of Interest

Our main independent variables are one-period lagged measures of the presence and distance of oil fields in each country in the pair from the bilateral border or from the other country's coastline. To construct these we have combined two sources. The first source is the CShapes dataset of Weidmann et al. (2010), which contains historically accurate georeferenced borders for every country and year. The dataset accounts for border changes over time, both the ones originating from state creation and split-ups, and those arising from border adjustments. Their border adjustment information is based on Tir et al. (1998).

The second source is a time varying and geo-referenced dataset on the location of oil and gas fields from Lujala et al. (2007, PETRODATA). It includes the geographic coordinates of hydrocarbon reserves and is specifically designed for being used with geographic information systems (GIS). In total, PETRODATA consists of 884 records for onshore and 378 records for offshore fields in 114 countries. Note that PETRODATA includes all oil and gas fields known to exist, including those not yet under production, which is clearly

[24] See, e.g., Gaubatz (1991), Gowa (1999), Potter (2007), and Conconi et al. (2012), for more detailed versions of these and other criticisms of the "direct dyad" approach.

appropriate given that incentives to appropriate will likely be similar for operating and not-yet-operating fields.[25]

Using Geographical Information System (GIS) software, we merge these two data sets so that we can pinpoint each oil field position vis-a-vis a country's borders as well as vis-a-vis the coastline of neighboring countries. Then, for each country pair and for each oil field belonging to one of the two countries, we measure the oil field's minimum distance to the other country's land border, as well as the minimum distance to the coastline of the other country. The oil field's distance to the other country is then the minimum of these two.[26] The minimum oil distance from the other country is the minimum across all oil fields' minimum distances.

On the basis of these data, we have constructed the following five explanatory variables. "One" is a dummy variable taking the value of 1 when only one country in the pair has oil. Similarly, "Both" takes a value of 1 if both countries of the pair have oil. The omitted baseline category hence is the case where none of the countries in the pair has oil. "One x Dist" is the product of the "One" dummy with the distance of the oil from the border. Similarly, "Both x MinDist" is the product of the "Both" dummy and the minimum of the distances of the oil from the border in the two countries. Analogously, "Both x MaxDist" captures the distance from the border in the country whose oil is further from the border. Note that an increase in "Both x MinDist" (holding "Both x MaxDist" constant) is a movement towards symmetry, while an increase in "Both x MaxDist" (holding "Both x MinDist" constant) is a movement away from symmetry.[27]

[25] The main data sources of PETRODATA include World Petroleum Assessment by U.S. Geological Survey (USGS, 2000), Digital database on Giant Fields of the World by Earth Sciences and Resources Institute at the University of South Carolina (ESRI-USC, 1996), and World Energy Atlas by Petroleum Economist (Petroleum Economist, 2003).

[26] Needless to say in many cases there is no land border and in many others there is no coastline, so in these cases the distance variable is just the distance from the coastline (border).

[27] The attentive reader will have noticed that, in constructing our key dependent variables, we have taken the min operator three times: first, for each oil field in a country, between its distance to the other country's border and the other country's coastline (distance of oil field to other country); second, for each country, among all its oil fields' distances to the other country (minimum oil distance to other country);

In our main specifications, all the distance variables are normalized to lie between 0 and 1, to reduce their range, and constructed so that there are "diminishing marginal costs" from geographical distance. In particular, the functional form is $1 - e^{-\lambda d}$, where d is the crude geographical distance in hundreds of Kms. The idea for the diminishing costs is that conquering the first Km in the enemy's territory may be a more momentous decision than conquering the 601st Km when one has already captured the first 600. In our benchmark specification we set $\lambda = 1$, which is equivalent to assuming that diminishing marginal costs set in fast, consistent with our intuition. We present robustness checks for alternative functional forms (including unscaled distance).

3.1.4 Control Variables

In all regressions we control for the average and the absolute difference of land areas in the pair. We also present specifications which further include the average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, the number of consecutive years the two countries have been at peace before the current period, the volume of bilateral trade (scaled by the sum of GDPs), a measure of genetic distance between the populations of the two countries, a dummy for membership in the same defensive alliance, a dummy for historical inclusion in the same country, kingdom or empire, a dummy for having been in a colonial relationship, two dummies for civil war incidence in one or both of the countries in the pair, and two dummies for OPEC membership of one or both countries in the pair.[28] Finally, in important robustness checks

and, third, between the two countries' minimum oil distances (MinDist). MaxDist is the max between the two countries' minimum oil distances.

[28]Population and GDP could affect the likelihood of conflict in myriad ways, e.g. through relative military strength; fighting capabilities directly affect the chances of success, so clearly enter the calculation of whether to engage in conflict; democracy scores are included to account for the "democratic peace" phenomenon (Maoz and Russett, 1993); joint membership in alliances or in OPEC, or historical roots in the same kingdom or empire, may offer countries venues to facilitate the peaceful resolution of conflicts; previous history of conflict is meant to absorb unobserved persistent factors leading to conflict between the two countries; recent history of domestic civil wars captures one factor that may weaken one country

we discuss later, we further include several measures of the amounts of oil production and reserves in the two countries. Again, all variables are discussed in detail in Appendix A.

3.1.5 Specification and Methods

Our benchmark specification is a linear-probability model that takes the form

$$\begin{aligned} \text{HOSTILITY}_{d,t+1} &= \alpha + \beta \text{ One}_{dt} + \gamma \left(\text{One x Dist}\right)_{dt} \\ &+\delta \text{ Both}_{dt} + \eta \left(\text{Both x MinDist}\right)_{dt} + \omega \left(\text{Both x MaxDist}\right)_{dt} \\ &+\mathbf{X}'_{dt}\boldsymbol{\xi} + u_{dt}, \end{aligned}$$

where d indexes country pairs, t indexes time, and $\mathbf{X}$ is the vector of afore-mentioned controls. We consider alternative functional forms (including probit and logit) in robustness checks.

Crucially, our preferred specification for the error term u_{dt} includes a full set of country dummies as well as a full set of time dummies. This implies that the key source of identification for, say, the effect of "One" is the relative propensity of a given country to experience conflict with its oil-rich neighbors and with its oil-poor neighbors. We will find a positive estimate of β when the same country has more conflicted relations with its oil-rich neighbors. The identification of the other coefficients is driven by similar within-country comparisons, e.g. is a given country more likely to find itself in conflict with a neighbor whose oil is near the border than with one whose oil is far away from the border.

The inclusion of country fixed effects serves to limit the influence of unobservable determinants of a country's proneness to engage in conflict that may be spuriously correlated with its having oil (or with its having many neighbors having oil). Clearly the theory also predicts that countries with oil (or with oil-rich neighbors) should engage in conflict more frequently, a prediction that is not allowed to influence the results when fixed effects are included. If we could be confident that our control variables fully absorbed all the other determinants of bilateral conflict, specifications that omit fixed effects might be preferable

and tempt the other to take advantage; bilateral trade has been found to matter for bilateral conflict by Martin et al. (2008), and so has genetic distance [Spolaore and Wacziarg (2013)].

(and we report them). But it is unlikely that the controls fully account for all the determinants of conflict that may be spuriously correlated with having oil (or neighbors with oil). This is particularly true in the present context: the dyadic specification means that all controls must be defined at the country-pair level, not at the country level. Hence, it is likely that the controls are quite ineffective at accounting for country-level covariates of oil endowments and conflict outcomes.

For the same reason, the country fixed effects are insufficient to absorb the influence of factors that affect the likelihood of conflict at the country-pair level, leading us to prefer specifications that include controls. The downside of including the controls is, of course, that some of them may be endogenous to bilateral conflict. This is why we present specifications with and without controls - except for the controls based on surface area which seem clearly exogenous.

Ideally one would use country-pair fixed effects, and base all inference on time-series variation in the variables of interest. Identification of the oil-related coefficients would then be driven by (i) oil discoveries, which switch the dummies "One" and "Both" from 0 to 1, and potentially change the distance measures (if the newly-discovered field is closer to the border than all the pre-existing fields); and (ii) changes in borders. Unfortunately there are too few (relevant) oil discoveries and border changes in our dataset to provide sufficient power for identification.[29]

In all regressions reported in then main body of the paper the standard errors (which are always displayed in parenthesis below the coefficient) are clustered at the country-pair level. In the Online Appendix we further report standard errors based on methods that attempt to implement clustering at the country level. The Online Appendix also reports results that control for region-year fixed effects, and also presents findings for a simple

[29]For each country pair and each of the five variables of interest we have calculated the number of changes during the sample period. Across the five variables, the fraction of country pairs experiencing no change whatsoever varies between 75 and 85%, and the fraction experiencing no more than one change is between 95 and 100%. Unsurprisingly, this time variation is too small to yield sharp estimations once country-pair fixed effects are included. With the full set of controls, the estimated coefficients (standard errors) are β =0.018 (0.029), γ =-0.019 (0.032), δ =0.049 (0.044), η =0.021 (0.042), and ω =-0.078 (0.046).

cross-section of country pairs.

3.2 Results

Table 1 presents the baseline regressions for the main dependent variable, Hostility. In the first four columns we use all oil fields to construct our measures of oil endowments and distance, while in columns 5-8 we only use offshore oil, and in columns 9-12 only onshore oil. In column 1 we show the coefficients on our variables of interest only after controlling for annual time dummies and average and absolute difference in land areas. In column 2 (3) we add all the other controls (country fixed effects), and in column 4 we present our preferred specification with both controls and fixed effects. The estimates are reasonably stable across the four specifications, though statistical significance tends to improve as we add country fixed effects and the further controls.

When we include the full set of country fixed effects and controls (column 4), both the presence and geographic location of the oil are statistically significant predictors of bilateral conflict. As predicted by the model a country pair with one or both countries having oil is significantly more prone to inter-state disputes than a pair with no oil whatsoever (which is the omitted category). More importantly, when only one country has oil, the likelihood of conflict significantly drops when the oil is further away from the border. Similarly, when both countries have oil, the likelihood of conflict is decreasing in the distance from the border of the oil that is closest to the border - a movement towards symmetry. The only prediction of the model for which the support is weak concerns the distance of the furthest oil field: while the sign of the coefficient is positive, as predicted, it is not statistically significant.[30]

Quantitatively, the effect of geographic location is very sizeable. Figure 2 shows the

[30] Generally speaking, in most specifications we have run the two versions with fixed effects (with and without controls for country-pair characteristics) generate quite similar results. However, the fixed effects are important. For example, in the specifications with controls but without country fixed effects the coefficients on the key distance variables drop by one third to one half, and lose significance in about 50% of cases. This suggests that there are unobservable country-level determinants of conflict that are spuriously positively correlated with oil distance.

probability of conflict implied by the regression coefficients in Column 4 as a function of the oil's distance from the border (when all the controls are set at their average values). As already noted, the average risk of conflict in our sample is 5.7 percent. This drops to 3.1 percent for country pairs in which neither country has oil. In contrast, when one country in the pair has oil, and this oil is right at the border (Distance = 0), the probability of conflict is about 3.5 times as large: 10.8 percent. But this greater likelihood of conflict is very sensitive to distance. Indeed when the oil is located at the maximum theoretical value for our distance measure (Distance = 1) the likelihood of conflict is similar to the likelihood when neither country has oil.[31] The last two bars in the figure look at the case where both countries have oil. In the first instance, asymmetry is maximal: one country has oil right at the border (MinDist=0), the other at the maximum distance (MaxDist=1). The likelihood of conflict is over 2.5 times as large as in the case where neither country has oil, or 8 percent. In the second instance, we look at a case of perfect symmetry: both countries have oil at a distance that is one half of the maximum distance (MinDist=MaxDist=0.5). The likelihood of conflict is a much more modest 3.4 percent.[32]

The remaining columns in the table investigate whether the results are driven particularly by offshore or onshore oil. In particular, in columns 5-8 we construct our variables of interest using exclusively information on offshore oil fields (so, e.g., if in a country pair all the oil is onshore the pair is treated as a "no oil" pair), and then repeat the four specifications with no controls, only country-pair controls, only country dummies, and all fixed effects and controls. In columns 9-12 we do the same for onshore oil. It turns out that the coefficients on the variables of interest and patterns of significance are quite similar for offshore and onshore oil (and thus to the baseline case). Hence, if the mechanism driving the results is the one implied by our theory, it seems that having another country's oil near one's coastline is as "tempting" as having it near one's border.

