Natural Resource Distribution and Multiple Forms of Civil War*

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August 10, 2010

Abstract

We examine how natural resource location, rent sharing and fighting capacities of different groups matter for ethnic conflict. A new type of bargaining failure due to multiple types of potential conflicts (and hence multiple threat points) is identified. The theory predicts conflict to be more likely when the geographical distribution of natural resources is uneven and when a minority group has better chances to win a secessionist rather than a centrist conflict. For sharing rents, resource proportionality is salient in avoiding secessions and strength proportionality in avoiding centrist civil wars. We present empirical evidence that is consistent with the model.

Keywords: Natural Resources, Conflict, Strength Proportionality, Resource Proportionality, Secession, Bargaining Failure.

JEL Classification: C72, D74, Q34.

*We wish to thank Peter Van der Windt for excellent research assistance and Lars-Erik Cederman, Tanisha Fazal, Benedikt Goderis, Päivi Lujala, Egil Matsen, Jonathan Temple, Mathias Thoenig, Ragnar Torvik, Nicolas Van de Sijpe, Fabrizio Zilibotti and seminar and workshop participants in Geneva, Zurich, Columbia, Bristol, Oxford, York, London School of Economics, Gerzensee, and Trondheim for helpful comments. The usual disclaimer applies.

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1 Introduction

The empirical literature on conflict has found that the existence of natural resources and of ethnic divisions make a country more prone to war (see e.g., Collier and Hoeffler, 2004; Montalvo and Reynal-Querol, 2005). Our goal in this paper is to provide a unified theoretical framework for the study of multiple types of conflict that takes into account natural resources, geography, and ethnicity.

In every society, groups typically differ in political power, size, location, wealths, and shares of the surplus from the extraction of natural resources in different regions. For all the combinations of parameters capturing the above heterogeneities, we will characterize the equilibrium strategies and outcomes. In particular, we focus on what set of initial conditions may induce peace, secessionist conflict, uncontested secession or centrist conflict (i.e., conflict with the aim of conquering the whole state).

We will first analyze the model when the government can select an optimal level of rent sharing, which corresponds to a situation in which frictionless bargaining is possible. We will show that even in this frictionless environment the mere presence of two types of conflict incentives (secessionist and centrist) for different combinations of resource and strength distributions may make it impossible to reach a surplus sharing agreement that induces peace. In particular, our theory predicts that costly conflict is harder to avoid when the geographical distribution of natural resources is uneven (i.e., when the homelands of a minority group are particularly resource rich) and when it is much easier for a minority group to win a secessionist rather than a centrist conflict. Intuitively, in such a situation secession attempts are a salient option for the minority group, which leads to two salient threat points that cannot be jointly addressed by bargaining.

After deriving the empirically testable implications of the new source of bargaining failure that we uncover, we will turn to examine the implications of the model for the (realistic) cases in which surplus sharing cannot be easily adjusted, corresponding to situations in which bargaining on surplus shares is not frictionless.[1] Clearly, when the rent share of the minority group is difficult to (credibly) change in the short run, this further reinforces the potential for conflicts. Our framework allows us to make detailed predictions on how parameter values map into various forms of outcomes.

Our model has also some simple but at the same time important implications for the discussion on the role of power sharing agreements: A failure of "minimal strength proportionality" is most

[1] Whether this inability to negotiate comes from commitment problems, indivisibilities, agency problems, or one source or another of asymmetric information, we will just take such causes as given and focus instead on the consequences, for different types of conflict. See Fearon (1995) and Jackson and Morelli (2010) for summary comparisons of the causes of bargaining breakdown.

likely to cause a centrist all-out conflict, i.e., a war that will involve all the regions of the State, whereas a secessionist conflict has always a failure of "resource proportionality" among its causes.

Besides the novel type of bargaining failure result and the conceptual contribution about power sharing, the contribution of the paper is in the detailed implications it allows us to draw and test on the role of the geographic distribution of natural resources for the different types of conflict. The previous theoretical literature did not contain, in fact, such a characterization.[2] Our model is the first one to focus on resource location and the initial distribution of natural resource rents and wealth across different ethnic groups, and to study the ensuing incentives of different groups to determine conflict, distinguishing between cases in which the incentives lead to secessionist conflict and cases in which the civil war does not have secession at stake.

Several historical examples suggest that natural resource *location* matters indeed in reality. When the presence of a local ethnic group coincides with large natural resource abundance concentrated in its region, this local ethnic group could be financially better off if it were independent and may under some conditions have incentives to start secessionist rebellion. This corresponds for example to the separatist movement in the now independent Timor-Leste, and the recent turmoil in the oil-abundant regions of Nigeria. Also the rebellion of the Aceh Freedom Movement in Indonesia starting in 1976 and the armed fight of the Sudan People's Liberation Army beginning in 1983 can to a large extent be explained by the abundance of natural resources in these separatist regions.[3] Other countries where secessionist movements have been linked to large local natural resources include Angola, Myanmar, Democratic Republic of Congo, Morocco and Papua New Guinea (see Ross, 2004, for a discussion).

In all the cases above, an uneven natural resource distribution was amplified by ethnic divisions. In contrast, if natural resources are absent or if natural resources (and political power) are evenly dispersed in a country, there are typically few incentives for conflict, even when there are ethnic

[2] Esteban and Ray (2010, 2010b) are mostly focused on the role of inequality and fractionalization, which we also consider as an important set of fundamental reasons for conflict, but they do not take the role played by natural resources into account. Caselli and Coleman (2006) focus on the decision of the dominant ethnic group to exploit or not the other groups in terms of the proceeds from extraction of natural resources, but do not take into account how the geographic distribution and the economic features of natural resources affect the risk of ethnic conflict of different kinds. Reuveny and Maxwell (2001) build a dynamic version of a Hirshleifer-style model of conflict over a single contested renewable resource. Also Grossman and Mendoza (2003) use a dynamic framework to predict that present resource scarcity and future resource abundance cause appropriative competition. Hodler (2006) finds that natural resources lead to lower growth in fractionalized countries through the channel of more fighting. Caselli (2006) studies elite behavior in resource abundant countries to discuss potential politico-economic channels for the resource curse. Similarly, Fearon (2005) argues that natural resources can foster conflict by weakening state capacity. Besley and Persson (2009) emphasize that weak institutions, low income and large natural resources lead to a greater risk of civil war. Van der Ploeg and Rohner (2010) study the two-way interaction between natural resource extraction and conflict, allowing for depletion speed and method to be endogenous.