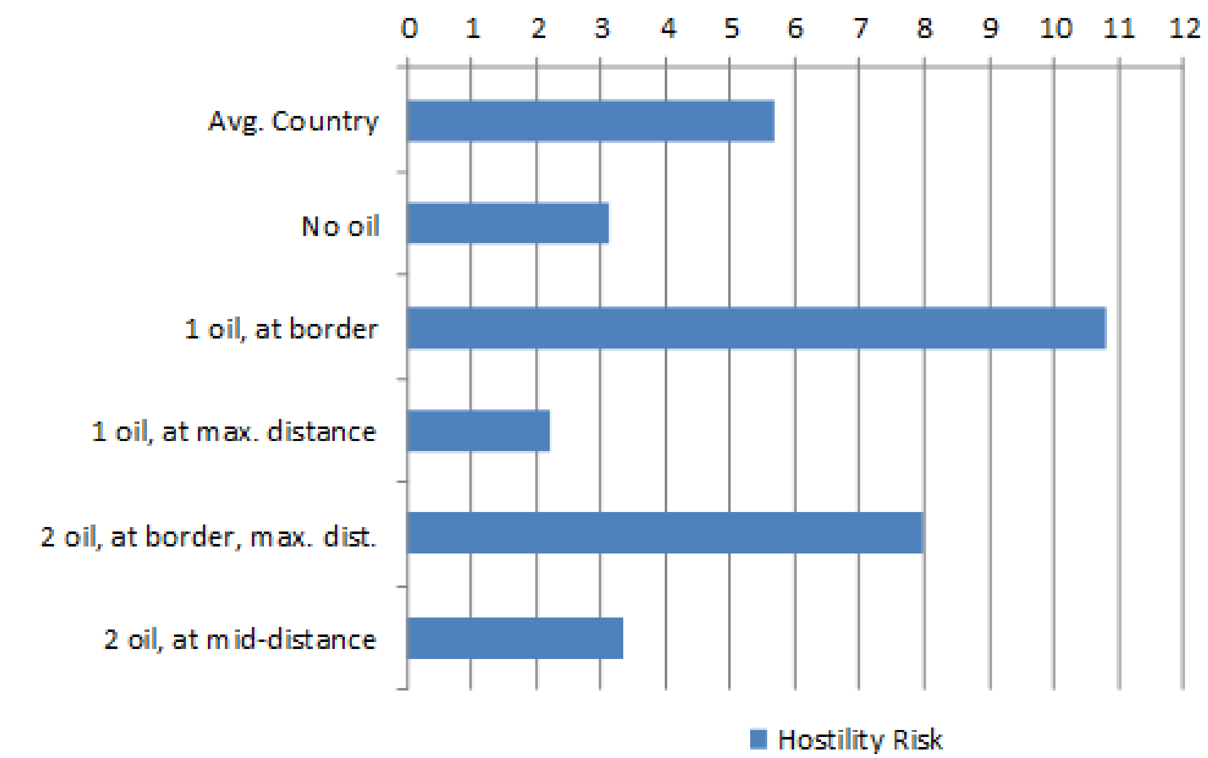
[31] Hence, our model's formal isomorphism between the cases of no oil and "infinitely distant" oil seems to hold empirically.

[32] In constructing Figure 2 we have used the coefficient on the interaction term between the "oil in two countries" dummy and the maximum distance variable even though it is statistically insignificant. Because it is a very small number, however, using 0 instead has only a minor effect on the quantities in the table.

	Dependent variable: Hostility											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.034	0.029	0.049*	0.077**	0.087	0.081**	0.143***	0.124***	0.048	0.063*	0.058*	0.132***
	(0.032)	(0.027)	(0.027)	(0.030)	(0.054)	(0.040)	(0.048)	(0.035)	(0.042)	(0.038)	(0.033)	(0.044)
One x Dist	-0.050	-0.044	-0.073***	-0.086***	-0.107*	-0.087**	-0.138***	-0.118***	-0.079*	-0.072*	-0.103***	-0.137***
	(0.035)	(0.027)	(0.026)	(0.027)	(0.056)	(0.043)	(0.048)	(0.034)	(0.044)	(0.039)	(0.033)	(0.041)
Both	0.022	0.028	0.034	0.045*	0.023	0.048*	0.110***	0.073**	0.009	0.024	0.020	0.047
	(0.021)	(0.020)	(0.029)	(0.027)	(0.030)	(0.027)	(0.035)	(0.030)	(0.024)	(0.020)	(0.032)	(0.031)
Both x MinDist	-0.077**	-0.044	-0.105***	-0.089***	-0.088*	-0.028	-0.107**	-0.066**	-0.102***	-0.096**	-0.122***	-0.125***
	(0.035)	(0.035)	(0.030)	(0.029)	(0.047)	(0.035)	(0.051)	(0.032)	(0.038)	(0.043)	(0.032)	(0.036)
Both x MaxDist	0.026	-0.014	0.016	0.004	0.048	-0.048	0.012	-0.010	0.059	0.042	0.047	0.043
	(0.040)	(0.036)	(0.030)	(0.029)	(0.065)	(0.050)	(0.065)	(0.044)	(0.043)	(0.045)	(0.034)	(0.038)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303
R-squared	0.019	0.090	0.145	0.158	0.020	0.091	0.145	0.156	0.021	0.092	0.146	0.160

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All explanatory variables are taken as first lag. All specifications control for the average and the absolute difference of land areas in the pair, intercept and annual time dummies. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 1: Baseline results for Hostility



Note: Risk of bilateral conflict based on the coefficients in column (4) of Table 1. "No oil" is when One=Both=0. "1 oil, at border" ("1 oil, at max. distance") is when One=1 and Dist=0 (Dist =1). "2 oil, at border, max. dist." ("2 oil, at mid-distance") is when Both=1, MinDist=0, and MaxDist=1 (MinDist=MaxDist=0.5).

Figure 2: Quantitative Effects

	Dep. var.: War				Dep. var.: Hostility+				Dep. var.: Dispute intensity			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.005	0.003	0.008	0.016**	0.036	0.026	0.051*	0.082***	0.480	0.454	0.530	1.768**
	(0.008)	(0.005)	(0.010)	(0.007)	(0.033)	(0.027)	(0.030)	(0.032)	(0.382)	(0.332)	(0.337)	(0.789)
One x Dist	-0.007	-0.002	-0.010	-0.010**	-0.059*	-0.046*	-0.083***	-0.094***	-0.804*	-0.793**	-1.022***	-2.134***
	(0.008)	(0.005)	(0.008)	(0.005)	(0.035)	(0.027)	(0.027)	(0.028)	(0.429)	(0.321)	(0.292)	(0.624)
Both	0.004	0.010**	0.009	0.020**	0.033	0.035	0.037	0.055*	0.384	0.263	0.478	0.503
	(0.006)	(0.005)	(0.009)	(0.009)	(0.024)	(0.026)	(0.033)	(0.033)	(0.278)	(0.272)	(0.363)	(0.506)
Both x MinDist	-0.003	-0.008	-0.008*	-0.007	-0.092**	-0.051	-0.131***	-0.111***	-1.050***	-1.039***	-1.724***	-1.575***
	(0.005)	(0.008)	(0.005)	(0.006)	(0.041)	(0.039)	(0.035)	(0.033)	(0.404)	(0.345)	(0.395)	(0.438)
Both x MaxDist	-0.004	-0.003	-0.005	-0.006	0.025	-0.018	0.021	0.005	0.254	0.158	0.143	0.241
	(0.007)	(0.008)	(0.006)	(0.008)	(0.047)	(0.041)	(0.035)	(0.031)	(0.408)	(0.348)	(0.348)	(0.441)
Method	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	Poisson	Poisson	Poisson	Poisson
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	23768	11303	23768	11303	19962	11303	19962	11303	19962	11303	19962	11303
R-squared	0.005	0.033	0.073	0.103	0.024	0.105	0.155	0.179	n/a	n/a	n/a	n/a
Log pseudolikelihood	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-16589.39	-6058.98	-12419.69	-5217.07

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2008. Robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. The oil variables are constructed using all oil fields (onshore and offshore). All explanatory variables are taken as first lag. All specifications control for the average and the absolute difference of land areas in the pair, intercept and annual time dummies. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 2: Baseline results for alternative dependent variables

3.2.1 Robustness

Alternative dependent variables Table 2 presents results from our benchmark specifications, but using alternative measures of conflict. Given the similarity between the offshore and onshore results, and to save space, we focus on exercises that treat offshore and onshore oil equally, as in the first four columns of Table 1. In columns (1)-(4) we use the most stringent definition of conflict, namely "War." Because of the very infrequent occurrence of "War" (sample mean 0.004), these regressions have much less statistical power than those using Hostility, and some of our variables of interest accordingly lose statistical significance. Nevertheless, perhaps surprisingly, the coefficients on the One and Two dummies, as well as the coefficient on Distance, remain significant. Quantitatively, the coefficients are smaller than when using Hostility, though the impact of distance on War is still economically very sizable.[33]

In a similar spirit, columns (5)-(8) present results using a definition of conflict broader than Hostility, namely including conflicts classified as having intensity 3 in the Maoz data set. The results are very similar to the ones using our baseline Hostility measure, with the coefficients of most of our key variables being sizeable and highly significant for our preferred specification of column (8).

Finally, in columns (9)-(12) we further exploit Moaz's finer-grained classification of conflicts on a 0-5 scale, by running Poisson Maximum Likelihood specifications for conflict intensity. We find that our oil-distance variables exert an economically and statistically significant effect on the intensity of conflict, much as they do on conflict occurrence.

In Appendix B we estimate further regressions in the same spirit to predict whether country A is classified as more "revisionist", "attacker" or "initiator of conflict" than country B. We find robust evidence that oil-rich countries are less likely to be classified in any of the above categories, and that this effect becomes stronger as the oil gets closer to the border. There is also fairly strong evidence that countries are more likely to be

[33] For example, while in an average country pair the risk of war is 0.4% per year, this risk goes up to 2.4% –which is 6 times higher– in the most dangerous configuration where only one country in the pair has oil and this is located right at the border.

classified as revisionist towards neighbors that have oil, the more so the closer the oil is to the border.

Alternative distance scales, functional forms, subsamples To further assess the robustness of our results, Table 3 presents variants of our preferred specification of column 4 of Table 1. In column 1 we re-scale the distance of oil fields from the border using a plain natural log function, while in column 2 we use raw oil distance. The results are very similar to the ones of the benchmark regression. In columns 3, 4 and 5 we replace our linear probability model with, respectively, logit, probit and rare events logit (ReLogit) estimators.[34] The results are again very similar to our benchmark.[35] To further reduce unobserved heterogeneity, in column 6 we restrict the sample to country pairs where one or both of the countries have oil (hence dropping all country pairs without any oil). The results of the benchmark continue to hold in this restricted sample. In column 7 we show that our results are robust to dropping country pairs including Israel, a country that has been involved in frequent conflict in an oil-rich region of the world (but not necessarily because of oil). Finally, column 8 shows that our results are also robust to dropping country pairs with oil fields that straddle the border (i.e. for which MinDist=0). This indicates that the findings are not driven by hostilities arising from difficulties in managing common-pool resources.

[34]The rare events logit (ReLogit) estimator is from Tomz et al. (2003), and adjusts the estimation for the fact that the dependent variable takes much more often a value of 0 than of 1. The ReLogit estimator is not designed for the inclusion of fixed effects and for robust standard errors. Hence, we remove all fixed effects and use standard errors without the robust option, but still cluster at the country-pair level.

[35]Note that the sample size drops in columns 3 and 4 with the logit, resp. probit estimators as countries with no variation in the dependent variable (i.e. countries being in all periods in peace with all their neighbors) drop from the sample when country fixed effects are included.

	Dependent variable: Hostility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
One	0.050	0.048***	2.603***	1.089**	0.886**		0.066**	0.077**
	(0.034)	(0.018)	(0.992)	(0.448)	(0.450)		(0.028)	(0.030)
One x Dist	-0.004*	-0.008***	-3.063***	-1.362***	-1.121**	-0.090***	-0.077***	-0.086***
	(0.002)	(0.002)	(0.829)	(0.386)	(0.460)	(0.028)	(0.026)	(0.027)
Both	0.049	0.047*	0.772	0.285	0.359	-0.032	0.043*	0.046*
	(0.031)	(0.024)	(0.623)	(0.291)	(0.311)	(0.029)	(0.026)	(0.027)
Both x MinDist	-0.005***	-0.011**	-2.050***	-1.084***	-1.341***	-0.092***	-0.050**	-0.088***
	(0.002)	(0.006)	(0.497)	(0.244)	(0.485)	(0.030)	(0.023)	(0.029)
Both x MaxDist	-0.000	-0.005*	0.312	0.175	0.241	0.002	-0.026	0.002
	(0.002)	(0.003)	(0.500)	(0.258)	(0.474)	(0.030)	(0.026)	(0.029)
Sample	All	All	All	All	All	Only pairs with oil	w/o Israel	w/o Dist. 0
Method	OLS	OLS	Logit	Probit	ReLogit	OLS	OLS	OLS
Country FE and TE	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Scale distances	Nat.log.	in 100 km	Standard	Standard	Standard	Standard	Standard	Standard
Observations	11303	11303	8840	8840	11303	9839	11158	11294
R-squared	0.154	0.161	0.319	0.310	0.232	0.171	0.155	0.158

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. In all columns except (5) robust standard errors clustered at the country pair level; in column (5) robust non-clustered standard errors (ReLogit does not allow for clustering). Significance levels *** p<0.01, ** p<0.05, * p<0.1. The oil variables are constructed using all oil fields (onshore and offshore). All explanatory variables are taken as first lag. All specifications control for intercept, the average and the absolute difference of land areas in the pair, the average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair. All columns, with the exception of (5), also include country fixed effects and annual time dummies (ReLogit does not allow for FE and TE).

Table 3: Robustness with respect to Estimator and Sample

Oil endowments In Section 2.4.3 we noted that countries with oil might experience more frequent conflict simply because oil revenues confer resources that can be spent on weaponry and other military capabilities. Our regressions already control for GDP and a measure of military capability, so in principle this effect should indirectly already have been absorbed by these variables. Having said this, in order to make sure that our distance variables do not spuriously correlate with oil endowments, in Table 4 we perform further robustness checks with respect to the overall quantitative endowments of oil in the two countries in each pair.[36] Specifically, we control (in turn) for the mean and difference of: oil output (column 1), estimated oil reserves (2), and oil output as a share of GDP (3). Further, we control for oil output in the country with oil closest to the border, and in the country with oil further from the border (column 4). In column 5 we perform the same analysis as in column 4, but this time with oil reserves.

We can make three broad observations from the results of Table 4. First, and most important, the results relating to distance of the oil from the border are very robust, both in magnitude and in statistical significance, to controlling for the overall oil endowments. Second, the One and Two dummies are less systematically significant, especially the latter. However, we have verified that this effect is due to a drop in the sample size. Third, the oil output/endowment variables are only rarely statistically significant predictors of conflict, possibly because their influence is already captured by the controls for GDP and for military capabilities.

3.2.2 Endogenous Borders

In interpreting our regressions so far we have implicitly assumed that borders are located randomly in space - or at least without consideration for the presence and location of the oil. There may be reasons to query this identifying assumption, as the process by which borders come about may be affected by the spatial distribution of oil fields. Indeed in our own model the *ex-post* border is certainly endogenous to the oil's location, since countries

[36] Recall that we do not have oil field-level information on endowments, so we cannot test the model's predictions with respect to oil field size.

	Dependent variable: Hostility				
	(1)	(2)	(3)	(4)	(5)
One	0.082**	0.061	0.078**	0.084**	0.061
	(0.036)	(0.039)	(0.036)	(0.037)	(0.039)
One x Dist	-0.101***	-0.082**	-0.099***	-0.104***	-0.083**
	(0.034)	(0.034)	(0.034)	(0.035)	(0.034)
Both	0.042	0.013	0.039	0.036	0.016
	(0.032)	(0.042)	(0.032)	(0.032)	(0.042)
Both x MinDist	-0.070***	-0.072***	-0.072***	-0.070***	-0.072***
	(0.025)	(0.025)	(0.024)	(0.024)	(0.026)
Both x MaxDist	-0.013	-0.009	-0.010	-0.014	-0.012
	(0.028)	(0.028)	(0.027)	(0.027)	(0.029)
Oil Production (mean)	-0.008**				
	(0.004)				
Oil Production (difference)	0.002				
	(0.001)				
Oil Reserves (mean)		0.062			
		(0.123)			
Oil Reserves (difference)		-0.041			
		(0.031)			
Oil Production / GDP (mean)			-0.188***		
			(0.063)		
Oil Production / GDP (difference)			0.063		
			(0.043)		
Oil Production (further)				0.000	
				(0.001)	
Oil Production (closer)				-0.001	
				(0.001)	
Oil Reserves (further)					0.020
					(0.035)
Oil Reserves (closer)					0.018
					(0.034)
Observations	9580	7089	9240	9580	7089
R-squared	0.167	0.181	0.161	0.166	0.181

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. The oil variables are constructed using all oil fields (onshore and offshore). All explanatory variables are taken as first lag. All specifications control for intercept, annual time dummies, country fixed effects for each country of the dyad, the average and the absolute difference of land areas in the pair, the average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 4: Robustness with respect to oil quantities

enter into (potentially) border-changing conflict with a view of capturing each other's oil. But even *ex-ante* borders, i.e. borders drawn before countries have made conflict-peace decisions, could have been influenced by the location of oil. For example, a country with more bargaining power might have insisted on deviating somewhat from "natural" borders in order to insure oil fields remained on its side. Or, colonial powers might have chosen to draw post-colonial borders so as to make sure that oil fields are located in the country more likely to be friendly to its interests - or perhaps so as to divide the oil fields between the two countries in order to diversify the risk of disruption arising from turbulence in any one country.

In order to address these concerns, we follow three distinct strategies. The first strategy is to focus on observations were we know that the border predates the discovery of oil. The second strategy is to focus on observations in which the border has the physical appearance of a natural border. The third strategy is to focus on observations in which the distance variables are distances of the oil from a coastline, which are necessarily exogenous.

We begin with borders that were drawn/set *before* the oil was discovered. If the parties do not know the oil is there, they cannot be influenced by its presence when drawing the border or fighting over territory. We implement two versions of this idea in columns (1)-(2) and, respectively, (3)-(4) of Table 5. In columns (1)-(2) we drop from our sample all observations featuring a border that has changed subsequently to the first oil discovery in either country in the pair. More specifically, we use information from Lujala et al. (2007) to identify the date at which oil was first discovered in either country in the pair, and we use information from Tir et al. (1998) to identify all dates at which borders changed between the two countries. We then drop from the analysis all observations dated after the first border change following the first oil discovery.[37] The results of columns (1)-(2)

[37]Hence, if t_{oil} is the date at which oil was first discovered in either country, and t_1, t_2, t_3, ... are the *ordered* dates of border changes (i.e. $t_i > t_{i-1}$), we (i) define $\tilde{\imath}$ such that $t_{\tilde{\imath}-1} < t_{oil}$ and $t_{\tilde{\imath}} \geq t_{oil}$, and (ii) drop all observations dated $t > t_{\tilde{\imath}}$. Note that if oil was discovered in a country pair before 1946, and the border experienced one or more changes between the date of discovery and 1946, the country pair is dropped entirely from the analysis. Also note that we do not observe border changes before 1816, so t_1 is the first border change after 1816. However oil was a nearly valueless commodity before 1816 so any

show that our key findings are statistically and economically robust to dropping borders that changed after oil discoveries.[38]

The exercise in columns (1)-(2) is suitable to remove concerns with *ex-post* endogeneity, i.e. with border changes in response to oil discoveries. However, it is still potentially vulnerable to *ex-ante* endogeneity, i.e. with the position of the oil affecting the drawing of the original borders. To address ex-ante endogeneity, in columns (3)-(4) we further drop all country pairs which first came to share a border (for example when one or both countries first came into existence) after oil was first discovered in either of them.[39] Again, despite the substantial drop in sample size, our headline results on minimum distance turn out to be robust.

Our second strategy to assess the threat to identification posed by endogenous borders is to drop country pairs whose borders "look artificial". This strategy, inspired by recent work by Alesina et al. (2011), consists of building, for each bilateral land border, a measure of the deviation of the actual border from a relatively smooth arc (see Appendix A for a detailed description). We name this variable "border snakiness." The idea is that the smoother the border (the less "snaky" it is), the more likely it is to have been designed artificially, while the more "snaky" it is, the more likely it is to follow natural geographical features like mountain ridges or rivers. Based on this reasoning, in columns (5)-(6) we re-

border change before that date cannot conceivably have been motivated by oil.

[38]The removal of borders which changed after oil discoveries, as well as the other strategies examined in Table 5, involves a significant drop in sample size. Our full set of controls induces further losses due to missing values. For these reasons, we include in the table specifications with no controls alongside our benchmark specifications with controls.

[39]Following on the same notation, denote now t_0 the date at which the border between two countries first came in existence. We now drop all the same observations as in columns (1) and (2) and, in addition, all those satisfying $t_{oil} \leq t_0$. As before, however, all pairs where the border was drawn before 1816 (which is the start date of the Correlates of War data on state creation) are kept in the analysis, on the ground that oil could not have influenced these borders even if its presence was known at the time. To find out the earliest establishment of current borders for all pairs, we have used data from Strang (1991), Correlates of War (2010), CIA (2012) and Encyclopedia Britannica (2012). Note that we use the date of the first drawing of the currently active borders, even if this date is earlier than independence, e.g. when borders were already drawn in colonial times.

estimate our baseline specifications only on the subset of country pairs with above median snakiness. Once again despite the massive loss of sample size, the key results appear robust (except for the coefficient on "Both x MinDist," which loses significance in the specification with the full set of controls).

Our third and final strategy to assuage concerns with endogeneity builds on the fact that coastlines, as opposed to land borders, are (mostly) exogenous to human activity. Recall that our sample contains both country pairs that share a land border and country pairs that do not share a land border but are separated by less than 400 miles of water. In the latter case, by construction, all our oil distance variables are distances of oil fields to the other country's coastline. Because both the oil location, and the position of the coastline are natural phenomena, it is difficult to think of plausible mechanisms that would lead these distances to respond to incentives by the two countries in the pair. Accordingly, in columns (7)-(8) we re-estimate our main specifications on the subsample of pairs that do not share a land border.[40] Even with this most restrictive criterion for inclusion in the sample we find that our headline results largely hold (except for the last column where the reduction in sample size is most extreme and where our key variables now narrowly miss the 10% significance threshold).

[40] Note that by construction the subset for the results in columns (7) and (8) is a strict subsample of the corresponding samples in the other columns of this table. This is because we have treated coastlines as pre-existing any oil discovery (so all country pairs without a land border are retained in columns (1)-(4)) and because we have treated all bodies of water separating countries (other than rivers) as "natural," and hence assigned maximum snakiness to country pairs that do not share a land border (so all country pairs without a land border are included in columns (5)-(6)). Recall that only about 40% of country pairs do not share a land border. It may also be appropriate to note that in this subsample about 50% of the pairs have the closest oil onshore.

	Dependent variable: Hostility							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
One	0.052*	0.087**	0.019	0.042	0.130***	0.081**	0.072**	0.191
	(0.029)	(0.034)	(0.027)	(0.026)	(0.037)	(0.032)	(0.031)	(0.117)
One x Dist	-0.079***	-0.103***	-0.042*	-0.061**	-0.127***	-0.084***	-0.061**	-0.195
	(0.027)	(0.032)	(0.024)	(0.024)	(0.035)	(0.029)	(0.025)	(0.122)
Both	0.045*	0.036	0.007	0.012	0.164***	0.045	0.154***	0.055
	(0.026)	(0.026)	(0.023)	(0.027)	(0.052)	(0.034)	(0.056)	(0.038)
Both x MinDist	-0.100***	-0.055**	-0.083***	-0.061***	-0.135**	-0.038	-0.157**	-0.023
	(0.030)	(0.025)	(0.028)	(0.023)	(0.062)	(0.042)	(0.073)	(0.039)
Both x MaxDist	-0.011	-0.025	0.026	0.009	-0.018	-0.028	0.016	-0.044
	(0.038)	(0.030)	(0.030)	(0.026)	(0.071)	(0.051)	(0.081)	(0.046)
Sample	No border changes after oil discovery		No border changes after oil discovery, historical borders older than oil discovery or 1816		Removed 50% with least "snaky" border		Only country pairs without land border	
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	16504	9482	11771	7266	9907	5399	8168	4341
R-squared	0.151	0.149	0.231	0.148	0.187	0.203	0.172	0.148

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. The oil variables are constructed using all oil fields (onshore and offshore). All explanatory variables are taken as first lag. All specifications control for intercept, annual time dummies, country fixed effects for each country of the dyad, and the average and the absolute difference of land areas in the pair. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 5: Controlling for potentially endogenous or artificial borders

4 Conclusions

In this paper we have studied the effect of natural resource endowments, as well as their geographic distribution, on the risk of inter-state conflict. We have built a simple model that predicts the risk of inter-state disputes to be largest in the presence of natural resource *asymmetry*. The most dangerous situations are the ones where only one country of the pair has oil, and this oil is close to the border. When both countries have oil, conflict risk is maximal when the location of oil fields is maximally asymmetric.

We have tested these predictions empirically with a novel geo-referenced dataset designed to capture these geographical asymmetries. Controlling for a battery of determinants of bilateral conflict, as well as country fixed effects and annual time dummies, we find large quantitative effects from asymmetric oil location. For example, country pairs where only one country has oil near the border are as much as three to four times more likely to engage in conflict than country pairs with no oil, or where the oil is very far from the border, or when both countries have oil near the border. These results are robust to several strategies to deal with the potential endogeneity of bilateral borders.

While our theoretical model is novel and has the advantage of simplicity, it also has several limitations. The theoretical framework is static, and is thus unable to capture a host of interesting dynamic effects, particularly as regards the endogenous evolution of borders and, hence, country size and location [e.g. Alesina and Spolaore (2003)]. This is a priority for future work.[41] Empirically, the priority is to complement our data on oil field location with data on oil field size and reserves. In addition, our theory applies equally, and our empirical methods could be usefully applied to, mineral natural resources other than oil. Finally, one could enrich the geographic dimension of both theory and empirics. For example, our analysis is silent on the location of oil fields vis-a-vis the country capital, but recent work suggests a weakening of political and institutional links away from the capital [Campante et al. (2013), Campante and Do (2014), Michalopoulos

[41] In the Online Appendix we take a first step towards a dynamic model, via a dynamic extension with discrete geography. The qualitative predictions of the static model are robust, but even this simple extension promises to generate additional interesting predictions that we plan to pursue in future work.

and Papaioannou (2014)], which might have implications for the propensity of peripheral areas to be targets of foreign military action.