[3] For a discussion of these cases see Ross (2004b).

divisions.[4] Similarly, when there are large amounts of natural resources available, but the society is ethnically homogeneous, conflict incentives are weak.[5]

We immediately turn now to present our basic model and bargaining failure result in section 2, followed by the equilibrium characterization in section 3 of the different types of conflict when other forms of bargaining frictions make it difficult to alter surplus sharing. The empirical implications of this new framework are very rich, and hence we kindly ask the reader to wait for these until sections 4 and 5: In section 4 we spell out all the implications and relate them to the existing empirical evidence; in section 5 we perform our own estimations of some of the predictions using novel panel data on the ethnic group level. Section 6 concludes. Appendices A to C contain some supplemental material and Appendix D the description of our data.

2 Frictionless Model

2.1 Setup

Consider a country populated by two ethnic groups, i and j.[6] The country is divided in two clearly defined regions, $1, 2$. We allow for different values of extractable natural resources in the regions 1 and 2, labeled r_1 and r_2, respectively.[7] For simplicity, natural resource extraction and export of such resources is the only activity in the country, and this sole activity is conducted by a unique State firm. The group in power can control the sharing of the ensuing surplus.

There are n_i^1 and n_i^2 members of group i in regions 1 and 2 respectively, and n_j^1, n_j^2 of group j. Assume that the two groups are to some degree concentrated in the two regions, as is very often the case. In particular, assume $n_i^1/n_i^2 > n_j^1/n_j^2$.

We assume that group j controls the government at the beginning of the game, which may mean that group j is a majority group ($n_j = n_j^1 + n_j^2 > n_i = n_i^1 + n_i^2$) in a democracy, or simply that j had won some conflict for power in a prior period.

In this section we assume that group j in power can choose the shares $\alpha, (1-\alpha)$ of the surplus to be attributed to groups i and j, respectively, and we assume that none of the standard bargaining frictions, like asymmetric information, agency, indivisibilities or commitment problems, are present. However, in spite of the absence of the standard frictions, we will show that the interac-

[4] This is for example the case of countries like Benin or Mali, which have only few natural resources, or of small oil-rich countries like Brunei or Qatar, where natural resources are evenly spread.

[5] Examples for this include Chile and Mongolia.

[6] We assume that ethnicity is the only cleavage, hence abstracting from class conflict or other differences within groups that could induce different political alignments or coalitions to form. See Ray (2009) for a treatment of multiple markers.

[7] The variables r_1 and r_2 capture the total value of rents, corresponding to the product of the amounts extracted times their price. Hence, r_1 and r_2 increase when there are resource discoveries or when the world prices rise.

tion of the three key variables described above, namely ethnic division, concentration of groups and distribution of natural resources in the different regions, can create nonetheless reasons for conflict.

There are four potential outcomes: peace (P), secessionist conflict (S), centrist (or all-out) conflict (C), and accepted secession (A). Secessionist conflict refers to war started with the aim of founding an independent State in one of the two regions, while centrist conflict is about gaining the control of the whole country. In this section we focus on the parameter values for which accepted secession will never occur. This streamlines the analysis without loss of generality of the important insights. In Appendix C we derive in detail for what parameter values accepted secession could occur in this framework.

The time line of the sequential version of the game is as follows:

1. group j selects α;

2. Nature selects player i as next mover with probability γ, while with probability $(1-\gamma)$ j is selected by Nature to be the only player with an opportunity to take violent actions;[8]

3. if i is the selected mover, i can choose between accepting the surplus sharing α arrangement (action p), start a centrist war (action c), or request secession (action s), implying separation of region 1 from region 2; if j is selected as the only potential mover, it can only choose between action p and action c;[9]

4. if i accepts the surplus sharing arrangement (action p), the peaceful payoffs are realized; if i chooses a centrist conflict (c), j has no choice but to fight back, in which case there is a standard contest success function determining the outcome; finally, if i asked for secession (s), then group j has the choice between accepting secession (a) and fighting against it (f), in which case the different nature of the fight (regional as opposed to spread out) determines a different contest success function. Similarly, if j is drawn by Nature, action p leads to peace, and action c to centrist conflict.

If peace (P) prevails, total group payoffs from natural resources are

$$\begin{aligned} \pi_P^i &= \alpha(r_1+r_2) \\ \pi_P^j &= (1-\alpha)(r_1+r_2) \end{aligned}$$

[8] In Appendix B we present a simultaneous moves version of the model. All results go through, but the exposition of section 3 would be messier with the simultaneous moves version.

[9] For simplicity, we ignore the (unrealistic) possibility that a group in power proposes secession of some region. We could easily extend the framework to allow for it.

On top of these flows of rents from selling oil or alike, each group may have control of a miscellaneous of other sources of wealth or income, and we will denote the per capita usable stock of such non-resource based wealth as w_i, w_j. These accumulated stocks are those that determine, together with the relative population sizes, the strength of the two groups in case of conflict, as we will see below.

There is an important difference between wealth from natural resource rents and wealth from industrial activity and the like. Typically only a small fraction of the former type of wealth is destroyed in conflict, while much of the latter type is often destroyed, because it is a vital input of the capacity of a fighting group or State in a conflict. Oil fields and diamond mines (and especially their future productivity) "survive" fighting, while high-tech industries and banking suffer considerably from political instability.[10] A similar argument could be applied to distinguish between various sorts of natural resources, according to their risk of destruction in civil war.

If centrist all-out conflict is initiated, we assume that the *winner takes all* the relevant natural resource rents in the relevant period. For simplicity the winner does not take instead the undestroyed wealth stocks.[11]

Thus, the payoffs for centrist conflict (C) are as follows:

$$\begin{aligned} \pi_C^i &= p_c(r_1 + r_2) - dw_i n_i \\ \pi_C^j &= (1 - p_c)(r_1 + r_2) - dw_j n_j \end{aligned}$$

where p_c is the winning probability of group i in centrist conflict and d denotes the fraction of the wealth stocks destroyed in the fighting. Conflict is costly only in terms of destroyed capital. Adding human losses would not alter the main results, but would make the analysis more tedious.[12]

The probability with which i wins a centrist conflict can be expressed as:

$$p_c = \frac{n_i w_i}{n_i w_i + n_j w_j + \lambda}$$

where λ measures the extra strength of group j due to the control of the government and perhaps the army. In this contest success function (CSF) the ratio of total wealth matters. Like Jackson and Morelli (2007) and Esteban and Ray (2010) we regard wealth as capacity, and therefore assume

[10] For these reasons, perhaps, full-blown conflict could be avoided in the Basque country and the Flemish region, even though their economic strength would give them incentives to split from Spain and from Belgium respectively.

[11] Our qualitative results go through when we include additional punishment means like wealth expropriation. The distinction between allowing the winner to take over also the stocks or not would probably matter more in a potential dynamic extension of the model.

[12] In a complementary paper, Esteban, Morelli and Rohner (2010) deal explicitly with the strategic incentives to decimate the population of enemies.

a group's probability of winning to be increasing in its total wealth.[13]

The logic of secessionist conflict is similar. We assume that when group i's secession attempt is unsuccessful, i is deprived of all resource rents during the present period. Again, we could allow for further punishment without affecting the qualitative results. When secession is successful, region 1 splits and group i gains control over all resources in region 1. The minorities in the new countries n_j^1 and n_i^2 are discriminated and do not receive anything.

The group leaders have a utilitarian social welfare function with equal weights for any group member independent of her location, i.e., they simply maximize the total rents. Again, conflict destroys a part d of the wealth in the conflict zone. Hence, the payoffs under secessionist conflict are:

$$\begin{aligned} \pi_S^i &= p_s r_1 - d w_i n_i^1 \\ \pi_S^j &= (1-p_s) r_1 + r_2 - d w_j n_j^1 \end{aligned}$$

where p_s is the winning probability of group i in secessionist conflict, which can be expressed as follows:

$$p_s = \frac{n_i^1 w_i}{n_i^1 w_i + n_j^1 w_j + \lambda}.$$

Note that in case of a secessionist conflict the men used are only those in the conflict region.[14]

The last possible outcome is accepted secession (A), which occurs when group i attempts secession (action s) and group j accepts the proposal without fighting (action a). In this case:

$$\begin{aligned} \pi_A^i &= r_1 \\ \pi_A^j &= r_2 \end{aligned}$$

Clearly, group i would always prefer accepted secession to secessionist conflict. In contrast, the ruling group j prefers to "fight out" secession attempts when fighting is not too costly, i.e.,

[13] Another interpretation of this formula and the destruction cost of war is that groups select what part of their wealth they want to invest as sunk cost in conflict. If they are constraint to not be able to invest more than d percent of their wealth and if this constraint is binding for both groups, this would lead exactly to the formula above and the corresponding costs of war.

[14] We could easily add some parameter to account for the fact that mountainous terrain, geographical remoteness, ideological recruitment etc provide a larger advantage for group i in secessionist than in centrist wars (cf. Gates, 2002; Buhaug, Gates and Lujala, 2009).

$dw_j n_j^1 < (1-p_s)r_1$.[15] In the present section we focus on situations where this condition holds, which allows us to disregard the possibility of accepted secession. In Appendix C we show that when this condition does not hold there is an additional zone of parameter values for which bargaining fails to prevent accepted secession.

2.2 Equilibrium

The solution concept is Subgame Perfect Equilibrium. On the basis of the expected outcomes for each group in all subgames for any α, group j selects the preferred level of α at the beginning of the game. Appendix A contains all the tedious algebra steps, but the following description of the analysis should be sufficient to understand what is going on.

Clearly, the choice of α can be reduced to a binary choice between $\alpha = 0$ and the "buying off" minimum level of α making group i indifferent between accepting and challenging. The endogenously selected α depends on γ. For high γ, i.e., when it is likely that group i can have a window of opportunity to challenge the status quo if exploitative, j chooses the "buying off" strategy for a wider range of parameter values.

While for many parameter values there exists an α that can prevent conflict, we will show that this is not always the case, regardless of γ and regardless of the timing of the game. This bargaining failure result, holding in spite of the availability of credible transfers, and hence in contrast with the "political Coase theorem" in Acemoglu (2003), is the main punchline of this section.

To explain the intuition right away, note first that group j prefers peace to centrist conflict when $\alpha \leq \overline{\alpha} \equiv p_c + \frac{dw_j n_j}{r_1+r_2}$, while group i prefers peace to centrist and secessionist conflict for $\alpha \geq \underline{\alpha}_c \equiv p_c - \frac{dw_i n_i}{r_1+r_2}$, resp. $\alpha \geq \underline{\alpha}_s \equiv p_s \frac{r_1}{r_1+r_2} - \frac{dw_i n_i^1}{r_1+r_2}$ (see Appendix A for details). Due to the destruction of war $\underline{\alpha}_c < \overline{\alpha}$ always holds. In line with standard intuition in the presence of a single form of conflict, transfers could always assure peace, as the destruction of war creates some peace dividend to be distributed ($\frac{d(w_i n_i + w_j n_j)}{r_1+r_2}$).

Things are different, however, in the presence of multiple conflicts. For a range of parameter values, $\underline{\alpha}_s > \overline{\alpha}$ holds. In these cases no level of α can be found for which conflict can always be avoided. This result does not hinge on the sequential structure of Nature drawing the mover, as the bargaining failure result holds for the same parameter values even in the simultaneous move game in Appendix B. Our bargaining failure result can be summarized in the first proposition of the paper:[16]

[15] As a tie-breaking rule, we assume throughout the paper that in the case of strict indifference between two actions, groups select the one that leads to less destructive outcomes.

[16] Technically we should talk about group j not being able to find an interior value of α that can avoid war, but it is basically a bargaining failure result, because the same impossibility to obtain certain peace under those conditions

Proposition 1 *There exist parameter values under which no surplus sharing exists that can avoid a conflict.*

Proof. See case 3 in Appendix A, where $p_s \frac{r_1}{r_1+r_2} > p_c + \frac{d(w_i n_i^1 + w_j n_j)}{r_1+r_2} \Longrightarrow \underline{\alpha}_s > \overline{\alpha}$. ■

It is easy to see that this type of bargaining failure is more likely when r_1 is sufficiently large, and when p_s/p_c is large. The intuition here is that when r_1 or p_s/p_c become too small, secessionist conflict becomes less attractive and we would fall back into a situation with only one form of salient threat (i.e., centrist conflict). Further, when accumulated usable wealth is small compared to the "cake" from natural resources, and conflict is not very destructive (small d) it is harder to avoid war.