References

[1] Acemoglu, Daron, Michael Golosov, Aleh Tsyvinski, and Pierre Yared, 2012, "A Dynamic Theory of Resource Wars", *Quarterly Journal of Economics* 127, 283-331.

[2] Alesina, Alberto, William Easterly and Janina Matuszeski, 2011, "Artificial States", *Journal of the European Economic Association* 9, 246-77.

[3] Alesina, Alberto, Michalopoulos, Stelios and Elias Papaioannou, 2012, "Ethnic Inequality," NBER WP 18512.

[4] Alesina, Alberto, and Enrico Spolaore, 2003, *The Size of Nations*, MIT Press.

[5] Anderson, Ewan, 1999, "Geopolitics: International Boundaries as Fighting Places", *Journal of Strategic Studies* 22, 125-136.

[6] Bakeless, John Edwin, 1921, *The economic causes of modern war: a study of the period: 1878-1918*, New York: Moffat, Yard and company.

[7] Baliga, Sandeep, David Lucca, and Tomas Sjöström, 2011, "Domestic Political Survival and International Conflict: Is Democracy Good for Peace?", *Review of Economic Studies* 78, 458-486.

[8] Barbieri, Katherine, and Omar Keshk, 2012, Correlates of War Project Trade Data Set Codebook, Version 3.0, http://correlatesofwar.org.

[9] BBC, 2011, "Western Sahara Profile", http://www.bbc.co.uk/news/world-africa-14115273 (9 December 2011).

[10] Beviá, Carmen, and Luis Corchón, 2010, "Peace Agreements without Commitment". *Games and Economic Behavior* 68, 469–487.

[11] Besley, Timothy, and Torsten Persson, 2009, "The Origins of State Capacity: Property Rights, Taxation, and Politics", *American Economic Review* 99, 1218-1244.

[12] Bozzoli, Carlos, Tilman Brueck, and Simon Sottsas, 2010, "A Survey of the Global Economic Costs of Conflict", *Defence and Peace Economics* 21, 165-176.

[13] British Petroleum, 2009, "BP Statistical Review of World Energy June 2009", dataset, http://www.bp.com/statisticalreview.

[14] Bueno de Mesquita, Bruce, and David Lalman, 1992, *War and Reason*, New Haven: Yale University Press.

[15] Campante, Filipe, and Quoc-Anh Do, 2014, "Isolated Capital Cities, Accountability, and Corruption: Evidence from US States," *American Economic Review*, forthcoming.

[16] Campante, Filipe, Bernardo Guimaraes, and Quoc-Anh Do, 2013, "Isolated Capital Cities and Misgovernance: Theory and Evidence," unpublished, Harvard University.

[17] Carter Center, 2010, "Approaches to Solving Territorial Conflicts: Sources, Situations, Scenarios, and Suggestions", mimeo, Carter Center.

[18] Caselli, Francesco, and Guy Michaels, 2013, "Do Oil Windfalls Improve Living Standards? Evidence from Brazil," *American Economic Journal: Applied Economics* 5, 208-238.

[19] Chassang, Sylvain, and Gerard Padró i Miquel, 2010, "Conflict and Deterrence under Strategic Risk," *Quarterly Journal of Economics* 125, 1821-1858.

[20] CIA, 2012, "World Factbook", dataset, https://www.cia.gov/library/publications/the-world-factbook/.

[21] Colgan, Jeff, 2010, "Oil and Revolutionary Governments: Fuel for International Conflict", *International Organization* 64, 661-694.

[22] Conconi, Paola, Nicolas Sahuguet, Maurizio Zanardi, 2012, "Democratic Peace and Electoral Accountability", *Journal of the European Economic Association*, forthcoming.

[23] Correlates of War, 2010, "Correlates of War Project", dataset, http://www.correlatesofwar.org/.

[24] Cotet, Anca M., and Kevin K. Tsui, 2013, "Oil and Conflict: What Does the Cross Country Evidence Really Show?," *American Economic Journal: Macroeconomics* 5, 49-80.

[25] De Soysa, Indra, Erik Gartzke, and Tove Grete Lie, 2011, "Oil, Blood, and Strategy: How Petroleum Influences Interstate Conflict", mimeo, Norwegian University of Science and Technology, Trondheim, and UCSD.

[26] Dube, Oendrila, and Juan Vargas, 2013, "Commodity Price Shocks and Civil Conflict: Evidence from Colombia", *Review of Economics Studies* 80, 1384–1421.

[27] Encyclopedia Britannica, 2012, "Encyclopedia Britannica - Academic Edition", encyclopedia, http://www.britannica.com/.

[28] ESRI-USC, 1996, "Giant fields of the world", digital database, technical report 95-472. Columbia, SC: Earth Sciences and Resource Institute, University of South Carolina.

[29] Esteban, Joan, Massimo Morelli, and Dominic Rohner, 2012, "Strategic Mass Killings", mimeo, IAE, Columbia University and University of Zurich.

[30] Fearon, James, 1995, "Rationalist Explanations for War", *International Organization* 49, 379-414.

[31] Fearon, James, 1996, "Bargaining over Objects that Influence Future Bargaining Power", unpublished, University of Chicago.

[32] Fearon, James, 1997, "Signaling Foreign Policy Interests: Tying Hands versus Sinking Costs", *Journal of Conflict Resolution* 41, 68-90.

[33] Franco, Jeffrey, 1997, "Peru Ecuador Border Dispute", ICE Case Studies 5.

[34] Gartzke, Erik, 2007, "The Capitalist Peace", *American Journal of Political Science* 51, 166-91.

[35] Gartzke, Erik, and Dominic Rohner, 2011, "The Political Economy of Imperialism, Decolonization, and Development", *British Journal of Political Science* 41, 525-556.

[36] Gaubatz, Kurt Taylor, 1991, "Election Cycles and War", *Journal of Conflict Resolution* 35, 212-244.

[37] Gowa, Joanne, 1999. *Ballots and Bullets: The Elusive Democratic Peace*. Princeton: Princeton University Press.

[38] Harari, Mariaflavia and Eliana La Ferrara, 2012, "Conflict, Climate and Cells: A disaggregated analysis", mimeo, Bocconi University.

[39] Heston, Alan, Robert Summers, and Bettina Aten, 2009, Penn World Table Version 6.3, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

[40] Hirshleifer, Jack, 1991, "The Technology of Conflict as an Economic Activity," *American Economic Review* 81, 130-134.

[41] Jackson, Matthew O. and Massimo Morelli, 2007, "Political Bias and War", *American Economic Review* 97, 1353-73.

[42] Jackson, Matthew O. and Massimo Morelli, 2010, "The Reasons of Wars - An Updated Survey", in Chris Coyne (ed.), *Handbook on the Political Economy of War*, Cheltenham UK: Edward Elgar Publishing.

[43] Kaldor, Mary, Terry Karl, and Yahia Said, 2007, *Oil Wars*, London: Pluto.

[44] Klare, Michael, 2002, *Resource Wars: The New Landscape of Global Conflict*, New York: Holt.

[45] Kocs, Stephen, 1995, "Territorial Disputes and Interstate War, 1945-1987", *Journal of Politics* 57, 159-175.

[46] Lujala, Päivi, Jan Ketil Rod and Nadja Thieme, 2007, "Fighting over Oil: Introducing a New Dataset", *Conflict Management and Peace Science* 24, 239-56.

[47] Mandel, Robert, 1980, "Roots of the Modern Interstate Border Dispute", *Journal of Conflict Resolution* 24, 427-454.

[48] Maoz, Zeev, 2005, "Dyadic MID Dataset (version 2.0)", http://psfaculty.ucdavis.edu/zmaoz/dyadmid.html.

[49] Maoz, Zeev and Bruce Russett, 1993, "Normative and Structural Causes of Democratic Peace, 1946-1986", *American Political Science Review* 87, 624-38.

[50] Martin, Philippe, Thierry Mayer, and Mathias Thoenig, 2008, "Make Trade not War?", *Review of Economic Studies* 75, 865-900.

[51] Mayer, Thierry, and Soledad Zignago, 2011, "Notes on CEPII's distances measures (GeoDist)", CEPII Working Paper 2011-25, data available under: http://www.cepii.fr/anglaisgraph/bdd/distances.htm#sthash.yi5CHEGw.dpuf.

[52] McLaughlin Mitchell, Sara, and Brandon Prins, 1999, "Beyond Territorial Contiguity: Issues at Stake in Democratic Militarized Interstate Disputes", *International Studies Quarterly* 43, 169-183.

[53] Michalopoulos, Stelios, and Elias Papaioannou, 2014, "National Institutions and Subnational Development in Africa," *Quarterly Journal of Economics* 129, 151-213.

[54] Michaels, Guy, and Yu-Hsiang Lei, 2011, "Do Giant Oilfield Discoveries Fuel Internal Armed Conflicts?", mimeo, LSE.

[55] Morelli, Massimo, and Dominic Rohner, 2014, "Resource Concentration and Civil Wars", mimeo, Columbia University and University of Lausanne.

[56] OPEC, 2012, "OPEC member countries", website, http://www.opec.org/opec_web/en/about_us/25.htm.

[57] Petroleum Economist, 2003, *World Energy Atlas*, London: Petroleum Economist.

[58] Ploeg, Frederick van der, 2011, "Natural Resources: Curse or Blessing?", *Journal of Economic Literature* 49, 366–420.

[59] Ploeg, Frederick van der, and Dominic Rohner, 2012, "War and Natural Resource Exploitation," *European Economic Review* 56, 1714-1729.

[60] Polachek, Solomon, 1980, "Conflict and Trade", *Journal of Conflict Resolution* 24, 55-78.

[61] Polity IV, 2009, "Political Regime Characteristics and Transitions, 1800-2007", Dataset, www.systemicpeace.org/polity4.

[62] Potter, Philip, 2007, "Does Experience Matter? American Presidential Experience, Age, and International Conflict", *Journal of Conflict Resolution* 51, 351-378.

[63] Powell, Robert, 1996, "Uncertainty, Shifting Power, and Appeasement", *The American Political Science Review* 90, 749-764.

[64] Powell, Robert, 2006, "War as a Commitment Problem", *International Organization* 60, 169-203.

[65] Price, Felicia, 2005, "The Bakassi Peninsula: The Border Dispute between Nigeria and Cameroon", ICE Case Studies 163.

[66] Rohner, Dominic, Mathias Thoenig, and Fabrizio Zilibotti, 2013, "War Signals: A Theory of Trade, Trust and Conflict", *Review of Economic Studies* 80, 1114-1147.

[67] Ross, Michael, 2012, *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations*, Princeton: Princeton University Press.

[68] Skaperdas, Stergios, 1992, "Cooperation, Conflict, and Power in the Absence of Property Rights", *American Economic Review* 82, 720-39.

[69] Skaperdas, Stergios, and Constantinos Syropoulos, 2001, "Guns, Butter, and Openness: On the Relationship between Security and Trade", *American Economic Review* 91, 353-357.

[70] Spolaore, Enrico, and Romain Wacziarg, 2009, "The Diffusion of Development", *Quarterly Journal of Economics* 124, 469-529.

[71] Spolaore, Enrico, and Romain Wacziarg, 2013, "War and Relatedness," unpublished, UCLA.

[72] Stinnett, Douglas, Jaroslav Tir, Philip Schafer, Paul Diehl, and Charles Gochman, 2002, "The Correlates of War Project Direct Contiguity Data, Version 3", *Conflict Management and Peace Science* 19, 58-66.

[73] Strang, David, 1991, "Global Patterns of Decolonization, 1500-1987", *International Studies Quarterly* 35, 429-454.

[74] Tir, Jaroslav, 2003, "Averting Armed International Conflicts Through State-to-State Territorial Transfers", *Journal of Politics*, 65, 1235-1257.

[75] Tir, Jaroslav, Philip Schafer, Paul F. Diehl and Gary Goertz, 1998, "Territorial Changes, 1816-1996: Procedures and Data", *Conflict Management and Peace Science* 16, 89-97.

[76] Tomz, Michael, Gary King, and Langche Zeng, 2003, "ReLogit: Rare Events Logistic Regression", *Journal of Statistical Software* 8, 1–27.

[77] Uppsala Conflict Data Program, 2011, "UCDP/PRIO Armed Conflict Dataset v.4-2011, 1946 – 2010", dataset, http://www.pcr.uu.se/research/ucdp/datasets /ucdp_prio_armed_conflict_dataset/.

[78] USGS, 2000, "U.S. Geological Survey world petroleum assessment 2000—Description and results", U.S. Geological Survey World Energy Assessment Team. USGS Digital Data Series DDS-60. Multi Disc Set. Version 1.1. http://pubs.usgs.gov/dds/dds-060/.

[79] Weede, Erich, 1973, "Nation-Environment Relations as Determinants of Hostilities Among Nations", *Peace Science Society (International) Papers* 20, 67-90.

[80] Weidmann, Nils, Doreen Kuse, and Kristian Skrede Gleditsch, 2010, "The Geography of the International System: The CShapes Dataset", *International Interactions* 36, 86-106.

[81] Westing, Arthur, 1986, *Global Resources and International Conflict: Environmental Factors in Strategic Policy and Action*, Oxford: Oxford University Press.

[82] World Bank, 2009, "World Development Indicators", dataset, http://go.worldbank.org/U0FSM7AQ40.

[83] Wright, Quincy, 1942, *A Study of War*, Chicago: University of Chicago Press.

Appendix A: Data

This appendix describes the variables used in section 3, and provides summary descriptive statistics in Table 6.

4.1 Dependent Variables

The dependent variables, "Hostility", "War", "Hostility+" and "Dispute intensity" have been explained in detail in subsection 3.1. We now explain the dependent variables used in Appendices B and C, respectively.

"Revisionist" (*"Attacker"*) [*"Initiator"*]: We use the variables revstata and revstatb (sidea and sideb) [rolea and roleb] from Maoz (2005) which take values 1 if state A and, respectively, state B are deemed to seek to change the borders (be on the side of the initiator) [be the conflict's initiator], and 0 otherwise. Note that it is possible that in a country pair either both, one or neither of the countries are revisionist (attacker) [initiator]. We construct our dependent variable for Appendix B as the difference between the dummy for the first-listed country in the pair (country A) and the dummy for the second-listed country (country B). This variable can be interpreted as a measure of relative aggressiveness of country A. This allows us to run a specification quite similar in spirit to the benchmark model we used for the other dependent variables. In particular, we estimate the impact on the relative aggressiveness of A of: oil in country A, distance of country A's oil to the border, oil in country B, and distance of country B's oil to the border.

"Territorial Change": Our dependent variable for Appendix C is a dummy taking a value of 1 if there has been a territorial change in a given pair year. From Tir et al. (1998), version 4.01 obtained from http://www.correlatesofwar.org/.

4.2 Explanatory Variables

The explanatory variables One, Both, Dist, MinDist, and MaxDist have also been described in the detail in the main text. The others are as follows.

"Land area": In 1000 Square kilometers. From World Bank (2009).

"GDP per Capita": Real Gross Domestic Product per Capita (in 1000), Current Price National Accounts at PPPs. From Heston et al. (2009).

"*Population":* In Millions. From Heston et al. (2009).

"Capabilities": Capability scores from Correlates of War (2010).

"*Polity Score":* Democracy scores ranging from -10 (strongly autocratic) to +10 (strongly democratic). From Polity IV (2009).

"Number of years since the last hostility, resp. war between the countries in the pair":

Authors' calculations, based on the "hostility", "war", resp. "hostility (broad definition)" variables.

"Bilateral trade /GDP": Sum of total bilateral trade between the two countries of the pair divided by the sum of their total GDPs. Bilateral trade data from Barbieri and Keshk (2012), GDP data from Heston et al. (2009).

"Genetic distance between the populations of the two countries": Genetic distance between current plurality groups (variable "fst_distance_dominant"), from Spolaore and Wacziarg (2009).

"Defensive pact": Dummy taking a value of 1 if the countries of the pair are together in a defense pact, and 0 otherwise. From Correlates of War (2010).

"Historical inclusion in the same country, kingdom or empire": Dummy variable taking value 1 if countries were or are the same country (variable "smctry"), from Mayer and Zignago (2011).

"Having been in a colonial relationship": Dummy variable taking value 1 for pairs that were ever in colonial relationship (variable "colony"), from Mayer and Zignago (2011).

"CW1": Dummy with value of 1 if there is a civil war in one country of the pair, and 0 otherwise. Constructed using data from Uppsala Conflict Data Program (2011).

"CW2": Dummy with value of 1 if there is a civil war in both countries of the pair, and 0 otherwise. Constructed using data from Uppsala Conflict Data Program (2011).

"OPEC1": Dummy with value of 1 if one country in the pair is an OPEC member, and 0 otherwise. From OPEC (2012).

"OPEC2": Dummy with value of 1 if both countries in the pair are OPEC members, and 0 otherwise. From OPEC (2012).

"Oil production": In 10 million tones (mean = 3). From British Petroleum (2009).

"Oil reserves": In 100 billion barrels. From British Petroleum (2009).

"Oil production/GDP": Total value of current oil production / GDP. Production quantities and prices from British Petroleum (2009), corresponding GDP in current prices from World Bank (2009).

"Border snakiness": Authors' calculations. Using the geo-referenced shapes of bilateral country borders from Weidmann et al. (2010), we compute an index of bilateral border snakiness, using the following formula: "Border snakiness" = "Actual bilateral border

length" / (0.5 * "Convex hull below the bilateral border" + 0.5 * "Convex hull above the bilateral border"). This measure takes a value of 1 when the border is a straight line, while its value increases when the border becomes more winding, resp. snaky.

Appendix B: Directed Dyads

The results of the regressions with directed dyads are displayed in Table 7.

Appendix C: Border Changes

The results of the regressions with border changes are displayed in Tables 8 and 9.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Hostility	20564	0.057	0.233	0	1
War	24387	0.004	0.066	0	1
Hostility+ (Int. 3, 4 and 5)	20564	0.072	0.259	0	1
Hostility scale (cont.)	20564	0.284	1.014	0	5
State A revisionist	19965	0.011	0.216	-1	1
State A attacker	19965	0.006	0.263	-1	1
State A initiator	19965	0.008	0.256	-1	1
Border change	24387	0.004	0.061	0	1
One	24387	0.349	0.477	0	1
One x Dist	24387	0.285	0.424	0	1
Both	24387	0.512	0.500	0	1
Both x MinDist	24387	0.253	0.382	0	1
Both x MaxDist	24387	0.332	0.431	0	1
Land area (mean)	24366	1330.520	2277.200	0.300	13365.100
Land area (diff)	24366	1928.770	3909.240	0.010	17055.200
GDP p.c. (mean)	18075	6.099	7.219	0.108	80.983
GDP p.c. (diff)	18075	3.941	5.982	0	99.604
Pop. (mean)	20418	31.991	63.520	0.053	682.280
Pop. (diff)	20418	45.064	109.178	0.003	1129.500
Capabilities (mean)	20489	0.013	0.024	0	0.200
Capabilities (diff)	20489	0.019	0.040	0	0.362
Democracy (mean)	20055	0.086	6.508	-10	10
Democracy (diff)	20055	5.499	6.063	0	20
Bilat. Trade / GDP	17201	0.003	0.007	0	0.121
Genetic distance	23566	374.012	563.105	0	2908
Defensive pact	19948	0.389	0.488	0	1
Ever same country	22738	0.156	0.363	0	1
Colonial relation	22738	0.062	0.242	0	1
Civil war 1	24387	0.263	0.440	0	1
Civil war 2	24387	0.041	0.197	0	1
OPEC 1	24387	0.134	0.340	0	1
OPEC 2	24387	0.025	0.157	0	1
Oil prod. (mean)	19547	2.850	5.975	0	52.175
Oil prod. (diff)	19547	4.674	9.930	0	56.950
Oil res. (mean)	15606	0.088	0.252	0	2.014
Oil res. (diff)	15606	0.139	0.396	0	2.643
Oil/GDP (mean)	18600	0.061	0.125	0	1.125
Oil/GDP (diff)	18600	0.077	0.149	0	1.213
Border snakiness	24387	1.929	0.744	1	2.757

Table 6: Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	State A revisionist				State A attacker				State A initiator			
Oil A	-0.022	-0.012	-0.044**	-0.034**	-0.006	-0.018	-0.022	-0.041***	-0.006	-0.016	-0.024	-0.041***
	(0.014)	(0.010)	(0.019)	(0.017)	(0.015)	(0.014)	(0.017)	(0.015)	(0.015)	(0.015)	(0.016)	(0.015)
Oil A x MinDist A	0.033**	0.022	0.032**	0.045***	0.027*	0.018	0.033*	0.040***	0.029*	0.019	0.037**	0.041***
	(0.016)	(0.015)	(0.016)	(0.015)	(0.015)	(0.015)	(0.017)	(0.013)	(0.016)	(0.015)	(0.016)	(0.013)
Oil B	0.031*	0.003	-0.004	0.000	0.008	-0.010	-0.007	-0.010	0.004	-0.012	-0.014	-0.017
	(0.017)	(0.022)	(0.014)	(0.016)	(0.018)	(0.017)	(0.020)	(0.018)	(0.018)	(0.017)	(0.019)	(0.018)
Oil B x MinDist B	-0.035**	-0.018	-0.025*	-0.022*	-0.014	-0.005	-0.021	-0.023	-0.011	-0.001	-0.017	-0.016
	(0.017)	(0.021)	(0.014)	(0.013)	(0.017)	(0.016)	(0.017)	(0.016)	(0.018)	(0.016)	(0.017)	(0.017)
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303
R-squared	0.006	0.022	0.058	0.089	0.005	0.014	0.046	0.048	0.006	0.017	0.048	0.054

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. The oil variables are constructed using all oil fields (onshore and offshore). All explanatory variables are taken as first lag. The dependent variable in the columns 1-4 is the dummy for country A being revisionist minus the dummy for country B being revisionist (hence the dependent variable takes values of -1, 0, and 1). The construction of the dependent variable is analogous for columns 5-8 and 9-12 with being attacker, resp. initiator instead of revisionist as underlying variable. All specifications control for intercept, land areas of both countries and annual time dummies. Additional controls for each country in the pair are: Population, GDP per capita, democracy score, capabilities, dummy for having a civil war, dummy for being OPEC member, and all the controls at the country pair level, which are, years since the last hostility in the country pair, bilateral trade / GDP, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, and dummy for having been in a colonial relationship.

Table 7: Regressions with Directed Dyads

	(1)	(2)	(3)	(4)
	Dependent variable: Border Change			
Hostility	0.018***		0.015***	
	(0.006)		(0.004)	
War		0.070***		0.064***
		(0.022)		(0.020)
Country FE	No	No	Yes	Yes
Observations	20564	24387	20564	24387
R-squared	0.013	0.014	0.033	0.031

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2008. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All specifications control for intercept and annual time dummies.

Table 8: Conflict and Border Changes

	Dependent variable: Border change											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.002	0.001	0.004	0.005*	0.014*	0.014*	0.017**	0.020*	0.002	0.001	0.004	0.005
	(0.002)	(0.002)	(0.003)	(0.003)	(0.007)	(0.009)	(0.007)	(0.011)	(0.002)	(0.002)	(0.003)	(0.004)
One x Dist	-0.002	-0.001	-0.003	-0.004	-0.016**	-0.016*	-0.019**	-0.021**	-0.003	-0.001	-0.003	-0.004
	(0.002)	(0.001)	(0.002)	(0.003)	(0.008)	(0.009)	(0.007)	(0.009)	(0.002)	(0.002)	(0.003)	(0.004)
Both	0.006***	0.006**	0.013***	0.008*	0.006	0.001	0.011**	0.004	0.005**	0.006**	0.011**	0.008
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.005)	(0.005)	(0.002)	(0.003)	(0.005)	(0.006)
Both x MinDist	0.000	-0.002	-0.001	-0.002	0.002	0.000	0.000	-0.002	-0.003	-0.004	-0.004	-0.002
	(0.003)	(0.005)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.004)	(0.006)	(0.003)	(0.004)
Both x MaxDist	-0.006*	-0.005	-0.009***	-0.005	-0.008	-0.002	-0.010*	0.000	-0.002	-0.003	-0.006*	-0.006
	(0.003)	(0.004)	(0.003)	(0.005)	(0.006)	(0.004)	(0.006)	(0.003)	(0.004)	(0.004)	(0.003)	(0.005)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	23768	11303	23768	11303	23768	11303	23768	11303	23768	11303	23768	11303
R-squared	0.011	0.011	0.027	0.035	0.012	0.012	0.027	0.037	0.011	0.011	0.026	0.035

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2008. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All explanatory variables are taken as first lag. All specifications control for the average and the absolute difference of land areas in the pair, intercept and annual time dummies. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last border change in the country pair.

Table 9: Oil Location and Border Changes

Online Appendix for
The Geography of Inter-State Resource Wars

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1 Endogenous Armament

The model is identical to the model in the paper, except that we introduce a new stage at the very beginning. In this new first stage, each country decides how much to invest in armaments. Armament spending by country i is denoted by W_i. It carries a cost $\gamma(W_i)$. The two countries' spending in armaments affect the distribution of Z.

Assumption 1.1 *Z is a continuous random variable with domain $\mathbb{R}$, density $f(Z; W_A, W_B)$, and cumulative distribution function $F(Z; W_A, W_B)$.*

Following the choices of W_A and W_B, the game proceeds exactly as in the baseline model. Hence, if the outcome is peace, the payoffs are $R_A - \gamma(W_A)$ for country A, and $R_B - \gamma(W_B)$ for country B. If there has been a war, the payoffs are:

$$
\begin{aligned}
U_A^C &= R_A I(Z > G_A) + R_B I(Z > G_B) + c_A - \gamma(W_A), \\
U_B^C &= R_A I(Z < G_A) + R_B I(Z < G_B) + c_B - \gamma(W_B).
\end{aligned}
$$

where I is an indicator function.