Using the explicit dependence of p_s and p_c on the distribution of populations of the different groups in the territory, the condition for bargaining failure becomes

$$\frac{n_i^1 w_i}{n_i^1 w_i + n_j^1 w_j + \lambda} \frac{r_1}{r_1 + r_2} > \frac{n_i w_i}{n_i w_i + n_j w_j + \lambda} + \frac{d(w_i n_i^1 + w_j n_j)}{r_1 + r_2}.$$

This reveals that conflict is more likely when the minority group i is very concentrated (large n_i^1) and the corresponding region relatively homogeneous (low n_j^1); and state capacity is low (i.e., low λ). The results of the comparative statics implied by the characterization of Proposition 1 are summarized below.

Corollary 1 *Conflict becomes more salient when*

1. *the winning chances of the minority are much better for secessionist than for centrist conflict,*
2. *most of the natural resources are located in the region of the minority group,*
3. *a country is poor and/or war is not very destructive,*
4. *the minority group is very concentrated in a relatively homogeneous region,*
5. *state capacity is low.*

This characterization can be displayed graphically in terms of n_i^1, r_1 and d (cf. Figures 1-3).[17]

We conclude this section by illustrating that the bargaining failure due to multiple types of conflict can occur even in a democracy. Consider the following "poor democracy" example:

would arise under any other bargaining procedure to set surplus sharing.

[17] The following parameter values have been used for the variables not appearing in each figure: $r_1 = 0.8$, $r_2 = 0.2$, $n_i = n_j = 1$, $w_i = w_j = 1$, $\lambda = 0$, $n_j^1 = 0.3$, $n_i^1 = 0.7$, $d = 0.05$. The zone "bargaining sustains peace" refers to outcomes P or A.

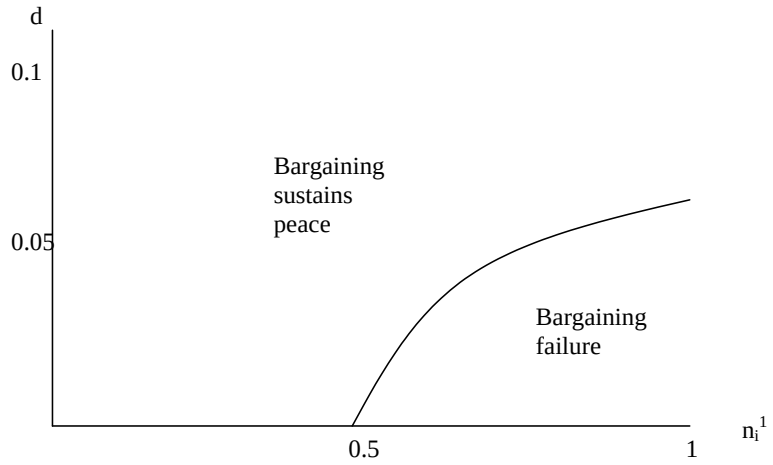

Figure 1: Bargaining failure in terms of n_i^1 and d

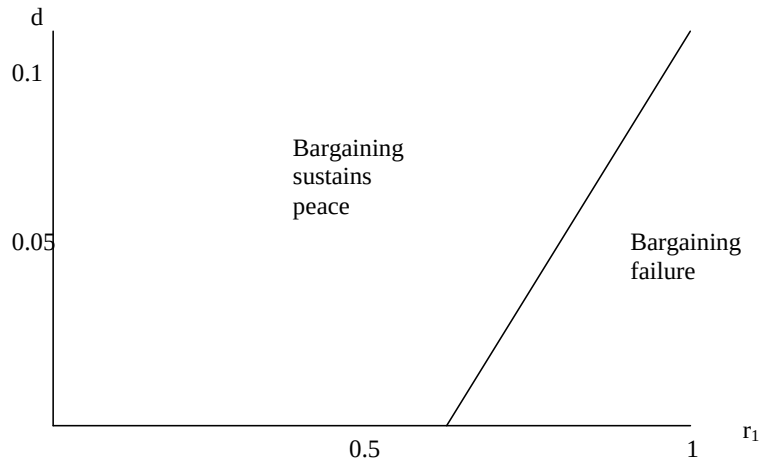

Figure 2: Bargaining failure in terms of r_1 and d

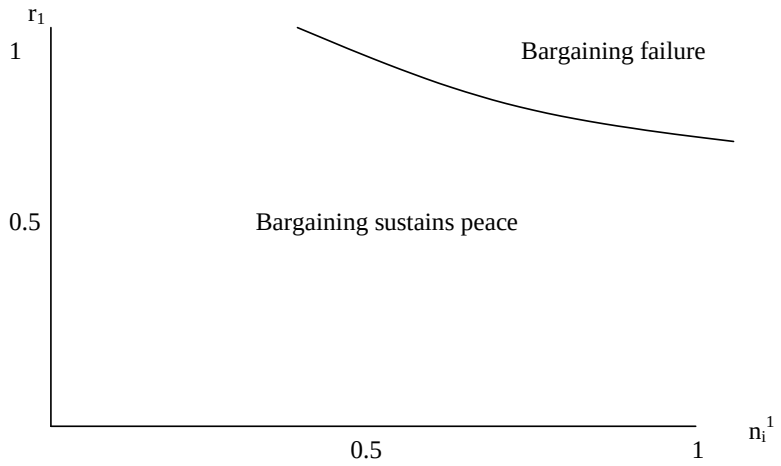

Figure 3: Bargaining failure in terms of n_i^1 and r_1

Example 1 *Consider a proportional democratic benchmark, in which surplus sharing is determined by vote strength, i.e.,* $\alpha^D = \frac{n_i}{n_i+n_j}$ *and where there is perfect wealth equality, i.e.,* $w_i = w_j$*. When the country is poor (low* w*) and / or conflict is not very destructive (low* d*), and if an ethnic minority is very concentrated in an area with large resource rents (high* n_i^1 *and high* r_1*), even such perfect democracy in an egalitarian society cannot guarantee peace.*

Basically, as soon as our bargaining failure condition holds, $\underline{\alpha}^s > \overline{\alpha}$, even "fair" surplus sharing in a perfect democracy cannot prevent conflict. In the worst case scenario we can even end up in a situation where any of the two groups would like to start war because $\underline{\alpha}^s > \alpha^D > \overline{\alpha}$.[18] This can occur when the minority group is very concentrated (large n_i^1/n_j^1), when the geographical distribution of natural resources is unequal (high r_1), the country is poor and conflict is not very destructive (small dw), and when state capacity is neither too small nor too large (intermediate λ). For these parameter values either group that has a window of opportunity would like to start conflict.