In the second stage of the game the players take W_A and W_B as given. Hence, following the identical logic of the Proposition in the main text, we see that the probability of peace is

$$
\begin{aligned}
P(G_A, G_B, R_A, R_B; W_A, W_B) &= H(-x)H(x) \\
x &= R_B\left[1 - F(G_B; W_A, W_B)\right] - R_A F(G_A; W_A, W_B),
\end{aligned}
$$

and it is decreasing in the absolute value of x.

In the first stage, each country i chooses W_i. Country B's problem is

$$\max_{W_B} \left\{ \begin{array}{c} [1 - P(G_A, G_B, R_A, R_B; W_A, W_B)] \left[R_A F(G_A; W_A, W_B) + R_B F(G_B; W_A, W_B)\right] \\ +P(G_A, G_B, R_A, R_B; W_A, W_B) R_B - \gamma(W_B) \end{array} \right\},$$

which can be rewritten as

$$\max_{W_B} \{-[1 - H(-x)H(x)]x + R_B - \gamma(W_B)\}.$$

From this, we see that even in the two-stage game with endogenous arming effort our **Remark** 2 in the baseline model still holds: the case $R_A = 0$ is isomorphic to the case $G_A \to -\infty$, and the case $R_B = 0$ is isomorphic to $G_B \to \infty$. In other words, we can just write W_A as a function of G_A and G_B, and W_B as a function of G_A and G_B. Then we can define a function $\phi(Z; G_A, G_B) \equiv F(Z; W_A(G_A, G_B), W_B(G_A, G_B))$. Accordingly, the probability of peace is

$$\begin{aligned} P(G_A, G_B) &= H(-x)H(x) \\ x &= R_B - R_B\phi(G_B; G_A, G_B) - R_A\phi(G_A; G_A, G_B). \end{aligned}$$

As in the baseline model, we set $R_A, R_B \in \{0, 1\}$. We then obtain the following predictions:

Proposition 1.1

(i) $P(G_A, \infty) \leq P(-\infty, \infty)$;

(ii) $\partial P(G_A, \infty)/\partial G_A \leq 0$ if $\phi_1(G_A; G_A, \infty) > -\phi_2(G_A; G_A, \infty)$;

(iii) $P(G_A, G_B) \leq P(-\infty, \infty)$;

(iv) $P(G_A, \infty) \leq P(G_A, G_B)$ *if and only if* $-\phi(G_A; G_A, \infty) \leq 1 - \phi(G_B; G_A, G_B) - \phi(G_A; G_A, G_B) \leq \phi(G_A; G_A, \infty)$;

(v) $\partial P(G_A, G_B)/\partial G_A \leq 0$ *if and only if either* $1 - \phi(G_A; G_A, G_B) - \phi(G_B; G_A, G_B) \leq 0$ *and* $\phi_1(G_A; G_A, G_B) \geq -\left[\phi_2(G_A; G_A, G_B) + \phi_2(G_B; G_A, G_B)\right]$ *or* $1 - \phi(G_A; G_A, G_B) - \phi(G_B; G_A, G_B) > 0$ *and* $\phi_1(G_A; G_A, G_B) < -\left[\phi_2(G_A; G_A, G_B) + \phi_2(G_B; G_A, G_B)\right]$;

where $\phi_1(x; y, z)$ is the derivative of ϕ with respect to x, and $\phi_2(x; y, z)$ is the derivative of ϕ with respect to y.

The proposition says that parts (i) and (iii) of the original proposition in the baseline model are entirely robust to endogenous arming effort (or any other endogenization of the distribution of contest success). This is not surprising. Even if the two countries can respond to oil discoveries by arming there is still a country who (weakly) expects to "do better" from war, and conflict unambiguously goes up relative to the case where neither country had oil.

Part (ii) is robust as long as $\phi_1(G_A; G_A, \infty) > -\phi_2(G_A; G_A, \infty)$. Clearly $\phi_1(G_A; G_A, \infty) > 0$ so our original prediction fails only if $\phi_2(G_A; G_A, \infty)$ is negative and large in absolute value. We can think of ϕ_1 as the "direct" effect of moving A's oil towards the border, which is to make A's oil within easier reach for country B. On the other hand, $\phi_2(G_A; G_A, \infty)$ is the "indirect" effect that occurs as the two countries endogenously change their armaments. For ϕ_2 to be negative it must be the case that the relative military strength of country A increases as country A's oil moves towards the border. This may be the case, for example, if country A responded to the movement of the oil towards the border by ramping up military spending much more than country B. Clearly both countries may have an incentive to increase military spending as country A's oil moves towards the border, but there is no particular reason to presume that country A will do more - at any rate not so much more that ϕ_2 becomes sufficiently negative for the indirect effect from endogenous arming to overcome the direct geographic effect. In the special case where the two countries have the same marginal cost from arming we expect $\phi_2 = 0$, and our original proposition goes through unchanged.

The notion of "direct" and "indirect" effects helps interpreting the new parts (iv) and (v) as well. To interpret part (iv) note that we can think of the quantity $1 - \phi(G_B; G_A, G_B) - \phi(G_A; G_A, G_B)$ as country A's (expected) net territorial gain from conflict after the discovery of oil in country B, and of $-\phi(G_A; G_A, \infty)$ as country A's (expected) loss (equal to B's expected gain) before B's oil discovery. Then the proposition says that: (i) if country A continues to be the net territorial loser after the discovery of oil in country B $[1 - \phi(G_B; G_A, G_B) - \phi(G_A; G_A, G_B) \leq 0]$, then the new discovery has reduced conflict unless B's discovery of oil on its own soil has *increased* B's benefits from conflict compared to when only A had oil. Clearly the direct effect of the discovery militates against this [this condition for less conflict is always satisfied if

$\phi(G_A; G_A, G_B) = \phi(G_A; G_A, \infty)$]. What is required is that B increases its military spending relative to A so much as to overturn the direct effect. Once again, it is not clear why this should be the case. (ii) If instead country A becomes the net territorial winner after the new discovery $[1 - \phi(G_B; G_A, G_B) - \phi(G_A; G_A, G_B) > 0]$, then the discovery in the second country has reduced conflict if B's net benefit from conflict before the discovery exceeds A's benefits after. As in the baseline model, we would expect this to be the case in most scenarios, since in the two-oil scenario both countries have something to lose from conflict, while in the one-oil scenario the net territorial winner has no territorial losses to fear.

This reasoning also allows us to easily interpret part (v). If $1 - \phi(G_A; G_A, G_B) - \phi(G_B; G_A, G_B) \leq 0$ then A is the territorial loser, and the relevant condition for increased conflict from an increase in G_A, $\phi_1(G_A; G_A, G_B) \geq -[\phi_2(G_A; G_A, G_B) + \phi_2(G_B; G_A, G_B)]$, says that the direct effect $\phi_1 > 0$ must exceed any indirect effect from endogenous arming. In particular, to reverse the predictions of the baseline model the territorial loser must respond to a movement of its oil towards the border by a disproportionate increase in armaments (so that ϕ_2 is not only negative but also large in absolute number). Again, it is hard to see why this should generally be the case. (The case were B is the territorial loser is entirely symmetric, of course).

2 A Dynamic Model

In this section we show that the sharp predictions of our model summarized in Proposition 1 extend to a dynamic setting in which a war can be followed by other wars. Given that in the model in the main text a war has a stochastic outcome, the dynamic model will continue to have that feature, but we need to "discretize" the model in order to avoid having to handle a continuum of realizations of the state variable, namely the border.

In particular, we now switch to a “finite” geography which identifies the world with the segment $[-\bar{Z}, \bar{Z}]$, $\bar{Z} > 0$, and assume that the border can take only 5 values (locations), namely $-\bar{Z}$, $-Z^*, Z_0, Z^*$, and $\bar{Z}$, with $Z_0 = 0$, $Z^* > 0$.[1] Given any distribution of oil on

[1] This discretization is for convenience but it also has the flavor of a realistic feature. Namely, in case

the space, we need to study the equilibrium strategies at the initial state of the world, Z_0 (the middle), fully anticipating the continuation war-or-peace behavior that would be taken at all other nodes $Z_t = -Z^*$ or $Z_t = Z^*$ if reached as a consequence of a war. The game has an infinite number of periods.

In case of war let p_Z denote the probability of a change of the state "one step to the right" and q_Z the probability of a shift "one step to the left", with $1 - p_Z - q_Z$ being the probability of remaining at border Z. We make the following two assumptions:

Assumption 2.1 (Equal strength) $p_Z = q_Z = p \;\; \forall z = -Z^*, Z_0, Z^*; \; p_{-\bar{Z}} = q_{-\bar{Z}} = p_{\bar{Z}} = q_{\bar{Z}} = 0.$

The expression $p_{-\bar{Z}} = q_{-\bar{Z}} = p_{\bar{Z}} = q_{\bar{Z}} = 0$ means that once a country is fully conquered it ceases to exist, implying that the border will never change anymore. The present discounted value of being conquered (and ceasing to exist) is normalized to zero, i.e. $V^A(Z = -\bar{Z}) = V^B(Z = \bar{Z}) = 0$.

Assumption 2.2 (Equal cost of war) *At time 0 there is a realization of the net benefit parameter c, from a distribution H on the real line. This parameter remains constant for the subsequent periods and it is the same for both countries.*

Both the equal strength assumption and the equal c assumption can be removed, only at the cost of more complex algebra. With these two assumptions we can focus exclusively on the role of the geographic asymmetries.

Consistent with the basic model, assume that the instantaneous utility of a country depends only on oil rents: $u^A(Z_t) = R_A I(Z_t > G_A) + R_B I(Z_t > G_B)$, where G_i, $i = A, B$ denotes the location of an oil well on the line, and I is an indicator function. It is symmetric for B.

The game starts at time 0 at Z_0 and then the two players are free to decide in every subsequent period whether to accept the current state of the world (border) or try to change

one country succeeds in moving the border, the new border is often located along the “next” natural barrier or ridge within the territory of the other country. For example, if one country manages to breach a river border, the defender are likely to retreat to the next river and retrench there.

it with a war. We shall assume that in every period one of the two players is randomly selected with equal probability to move first. This assumption serves the purpose of ruling out all weakly dominated equilibria.[2]

The timing under war is such that at the beginning of the war period the net benefit of war c (negative on average under most realistic assumptions on the distribution of c) is received, and in the same period the border shifts or stays. The instantaneous utility of the period is the one corresponding to the new border.

In terms of oil endowments, in order to mimic the situations discussed in the main text, we consider the following possibilities:

– *Case No-No:* $R_A = R_B = 0$ (no oil);

– *Case Far-No:* $R_i = 1$, $R_{-i} = 0$, $|G_i| > Z^*$ (oil only in one country, far from the border);

– *Case Close-No*: $R_i = 1$, $R_{-i} = 0$, $|G_i| < Z^*$ (oil only in one country, near the border);

– *Case Far-Far:* $R_A = R_B = 1$, $|G_A| > Z^*$, $|G_B| > Z^*$ (oil in both countries, far from the border);

– *Case Close-Close:* $R_A = R_B = 1$, $|G_A| < Z^*$, $|G_B| < Z^*$ (oil in both countries, near the border);

– *Case Far-Close:* $R_A = R_B = 1$, $|G_i| > Z^*$, $|G_{-i}| < Z^*$ (oil in both countries, one far and one near the border);

where $-i$ stands for B (A) when i stands for A (B).

Given the equal strength assumption and the equal cost of war assumption, the three asymmetric cases can be described just in terms of *endowment* and *distance*: both *case Far-No* and *case Close-No* are asymmetric in terms of endowment, but the latter case has closer oil to the initial border; *case Far-Close* does not have endowment asymmetry but only distance asymmetry.

Let us consider the Markov Perfect Equilibrium of this game, which allows players to

[2]Notice that an alternative way of ruling out weakly dominated equilibria would be to focus on a "trembling hand perfect" equilibrium refinement, which would lead to identical results. Note also that all results of the static model of the main text would be unchanged if we made there the analogous assumption of sequential moves.

consider only payoff relevant information from the history of play.This standard selection gives prominence to the state variable "border" alone.

Proposition 2.1 *There exists a unique Markov Perfect Equilibrium (MPE). In the MPE, the probability of war in period 0 is:*

1. *Highest in case Close-No;*
2. *Lowest in cases No-No, Far-Far, and Close-Close;*

Proof.

At the two absorbing one-country states the value for the unique surviving state is $V^B(-\bar{Z}) = V^A(\bar{Z}) = kR/(1-\delta)$, where k denotes the number of oil wells in the whole region, which can take values 0,1,2.[3]

Let us now describe the values at the other states. For peace in every period,

$$V^i(Z) = \frac{u^i(Z)}{1-\delta}, \quad i = A, B, \quad Z = -Z^*, Z_0, Z^*.$$

Besides these "value of peace" simple expressions, denote by $W^i(Z)$ the continuation expected value of a war starting from a border Z.