In a dynamic snapshot interpretation, even though the two groups are equally well off from the past and democracy has already been achieved, a new conflict can erupt because of regional resources plus ethnic conflict interaction when r_1 jumps sufficiently high. In contrast to the conventional wisdom that stresses the importance of democracy for peace, when $\underline{\alpha}^s > \alpha^D > \overline{\alpha}$, a shift away from proportional democracy towards a non-democratic regime α^{ND}, with $\alpha^{ND} > \underline{\alpha}^s$ or $\alpha^{ND} < \overline{\alpha}$, can reduce the frequency of war (making it dependent on γ), but without eliminat-

[18] Expressed in structural parameters, this corresponds to $\frac{n_i^1 w_i}{n_i^1 w_i + n_j^1 w_j + \lambda} \frac{r_1}{r_1+r_2} - \frac{dw_i n_i^1}{r_1+r_2} > \frac{n_i}{n_i+n_j} > \frac{n_i w_i}{n_i w_i + n_j w_j + \lambda} + \frac{dw_j n_j}{r_1+r_2}$.

ing it. Note also that if we start from one of these non democratic surplus sharing regimes, for example with an α below $\bar{\alpha}$, the most promising policies to establish peace would be related to fostering development rather than pushing democracy. In the next section we instead show that in the presence of bargaining frictions and when countries are less poor there are indeed cases where democratic power sharing can reduce conflict.

3 Fixed Surplus Sharing

In many cases it is not feasible to significantly change α in the short run in reaction to stochastic shocks such as resource discoveries. A substantial part of surplus sharing goes through patronage spending for ethnic employment, which typically takes much time to change. In Northern Ireland, for example, it took decades to democratize the police force and to make sure that the fully protestant force could become religiously mixed. Also reforms of fiscal systems and inter-regional transfers need years to be implemented. Think of the debate on sharing Scotland's oil wealth. Scotland now has a local parliament and receives the highest per capita public spending in the UK from Westminster, but it had to wait for decades. When such rigidities make it impossible to adapt α to changing conditions, our model yields some additional predictions with respect to those already obtained in the previous section.

When $\bar{\alpha} < \underline{\alpha}_s$, of course it does not matter whether α is easy or hard to change. Now we want to focus on situations in which the additional rigidities in changing α can lead to conflict even if $\overline{\alpha} > \underline{\alpha}_s$.

Group i prefers peace to accepted secession when $\alpha \geq \underline{\alpha}_a \equiv \frac{r_1}{r_1+r_2}$. To eliminate uninteresting cases, we assume $\overline{\alpha} > \underline{\alpha}_a$. Note also that $\pi_A^i > \pi_S^i$ and accordingly $\underline{\alpha}_a > \underline{\alpha}_s$ always holds (this helps us to simplify some of the following expressions).

The proposition below fully characterizes the different outcomes for all fixed levels of α.

Proposition 2

- *When $\alpha > \overline{\alpha}$, centrist conflict triggered by group j occurs with probability $(1-\gamma)$, and peace prevails otherwise.*
- *When $\alpha \leq \overline{\alpha}$, peace occurs if group i does not have the opportunity to take action against the status quo (probability $(1-\gamma)$), whereas with probability γ i has a chance to choose it's preferred action, and the following possibilities arise:*
  - *Peace occurs under the two following sufficient conditions: (I) $\alpha \geq \max\{\underline{\alpha}_c, \underline{\alpha}_a\}$; (II) $\alpha \geq \max\{\underline{\alpha}_c, \underline{\alpha}_s\}$ and $dw_j n_j^1 < (1-p_s)r_1$. (I) and (II) together are a necessary condition.*

– *Centrist conflict occurs under the following sufficient conditions: (III)* $\alpha < \underline{\alpha}_c$ *and* $r_2 > \frac{(1-p_c)r_1+dw_in_i}{p_c}$*; (IV)* $\alpha < \underline{\alpha}_c$ *and* $r_2 > \frac{(p_s-p_c)r_1+dw_i(n_i-n_i^1)}{p_c}$ *and* $dw_jn_j^1 < (1-p_s)r_1$*. (III) and (IV) together are a necessary condition.*

– *Secessionist conflict occurs under the following necessary and sufficient condition: (V)* $\alpha < \underline{\alpha}_s$ *and* $r_1 \geq \frac{p_cr_2-dw_i(n_i-n_i^1)}{p_s-p_c}$ *and* $dw_jn_j^1 < (1-p_s)r_1$*.*

– *Accepted secession occurs under the following necessary and sufficient condition: (VI)* $\alpha < \underline{\alpha}_a$ *and* $r_1 \geq \frac{p_cr_2-dw_in_i}{1-p_c}$ *and* $dw_jn_j^1 \geq (1-p_s)r_1$*.*

Proof. Follows from the comparison of the payoff functions for the various outcomes. ■

The four relevant zones of parameters for the different outcomes are displayed in Figure 4 below. The same parameter values are used as in the figures before, the only difference being that now we focus on a case where conflict is more destructive ($d = 0.3$), which creates a larger "peace dividend" and always would prevent bargaining failure if α could be freely and easily changed.

The zone "Peace" corresponds to parameter values where the peaceful status quo always persists, independently of the identity of the first mover. In the zone "Centrist Conflict" on top of the figure (i.e., above $\overline{\alpha}$), centrist conflict occurs when group j moves first, and peace holds when group i is the first mover. In contrast, in the four zones at the bottom of this figure, the indicated outcomes occur when group i is the first mover, while for group j moving first peace is sustained. In particular, for exploitatively low levels of α, centrist conflict dominates for low and intermediate levels of r_1, peacefully accepted secession occurs for intermediate levels of r_1, and secessionist conflict takes place for a high r_1.[19]

It is hard to think of historical cases in which α is so high that the dominant group would like to start centrist conflict, as the ruling elite usually finds ways to guarantee that the status quo is in their favor. Hence, in the discussion below we will only focus on situations where $\alpha < \overline{\alpha}$, in which therefore the incentives for the minority group i are most salient.

The power share α can be compared to two benchmarks: the relative military strength of group i, i.e., $\alpha \gtreqless p_c = \frac{n_iw_i}{n_iw_i+n_jw_j+\lambda}$, and the relative resources, i.e., $\alpha \gtreqless \frac{r_1}{r_1+r_2}$. Thus, power sharing has two potential benchmarks: "*minimum strength proportionality*"[20] and "*resource proportionality*". All the above analysis has an important conceptual corollary that relates to the role of proportional power sharing for peace:

[19] A similar characterization could be achieved with simultaneous moves (see Appendix B). In that case a key variable determining the various cases is whether a group is able to escalate a secessionist conflict into a centrist all-out conflict or vice versa, rather than depending on a random draw of Nature like in the sequential move version.

[20] This concept is labeled "*minimum* strength proportionality" because we relate α to p_c, where $p_c < p_s$.

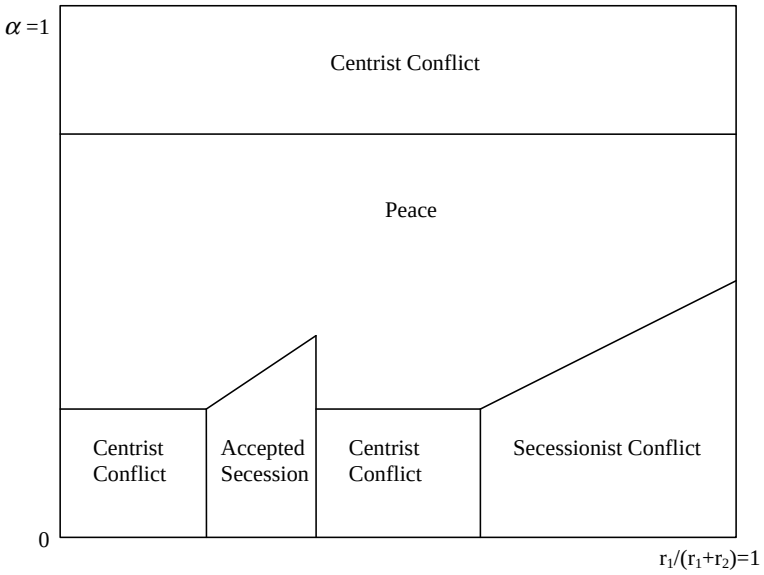

Figure 4: The different outcomes with a fixed rent share

Corollary 2 *When the minority group i starts a centrist conflict that aims to take over the control of the State, a failure of "minimum strength proportionality" of the initial power sharing arrangement is always involved.*
On the other hand, when we observe a secessionist conflict, the initial power sharing must have failed to satisfy "resource proportionality".

Proof. Follows from Proposition 2. ■

Intuitively, when a group is militarily strong, mostly the "minimum strength proportionality" condition is salient, while for a minority group with resource-rich homelands the "resource proportionality" criterion becomes binding. This becomes also apparent in Figure 4: When r_1 increases group i requires a larger α to maintain peace (note that the upper bound of the "Secessionist Conflict" zone is increasing in r_1). Similarly, in this same figure an increase in p_c would extend upwards the height of the two "Centrist Conflict" rectangles at the bottom of the figure, thereby increasing the minimum level of α for which peace can be maintained.

To sum up, assume that the parameter values are such that we are not in the "bargaining failure" range, and peace can always be sustained at least for some values of α. In this context power sharing can help preventing conflict, by respecting the "minimum strength proportionality" and/or "resource proportionality" criteria.

Empirically, having an equitable democracy with an intermediate value of α that is acceptable

for both groups will reduce the risk of war onsets, in countries with a large enough "peace dividend" that makes conflict preventable. This is typically the case in intermediately or fully developed countries (see Collier and Rohner, 2008).

4 Empirical Relevance of the Main Predictions

Our main goal has been to provide a framework to analyze the effect of the distribution of natural resources across regions and groups on the different types of civil conflict. We now want to judge the usefulness of this framework on the basis of the predictions it offers. Since the propositions provide a characterization of equilibrium in different relevant cases, we now want to flesh out the most interesting testable predictions that can be derived from such propositions and check how they relate to the existing empirical literature.

1. The first nuance that our model provides about the role of natural resources is that they pose the greater challenge the more *unevenly distributed* they are on a territory. This result is both present for the endogenous and for the fixed rent sharing cases. A greater r_1 basically implies that ethnic divisions can be reinforced by the geographical distribution of natural resources. In other words, when most natural resources are concentrated in the area of a local ethnic group that is not politically dominant, secessionist civil tensions are very likely. The fixed rent sharing case also provides further predictions on what forms of conflict we should expect: For $r_1 > r_2$ we should observe more secessionist conflicts, while for $r_1 < r_2$ centrist conflicts should be more frequent. Empirically, the secessionist conflicts of Timor-Leste, Sudan or Nigeria fit the case of $r_1 > r_2$, while for example Angola is a compelling case of $r_1 < r_2$ and centrist conflict.[21]

2. Typically countries with huge export shares of (and per capita income from) natural resources like for example Brunei, Kuwait, Qatar etc are small countries that due to their tiny size almost by definition have an even distribution of natural resources. Interestingly, these countries often achieve remarkable political stability. Countries with intermediate export shares of natural resources, like Angola or Nigeria, are usually geographically larger and tend

[21] Indeed, the two main factions in Angola's centrist conflicts of the last four decades are the dominant MPLA (group j) and the minority faction UNITA (group i). Angola is very rich in oil and diamonds, where especially the latter play a big role, as they are among the best diamonds in the world. The diamonds are mostly concentrated in the North-East of the country (in the Lunda provinces) and there most of the fighting takes place. The underlying ethnic group of the UNITA rebels are the Ovimbundu who have their geographical homeland in the central Bié Plateau region that is rather poor in natural resources. Thus, $r1/(r1 + r2)$ is low. Also, the MPLA has been reluctant to share power (low α), while the UNITA rebels have always focused mainly on trying to control the diamond mines. In a nutshell, our model would predict centrist conflict without secessionist goals between UNITA and MPLA, which is exactly what we have observed.

to have uneven distributions of natural resources. They are also frequently exposed to conflict. Hence, Collier and Hoeffler's (2004) finding that countries with intermediate natural resource exports over GDP are more likely to experience civil war could indeed be indirectly related to the unevenness effects described above.[22]

3. The model also predicts that conflicts are particularly frequent in situations when the probability of the minority group of winning a secessionist conflict is substantially larger than of winning a centrist war. This is the case when the minority group is geographically very concentrated in their homelands and when state capacity is weak. Consistent with this, Gates (2002) and Buhaug, Gates and Lujala (2009) find that in situations where the rebelling minority group is concentrated in remote peripheral areas and fights a localized war in this region, its odds of winning are larger and conflict tends to be harder to eradicate. Further, Fearon (2005) and Besley and Persson (2009)'s empirical results reflect the importance of state capacity to maintain peace.