Assume first that in states Z_0 and Z^* there will always be peace, and let us derive the indifference condition in state $-Z^*$ between war and peace. We know that $V^A(-Z^*) = (u^A(-Z^*))/(1-\delta)$, and will set $V^A(-Z^*) = W^A(-Z^*)$ to find the threshold. Given that

$$W^A(-Z^*) = c + p\left[\frac{u^A(Z_0)}{1-\delta}\right] + (1-2p)\left[u^A(-Z^*) + \delta V^A(-Z^*)\right],$$

the threshold for indifference is

$$c^A_{-*} = \frac{p}{1-\delta}[2u^A(-Z^*) - u^A(Z_0)].$$

Assume now that at states $-Z^*$ and Z^* there will always be peace. Solving for the indifference threshold at state Z_0 yields:

[3] Here we normalize the oil quantity per well to R, which is slightly more general than in the baseline model, where it is normalized to 1.

$$c_0^A = \frac{p}{1-\delta}(2u^A(Z_0) - u^A(-Z^*) - u^A(Z^*)).$$

Assuming that at states $-Z^*$ and Z_0 there will always be peace, solving for the indifference threshold at state Z^* yields:

$$c_{+*}^A = \frac{p}{1-\delta}(2u^A(Z^*) - u^A(Z_0) - kR).$$

The thresholds for country B are analogous.

Consider *case No-No*: In the absence of oil, the thresholds defined above are

$$c_{-*}^A = c_0^A = c_{+*}^A = c_{-*}^B = c_0^B = c_{+*}^B = 0.$$

For any $c < 0$, i.e., whenever the net benefits of war are negative, peace is the unique Markov Perfect Equilibrium. In fact, with $c < 0$, not only it is an equilibrium to stay peaceful given the (consistent) assumptions at the adjacent nodes, but it remains a best response in case 0 even when at an adjacent node there is war.

On the other hand, whenever $c > 0$, given that the expected value of eternal peace is 0, while with positive c the expected value of seeking war is strictly positive for both players, the unique MPE involves war at every node.

Consider now *case Far-No*. The thresholds become:

$$c_{-*}^A = \frac{p}{1-\delta}R,$$

$$c_0^A = c_{+*}^A = c_0^B = c_{+*}^B = 0,$$

$$c_{-*}^B = -\frac{p}{1-\delta}R.$$

Clearly A would always have (weakly) lower incentives to start war than B. Hence, we can focus on B's incentives, which are the binding constraint for the existence of a Markov Perfect Equilibrium with peace. Clearly, when $c < -\frac{p}{1-\delta}R$, there will always exist a MPE with peace (note that this is a higher cost of war with respect to the one needed in case 0), and no other MPE can exist.

Now consider $c > -\frac{p}{1-\delta}R$. Assuming war in node $-Z^*$ and peace in node Z^*, we can derive B's indifference condition in node Z_0. The value of a war in state Z_0 is

$$W^B(Z_0) = c + p(u^B(-Z^*) + \delta W^B(-Z^*)) + p\left[\frac{u^B(Z^*)}{1-\delta}\right] + (1-2p)\left[\frac{u^B(Z_0)}{1-\delta}\right],$$

where

$$W^B(-Z^*) = c + p\frac{R}{1-\delta} + p\frac{u^B(Z_0)}{1-\delta} + (1-2p)(u^B(-Z^*) + \delta W^B(-Z^*));$$

$$W^B(-Z^*) = \frac{c + p\frac{R}{1-\delta} + p\frac{u^B(Z_0)}{1-\delta} + (1-2p)u^B(-Z^*)}{1-\delta(1-2p)}.$$

Imposing the indifference condition $W^B(Z_0) = V^B(Z_0) = (u^B(Z_0))/(1-\delta)$, we obtain

$$c = -\frac{\delta p}{1-\delta(1-3p)}\frac{p}{1-\delta}R$$

Note that $\frac{\delta p}{1-\delta(1-3p)} < 1$ always holds. Hence, for $-\frac{p}{1-\delta}R < c < -\frac{\delta p}{1-\delta(1-3p)}\frac{p}{1-\delta}R$, there will be war at state $-Z^*$, but not at states Z_0 and Z^*. For c slightly above $-\frac{\delta p}{1-\delta(1-3p)}\frac{p}{1-\delta}R$ there will be a zone where there is war in states $-Z^*$ and Z_0, but peace at state Z^*.

What matters are the war incentives at state Z_0, and hence we can conclude that in *case a* war will occur iff $c > -\frac{\delta p}{1-\delta(1-3p)}\frac{p}{1-\delta}R$.

Let us now analyze *case Close-No*, for which the peace in all periods thresholds derived above become

$$c^A_{-*} = -\frac{p}{1-\delta}R;\ c^A_0 = \frac{p}{1-\delta}R;\ c^A_{+*} = 0;$$
$$c^B_{-*} = \frac{p}{1-\delta}R;\ c^B_0 = -\frac{p}{1-\delta}R;\ c^B_{+*} = 0.$$

When $c < -\frac{p}{1-\delta}R$, there will always be peace. Now suppose that c is a bit larger. Assume that at $-Z^*$ there will be war; at Z^* instead peace. Let us compute the condition under which B is indifferent between peace and war at Z_0.

Knowing the values at the boundaries, we also know that $V^B(Z_0) = (u^B(Z_0))/(1-\delta)$ and $V^B(Z^*) = (u^B(Z^*))/(1-\delta)$. The value of war at Z_0 is

$$W^B(Z_0) = c + p[u^B(-Z^*) + \delta W^B(-Z^*)] + p\left[\frac{u^B(Z^*)}{1-\delta}\right] + (1-2p)\left(\frac{u^B(Z_0)}{1-\delta}\right),$$

where

$$W^B(-Z^*) = c + p\frac{R}{1-\delta} + p\frac{u^B(Z_0)}{1-\delta} + (1-2p)[u^B(-Z^*) + \delta W^B(-Z^*)].$$

From the condition $W^B(Z_0) = V^B(Z_0) = (u^B(Z_0))/(1-\delta)$ it follows that

$$c = -\frac{1-\delta(1-p)}{1-\delta(1-3p)}\frac{p}{1-\delta}R.$$

Note that $-\frac{1-\delta(1-p)}{1-\delta(1-3p)}\frac{p}{1-\delta}R < -\frac{\delta p}{1-\delta(1-3p)}\frac{p}{1-\delta}R$, which implies that the ex ante probability of war is higher when the oil is close to the border.

For consistency with the assumption of war at $-Z^*$, we need to also derive the indifference threshold for A at $-Z^*$ when there is war at node Z_0, and peace at Z^*. The value of war at $-Z^*$ is

$$W^A(-Z^*) = c + p[u^A(Z_0) + \delta W^A(Z_0)] + (1-2p)\left(\frac{u^A(-Z^*)}{1-\delta}\right),$$

where

$$W^A(Z_0) = c + p\frac{u^A(-Z^*)}{1-\delta} + p\frac{u^A(Z^*)}{1-\delta} + (1-2p)[u^A(Z_0) + \delta W^A(Z_0)].$$

From $W^A(-Z^*) = V^A(-Z^*) = (u^A(-Z^*))/(1-\delta)$, we obtain

$$c = -\frac{1-\delta(1-p)}{1-\delta(1-3p)}\frac{p}{1-\delta}R.$$

This means that for $c > -\frac{1-\delta(1-p)}{1-\delta(1-3p)}\frac{p}{1-\delta}R$ at $-Z^*$ there is war, as assumed for computing B's threshold at node Z_0.

In summary, in *case Close-No* war will occur at Z_0 iff $c > -\frac{1-\delta(1-p)}{1-\delta(1-3p)}\frac{p}{1-\delta}R$.

Following similar steps, it is possible to show that *case Far-Far* and *case Close-Close* are equivalent to *case No-No*.

Finally, consider *case Far-Close*, with B having oil close to the border. The peace in all periods thresholds become

$$c^A_{-*} = \frac{p}{1-\delta}R;\ c^A_0 = -\frac{p}{1-\delta}R;\ c^A_{+*} = \frac{p}{1-\delta}R;$$

$$c^B_{-*} = -\frac{p}{1-\delta}R;\ c^B_0 = \frac{p}{1-\delta}R;\ c^B_{+*} = -\frac{p}{1-\delta}R.$$

Clearly, B has always lower incentives to attack at Z_0 than A given the assumptions at the adjacent nodes. So we need to check the incentives of A to attack. Now compute the indifference threshold of A at Z_0, assuming war at both adjacent states. The value of war at Z_0 is

$$W^A(Z_0) = c + p(u^A(-Z^*) + \delta W^A(-Z^*)) + p(u^A(Z^*) + \delta W^A(Z^*)) + (1-2p)(\frac{u^A(Z_0)}{1-\delta}),$$

where

$$W^A(-Z^*) = c + p\frac{u^A(Z_0)}{1-\delta} + (1-2p)(u^A(-Z^*) + \delta W^A(-Z^*)),$$

$$W^A(Z^*) = c + p\frac{2R}{1-\delta} + p\frac{u^A(Z_0)}{1-\delta} + (1-2p)(u^A(Z^*) + \delta W^A(Z^*)).$$

From $W^A(Z_0) = V^A(Z_0)) = (u^A(Z_0))/(1-\delta)$, we obtain

$$c = -\frac{pR}{1-\delta(1-4p)}.$$

Again, we need to check for consistency that at $-Z^*$ and Z^* B will indeed stage war, given war at Z_0. Analogous computations yield that indeed B is indifferent between war and peace at $-Z^*$ and Z^* in the presence of war at Z_0 when

$$c = -\frac{1-\delta(1-p)}{(1-\delta(1-3p))(1-\delta)}pR.$$

Given that unambiguously

$$-\frac{1-\delta(1-p)}{(1-\delta(1-3p))(1-\delta)}pR < -\frac{pR}{1-\delta(1-4p)},$$

we confirm that indeed B stages war at $-Z^*$ and Z^*, as assumed, when $c > -\frac{pR}{1-\delta(1-4p)}$.

In sum, in *case Far-Close* war occurs at Z_0 iff $c > -\frac{pR}{1-\delta(1-4p)}$.

Now compare the *case Far-Close* threshold $c = -\frac{pR}{1-\delta(1-4p)}$ for war at Z_0 to the thresholds we found before: $-\frac{pR}{1-\delta(1-4p)} > -\frac{1-\delta(1-p)}{1-\delta(1-3p)}\frac{p}{1-\delta}R$, which implies that war is more likely in *case Close-No* than in *case Far-Close*.

In contrast, whether war is more likely in *case Far-Close* or *case Far-No* is ambiguous, as one cannot sign $\frac{(1-\delta)}{1-\delta(1-4p)} \lesseqgtr \frac{\delta p}{1-\delta(1-3p)}$.

End of Proof of Proposition 2.1

Note that the probability of war at time 0 in *case Far-No* can be higher or lower than that in *case Far-Close*, depending on parameter values. The ambiguity is due to the fact that *case Far-No* is endowment asymmetric, while *case Far-Close* is endowment symmetric but has the close oil effect that is missing in *case Far-No*.

Beside proposition 2.1, which serves the purpose of a robustness check of the main results of our static theoretical model, this dynamic extension allows to make some extra predictions:

Corollary 2.1 *Conditional on observing a war at time 0, the probability of another war next period is higher if the first period war is won by the attacker than when it is won by the defender.*

Given that the attacker is (in this equal strength and equal cost-benefit benchmark) always the country that is either oil less or at least has no oil close to border, while the target country has oil, then if the attacker wins the other country will have roughly the same incentives to attack back, whereas if the defender wins, then the border shifts away from the oil, reducing the incentives to attack by the initial attacker.

3 Clustering at the Country Level

In the main body of the paper the standard errors are clustered at the country-pair level, which is standard practice in literatures focusing on dyadic relationships (e.g. the vast literature on gravity models in international trade, as well as of course much of the empirical literature on international conflict). One criticism of this approach (which applies to nearly all contributions in those literatures as well) is that it treats two different dyads featuring the same country as independent observations. This suggests that it could be preferable to have some sort of country-level clustering.

In a gravity-trade setting, Cameron, Gelbach, and Miller (2011) propose to use their multi-clustering approach, where the first country in each pair is assigned to one cluster and the second country to a second cluster. Spolaore and Wacziarg (2009) do the same in an application where the dyadic outcome is the difference in development between the two countries.

As can be seen in Table 1 below, our results are very robust to applying the Cameron et al. multi-clustering approach, treating country A and country B as different clusters. Nevertheless, this approach is actually quite problematic. Whenever one uses a dyadic data set, there will always be some countries that necessarily have to appear as country A in some observations, and as country B in others. Clustering at the "country A, country B" level will therefore create (for many countries) two separate clusters, one when the country appears as country A, and one when it appears as country B. For this reason, the multi-clustering approach is really not suitable to dyadic settings when one wants to cluster at the country level.

Fafchamps and Gubert (2007) propose an alternative in the context of individual-level data in a village-network setting. Their proposal looks more promising but – even in the network literature – we couldn't find other significant papers that use it as the primary method to estimate standard errors.[4] Those authors who have used it, have tended to find massive losses of significance using Fafchamps-Gubert clustering. Needless to say that the technique is unheard of in the international context, even though it is potentially applicable to the entirety of the enormous trade literature on gravity equations, where the problem of each country appearing in multiple dyads also applies (as well as in the literature on war, of course). We therefore feel that the Fafchamps-Gubert method has not been adequately "road tested" by the literature for us to make the big leap of adopting it as our benchmark method. But we report results using this method in Table 2 of this appendix. Consistent with the sparse references to results using this method in the network literature, we also find a massive increase in estimated standard errors. However, even with this method some of our core results survive, or remain very close to the margin of significance.

4 Results with Region x Year Fixed Effects

Results with fixed effects for world regions interacted with the year fixed effects are reported in Table 3.

5 Results with Cross-Section of Country Pairs

Results obtained after collapsing the panel into a simple cross-section of country pairs, where all variable values now correspond to the averages over the 1946-2001 period, are reported in Tables 4 (OLS estimates) and 5 (Poisson regressions).

References

Cameron, Colin, Jonah Gelbach, and Douglas Miller, 2011, "Robust Inference with Multi-way Clustering," *Journal of Business and Economic Statistics* 29, 238-249.

Fafchamps, Marcel and Flore Gubert, 2007, "The Formation of Risk-Sharing Net-

[4] We have checked Google Scholar for the first 100 papers which cite the Fafchamps-Gubert paper. Of these, only 11 actually use their method for their preferred specification. Of these, only 4 are not (co-)authored by Fafchamps.

works," *Journal of Development Economics* 83, 326-50.

Spolaore, Enrico and Romain Wacziarg, 2009, "The Diffusion of Development," *Quarterly Journal of Economics* 124, 469-529.

	Dependent variable: Hostility											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.034	0.029	0.049	0.077**	0.087*	0.081**	0.143**	0.124***	0.048	0.063	0.058	0.132***
	(0.032)	(0.029)	(0.030)	(0.033)	(0.051)	(0.041)	(0.063)	(0.047)	(0.043)	(0.040)	(0.037)	(0.050)
One x Dist	-0.050*	-0.044	-0.073***	-0.086***	-0.107*	-0.087**	-0.138**	-0.118**	-0.079**	-0.072*	-0.103***	-0.137***
	(0.031)	(0.028)	(0.026)	(0.032)	(0.056)	(0.043)	(0.065)	(0.046)	(0.039)	(0.040)	(0.033)	(0.048)
Both	0.022	0.028	0.034	0.045*	0.023	0.048*	0.110***	0.073**	0.009	0.024	0.020	0.047
	(0.025)	(0.023)	(0.032)	(0.026)	(0.032)	(0.028)	(0.042)	(0.032)	(0.029)	(0.024)	(0.037)	(0.031)
Both x MinDist	-0.077**	-0.044	-0.105***	-0.089**	-0.088**	-0.028	-0.107**	-0.066*	-0.102***	-0.096**	-0.122***	-0.125***
	(0.036)	(0.035)	(0.036)	(0.038)	(0.043)	(0.031)	(0.052)	(0.034)	(0.036)	(0.039)	(0.034)	(0.041)
Both x MaxDist	0.026	-0.014	0.016	0.004	0.048	-0.048	0.012	-0.010	0.059	0.042	0.047	0.043
	(0.042)	(0.039)	(0.032)	(0.036)	(0.060)	(0.046)	(0.068)	(0.046)	(0.043)	(0.045)	(0.034)	(0.042)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303
R-squared	0.019	0.090	0.145	0.158	0.020	0.091	0.145	0.156	0.021	0.092	0.146	0.160

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the levels of "first-country in the dyad" and "second-country in the dyad". Significance levels *** p<0.01, ** p<0.05, * p<0.1. All explanatory variables are taken as first lag. All specifications control for the average and the absolute difference of land areas in the pair, intercept and annual time dummies. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 1: Country clustering following Cameron et al.

	Dependent variable: Hostility											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.034	0.029	0.049	0.077*	0.087	0.081*	0.143**	0.124**	0.048	0.063	0.058	0.132**
	(0.033)	(0.030)	(0.034)	(0.040)	(0.055)	(0.043)	(0.068)	(0.052)	(0.046)	(0.041)	(0.042)	(0.059)
One x Dist	-0.050	-0.044	-0.073**	-0.086**	-0.107*	-0.087*	-0.138**	-0.118**	-0.079*	-0.072*	-0.103**	-0.137**
	(0.034)	(0.028)	(0.032)	(0.038)	(0.060)	(0.045)	(0.068)	(0.050)	(0.044)	(0.040)	(0.040)	(0.057)
Both	0.022	0.028	0.034	0.045	0.023	0.048*	0.110**	0.073**	0.009	0.024	0.020	0.047
	(0.029)	(0.024)	(0.034)	(0.032)	(0.032)	(0.027)	(0.044)	(0.034)	(0.032)	(0.026)	(0.038)	(0.034)
Both x MinDist	-0.077**	-0.044	-0.105***	-0.089**	-0.088***	-0.028	-0.107**	-0.066*	-0.102***	-0.096**	-0.122***	-0.125***
	(0.034)	(0.037)	(0.038)	(0.041)	(0.025)	(0.034)	(0.052)	(0.034)	(0.035)	(0.043)	(0.039)	(0.047)
Both x MaxDist	0.026	-0.014	0.016	0.004	0.048	-0.048	0.012	-0.010	0.059	0.042	0.047	0.043
	(0.046)	(0.042)	(0.036)	(0.042)	(0.046)	(0.045)	(0.069)	(0.047)	(0.047)	(0.050)	(0.039)	(0.052)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303
R-squared	0.076	0.131	0.195	0.196	0.077	0.132	0.195	0.193	0.078	0.133	0.196	0.198

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the country level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All explanatory variables are taken as first lag. All specifications control for the average and the absolute difference of land areas in the pair, intercept and annual time dummies. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 2: Country clustering following Fafchamps and Gubert

	Dependent variable: Hostility											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.020	0.025	0.027	0.065**	0.072	0.083**	0.132***	0.126***	0.036	0.057	0.040	0.130***
	(0.029)	(0.026)	(0.028)	(0.028)	(0.048)	(0.037)	(0.044)	(0.029)	(0.040)	(0.036)	(0.035)	(0.043)
One x Dist	-0.052	-0.045*	-0.071***	-0.092***	-0.107**	-0.087**	-0.130***	-0.107***	-0.080**	-0.071*	-0.100***	-0.148***
	(0.032)	(0.026)	(0.027)	(0.026)	(0.050)	(0.040)	(0.044)	(0.028)	(0.040)	(0.037)	(0.034)	(0.040)
Both	0.007	0.019	0.001	0.015	0.003	0.044*	0.094***	0.085***	-0.002	0.014	-0.004	0.034
	(0.022)	(0.019)	(0.030)	(0.025)	(0.036)	(0.026)	(0.034)	(0.028)	(0.026)	(0.020)	(0.032)	(0.031)
Both x MinDist	-0.084***	-0.047	-0.105***	-0.085***	-0.088	-0.038	-0.110**	-0.059*	-0.116***	-0.098**	-0.124***	-0.122***
	(0.032)	(0.031)	(0.032)	(0.029)	(0.054)	(0.034)	(0.052)	(0.032)	(0.035)	(0.040)	(0.034)	(0.035)
Both x MaxDist	0.014	-0.011	0.017	-0.000	0.040	-0.032	0.025	-0.006	0.051	0.043	0.048	0.039
	(0.036)	(0.033)	(0.031)	(0.029)	(0.073)	(0.048)	(0.064)	(0.041)	(0.039)	(0.043)	(0.034)	(0.037)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303	19962	11303
R-squared	0.061	0.121	0.164	0.186	0.060	0.122	0.162	0.182	0.064	0.124	0.165	0.189

Note: The unit of observation is a country pair in a given year. The sample covers all contiguous country pairs and the years 1946-2001. Method: OLS with robust standard errors clustered at the country-pair level. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All explanatory variables are taken as first lag. All specifications control for the average and the absolute difference of land areas in the pair, intercept and region*year fixed effects. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, dummy for having been in a colonial relationship, and years since the last hostility in the country pair.

Table 3: Baseline results with region*year fixed effects

	Dependent variable: Share of years with hostility											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	0.064	0.090	0.087	0.217	0.101**	0.099**	0.145*	0.259***	0.082	0.137	0.129	0.273
	(0.052)	(0.073)	(0.080)	(0.139)	(0.051)	(0.047)	(0.080)	(0.097)	(0.069)	(0.092)	(0.102)	(0.168)
One x Dist	-0.081	-0.119	-0.113**	-0.169*	-0.124**	-0.117**	-0.182***	-0.196***	-0.104	-0.148	-0.145*	-0.209*
	(0.054)	(0.074)	(0.057)	(0.091)	(0.053)	(0.049)	(0.060)	(0.063)	(0.072)	(0.096)	(0.075)	(0.113)
Both	0.022	0.015	0.036	0.174	0.003	0.037	0.021	0.206	0.012	0.020	0.085	0.206
	(0.018)	(0.019)	(0.120)	(0.185)	(0.027)	(0.032)	(0.116)	(0.143)	(0.019)	(0.016)	(0.139)	(0.217)
Both x MinDist	-0.043	-0.059*	-0.092**	-0.114**	-0.065*	-0.065*	-0.058	-0.071*	-0.067*	-0.099**	-0.102**	-0.139***
	(0.033)	(0.034)	(0.039)	(0.045)	(0.038)	(0.034)	(0.049)	(0.043)	(0.035)	(0.039)	(0.042)	(0.052)
Both x MaxDist	0.004	-0.001	0.006	0.020	0.046	-0.018	-0.040	-0.024	0.026	0.035	0.028	0.052
	(0.036)	(0.034)	(0.040)	(0.046)	(0.049)	(0.047)	(0.062)	(0.053)	(0.038)	(0.039)	(0.044)	(0.053)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	596	411	596	411	596	411	596	411	596	411	596	411
R-squared	0.046	0.282	0.548	0.611	0.051	0.275	0.545	0.600	0.051	0.296	0.549	0.614

Note: The unit of observation is a country pair. The sample covers all contiguous country pairs. Method: OLS with robust standard errors. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All specifications control for the average and the absolute difference of land areas in the pair and intercept. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, and dummy for having been in a colonial relationship.

Table 4: Baseline results for the simple cross-section of country pairs using OLS

	Dependent variable: Share of years with hostility											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
One	1.046	1.233*	0.440	1.626	1.324***	1.294***	1.878***	1.800	1.192	1.768***	1.520	4.588**
	(0.655)	(0.663)	(1.058)	(2.191)	(0.455)	(0.366)	(0.616)	(2.016)	(0.730)	(0.648)	(1.144)	(2.247)
One x Dist	-1.417**	-1.767***	-1.889***	-3.351***	-1.748***	-1.660***	-2.826***	-3.310***	-1.664**	-1.749***	-2.172***	-3.889***
	(0.682)	(0.603)	(0.605)	(1.004)	(0.488)	(0.320)	(0.495)	(0.803)	(0.781)	(0.621)	(0.641)	(1.202)
Both	0.401	0.289	-0.658	-1.451	0.073	1.135**	1.178	-0.001	0.206	0.415	1.497	2.814
	(0.325)	(0.335)	(1.646)	(3.856)	(0.420)	(0.535)	(1.152)	(3.663)	(0.323)	(0.295)	(1.865)	(3.817)
Both x MinDist	-0.751	-1.594***	-1.662***	-2.794***	-0.947**	-1.181**	-1.091	-2.024*	-1.139**	-2.230***	-1.653***	-3.707***
	(0.503)	(0.436)	(0.518)	(0.751)	(0.450)	(0.501)	(0.766)	(1.177)	(0.480)	(0.466)	(0.501)	(0.646)
Both x MaxDist	0.119	0.373	-0.244	0.880	0.631	-0.870	-1.789*	-1.507	0.425	0.997**	0.113	2.180***
	(0.495)	(0.415)	(0.498)	(0.787)	(0.604)	(0.622)	(0.930)	(1.086)	(0.491)	(0.448)	(0.500)	(0.687)
Type Oil	All	All	All	All	Offshore	Offshore	Offshore	Offshore	Onshore	Onshore	Onshore	Onshore
Country FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Add. Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Observations	596	411	596	411	596	411	596	411	596	411	596	411
Log pseudolikelihood	-107.1	-61	-78.2	-50.5	-107	-61.4	-78.7	-50.8	-106.8	-60.8	-78.2	-50.5

Note: The unit of observation is a country pair. The sample covers all contiguous country pairs. Method: Poisson regression with robust standard errors. Significance levels *** p<0.01, ** p<0.05, * p<0.1. All specifications control for the average and the absolute difference of land areas in the pair and intercept. Additional controls are: The average and absolute difference of GDP per capita, the average and absolute difference of population, the average and absolute difference of fighting capabilities, the average and absolute difference of democracy scores, dummy for one country having civil war, dummy for both countries having civil war, bilateral trade / GDP, dummy for one country being OPEC member, dummy for both countries being OPEC member, genetic distance between the populations of the two countries, dummy for membership in the same defensive alliance, dummy for historical inclusion in the same country, kingdom or empire, and dummy for having been in a colonial relationship.

Table 5: Baseline results for the simple cross-section of country pairs using Poisson