4. Another interesting point is that wealth in general has very different implications from natural resource abundance. A general increase in natural resources (i.e., larger r_1 and r_2) clearly makes the peaceful status quo more difficult to sustain, as shown in Proposition 1. This is consistent with the empirical findings in the literature that the rents from natural resources monotonically increase the risk of civil war (e.g., Ross, 2004; Fearon, 2005; Humphreys, 2005; Lujala, 2010).

5. The situation is somewhat different for non-resource wealth w. In Jackson and Morelli (2007) the effect of relative wealth on the probability of conflict was ambiguous, because wealth was the target of conflict as well as its input. Here, the realistic assumption that natural resources neither affect the probability of winning nor are particularly affected by wars eliminates that ambiguity. We find that higher wealth w decreases the risk of war, consistent with the empirical results by Fearon and Laitin (2003) and Collier and Hoeffler (2004). Moreover, relative wealth changes would affect the probability of conflict of one kind or another only through the consequences on the contest success function.

6. In our model both ethnic divisions and natural resource abundance (large r_1 and r_2) are necessary conditions for conflict. This is consistent with the empirical result of Lujala, Gleditsch and Gilmore (2005), pointing out that diamonds only increase the risk of conflict in the presence of ethnic fractionalization. Similarly, our framework is also in line with the finding that

[22] Another explanation for the non monotonic finding of Collier and Hoeffler (2004) is offered by Caselli and Coleman (2006).

violent secession attempts are most likely when ethnic groups are geographically concentrated (Walter, 2006).

7. Further, ethnic cleavages are more likely to result in conflict onsets when there are no power sharing institutions in place (see Reynal-Querol, 2002; Saideman *et al.*, 2002; Cederman and Girardin, 2007). More specifically, there is also evidence that political under-representation leads to a higher risk of violent self-determination challenges (Walter, 2006). These empirical findings are perfectly rationalized in our model. In the absence of proportionality of power sharing with respect to both strength and natural resources, conflict can be very hard to avoid, and we have shown which of the two criteria is responsible for the different types of conflict (see Corollary 2). Our results could be used to provide theoretical micro-foundations for Collier and Rohner (2008)'s empirical finding that democracy and power sharing mostly decreases the risk of war in rich nations, but can actually lead to more political violence in poor states (in which the "peace dividend" is smaller and $\underline{\alpha}_s > \overline{\alpha}$ is more likely to hold).

8. Interestingly, a small level of α could in some instances be interpreted as "grievances" (or "motives"). While approaches explaining the occurrence of conflict with frustration from relative deprivation have traditionally been influential in political science (e.g., Gurr, 1970), they have in recent years been challenged by rational choice frameworks mostly developed by economists and focusing on "greed" or "feasibility" (see Collier and Hoeffler, 2004; Collier, Hoeffler and Rohner, 2009, for a distinction of these approaches). Our model is able to reconcile both intellectual traditions by taking motives into account in a game theoretic framework of utility maximizing players.

9. In particular, conflict outbreaks due to a failure to achieve resource proportionality could be linked to "grievances", as they are related to some underlying conception of an "unfair" natural resource distribution. In contrast, a violation of minimum strength proportionality could be interpreted as "greed"-related factor. Interestingly, Collier and Hoeffler (2004) have interpreted their empirical finding that natural resources fuel civil conflict as evidence in favor of "greed"-based explanations, disregarding the role of grievances. Our reading of the resource proportionality criterion revives grievances as contributing factor to wars. The model goes even one step beyond that: It features the implication that grievances play a greater role in secessionist conflicts (where resource proportionality is crucial) than in centrist wars (where the minimum strength proportionality matters heavily). This is in line with the empirical evidence, as pointed out by Ross (2004b: 63): "Resources appear to play a different role

in separatist conflicts than in nonseparatist conflicts. Grievances over the distribution of resource wealth helped initiate (...) separatist wars (...), but grievances of all types played no role in (...) nonseparatist wars."

10. Further, our model also generates predictions about which kinds of natural resources are particularly risky. As shown in Proposition 1, it becomes harder to maintain peace when the natural resources of a country are very valuable, i.e., when r_1 and r_2 are large. This prediction is in line with the empirical evidence suggesting that diamonds (Lujala, Gleditsch and Gilmore, 2005; Humphreys, 2005; Lujala, 2010), oil (De Soysa, 2002; Ross, 2004; Fearon, 2005; Humphreys, 2005) and coca (Angrist and Kugler, 2008) are particularly conducive to civil conflict. Further, as mentioned above the model predicts that geographical concentration of natural resources is risky. This can rationalize the peace threatening effect of diamonds and oil, which are essentially point resources that tend to be unevenly distributed in the terrain. It is therefore not surprising that the oil-rich regions of e.g., Iraq, Nigeria or Indonesia and diamond-rich countries like for example Sierra Leone or the Democratic Republic of Congo have traditionally been hotspots of conflict.

11. Finally, our model can also be interpreted in a broader sense and be applied to regional interstate wars. The recent conflict in South Ossetia between Russia and Georgia can for example be analyzed in terms of our framework. The unit of analysis is in this case the Caucasus. The dominant power, Russia, corresponds to group j, while Georgia is the minority group i. Natural resources are broadly interpreted, including rents from "strategic" geopolitical location. Rents are significant here, given that two major oil pipelines, the Baku-Tbilisi-Ceyhan (BTC) pipeline and the Baku-Supsa pipeline, cross Georgian territory.[23] In terms of the model these large geopolitical rents correspond to a high r_1. As most "political influence" rents are appropriated by Russia, α is low. Thus, our model predicts "secessionist conflict", where sovereign Georgia attempts to break free of Russia's zone of influence, while Russia fights back to maintain its grip. In line with the predictions, in recent years Russia has fueled separatist rebellion in Abkhazia and South Ossetia, which weakened Georgia and provided Russia with a pretext for intervention. The recent military confrontation in August 2008 has been the logical consequence of this process, and has consolidated Russia's control of Caspian oil.

[23] According to Alam (2002: 10), these "western routes for transporting oil and gas from the region are primarily supported by the US in order to contain the Russian influence and dominance in the region (...) and are intended to bypass Iran and Russia. (The Baku-Supsa pipeline) terminates hardly 20 km away from Abkhazia".

5 Effects of Uneven Natural Resource Abundance on the Ethnic Group Level

The existing empirical literature on natural resources and civil war has two main weaknesses: First, it only studies the effects of the total *amount* of natural resources and not of their *geographical distribution*. Second, it studies the impact of natural resource abundance mostly on the country level rather than on the ethnic group level. On such an aggregate level of analysis there is much unobserved heterogeneity in the data.

To address these concerns, we will now analyze the effects of natural resource abundance on conflict with panel data *on the ethnic group level*. In particular we construct group level variables that capture closely the expression $r_1/(r_1 + r_2)$ of the model. There is a small number of papers in the literature that study conflict on the ethnic group level (e.g., Walter, 2006), but these papers either ignore natural resources or use a natural resource variable at the country-level, which does not allow to capture unevenness of resource distribution. Hence, to the best of our knowledge we are the first to study civil war using a panel on the ethnic group level with natural resource variables that vary for different ethnic groups.

To construct the dataset, we use as starting point the data of the "Minorities at Risk" (MAR) project which follows a multitude of ethnic minority groups over several years. All data is explained in detail in Appendix D. Below we focus on describing the construction of our novel independent variable, the surface of an ethnic group's territory covered with oil and gas as a percentage of the country's total surface covered with oil and gas. This proxies very well $r_1/(r_1 + r_2)$.

First, we matched the ethnic groups in the MAR dataset with the ethnic groups in the "Geo-referencing of ethnic groups" (GREG) dataset (Weidmann, Rod and Cederman, 2010), which allowed us to know the geographical coordinates of where a given ethnic group settles. Then we merged this with the geo-referenced petroleum dataset (PETRODATA) from Lujala, Rod and Thieme (2007), which tells us where oil fields lie. Combining this information we were able to compute a variable measuring which part of the territory occupied by a given ethnic group contains oil. Expressing this in terms of the total surface containing oil in the country, we obtain a rather precise measure of how relatively petrol-rich the homelands of a given ethnic group are.

As shown in the existing literature (e.g., Collier and Hoeffler, 1998; Gartzke, 1999; Buhaug, Gates and Lujala, 2009), we can think of war as a stochastic process, as some of the parameters of the model may in each period be drawn from an underlying distribution. This allows us to estimate the risk of war onset using logit regressions, which is standard in the conflict literature.

In Table 1 we display the effects of the group's relative resource abundance, which is a proxy

	(1) Inter-group Conflict	(2) Inter-group Conflict	(3) Inter-group Conflict	(4) Separatism Index	(5) Separatism Index
Group's petrol / country's petrol (A)	**1.09*** **	0.40	-0.00	-0.39	0.56
	(0.31)	(0.47)	(0.62)	(0.27)	(0.40)
Group's geographical concentration (B)	**0.56*** **	0.41***	0.52***	0.30***	0.62***
	(0.13)	(0.15)	(0.19)	(0.07)	(0.11)
Group pet. / country pet. x group concent. (C)		**1.41** **	**1.21**	**1.52*** **	**0.49**
		(0.66)	**(0.92)**	**(0.35)**	**(0.51)**
Joint significance level (A) + (C)		**1%**	**10%**	**1%**	**1%**
Joint significance level (B) + (C)		**1%**	**5%**	**1%**	**5%**
Group's pop. as % of country's pop.			0.47		-1.63***
			(0.71)		(0.38)
Group different language			0.38**		-0.10
			(0.17)		(0.10)
Group different race			0.00		-0.78***
			(0.18)		(0.11)
Group different religion			0.13		-0.56***
			(0.16)		(0.09)
Country's democracy (t-1)			0.01		-0.01*
			(0.01)		(0.01)
Country's ln GDP per capita (t-1)			-0.39***		-0.05
			(0.09)		(0.05)
Country's ln population (t-1)			0.30***		0.64***
			(0.06)		(0.04)
Country's growth (t-1)			-0.93		-2.98***
			(1.06)		(0.69)
Country's mountains as % territory			-0.00		-0.00
			(0.00)		(0.00)
Country's ethnic fractionalization			-1.20***		-1.57***
			(0.46)		(0.27)
Observations	1732	1732	1334	3874	2416
Pseudo R2	0.0160	0.0188	0.0688	0.00825	0.128
Log likelihood	-846.8	-844.4	-607.4	-4631	-2492

Note: Dependent variable: First row. Sample: 1990-2000. With intercept. Col. (1)-(3) logit, (4)-(5) ordered logit. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis.

Table 1: Regressions with pooled panel

	(1)	(2)	(3)	(4)	(5)
	Inter-group Conflict	Inter-group Conflict	Inter-group Conflict	Inter-group Conflict	Inter-group Conflict
Group's petrol / country's petrol (A)	**2.60***	-1.88	**44.29****		
	(1.34)	(2.88)	**(21.55)**		
Group's geographical concentration (B)	**-0.03**	-0.38			
	(0.30)	(0.36)			
Group pet. / country pet. x group conc. (C)		**4.87***			
		(2.77)			
Joint significance level (A) + (C)		**5%**			
Joint significance level (B) + (C)		**10%**			
Part of group's territory covered by petrol				**146.64**	
				(176.23)	
Group's oil / country's oil					**39.98****
					(19.44)
Group's pop. as % of country's pop.	0.82	1.79			
	(1.58)	(1.68)			
Group different language	-0.77**	-0.65**			
	(0.31)	(0.32)			
Group different race	-1.32***	-1.43***			
	(0.34)	(0.35)			
Group different religion	0.05	-0.08			
	(0.29)	(0.29)			
Country's democracy (t-1)	0.11**	0.11**	0.12***	0.12***	0.12***
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Country's ln GDP per capita (t-1)	1.12*	1.11*	1.19*	1.24*	1.18*
	(0.65)	(0.65)	(0.70)	(0.69)	(0.69)
Country's ln population (t-1)	-9.73***	-9.79***	-11.15***	-10.48***	-11.03***
	(2.98)	(2.99)	(3.26)	(3.21)	(3.25)
Country's growth (t-1)	-2.14	-2.12	-2.42	-2.33	-2.41
	(1.61)	(1.61)	(1.67)	(1.67)	(1.67)
Time effects	Yes	Yes	Yes	Yes	Yes
Fixed effects	Country FE	Country FE	Group FE	Group FE	Group FE
Observations	923	923	707	707	707
Pseudo R2	0.0721	0.0762	0.0684	0.0599	0.0675
Log likelihood	-352.6	-351.0	-269.0	-271.4	-269.2

Note: Dependent variable: Inter-group conflict. Sample: 1990-2000. Logit with intercept in all columns. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parenthesis.

Table 2: Regressions including group fixed effects

for $r_1/(r_1 + r_2)$, and group concentration, which is a proxy for p_s/p_c, on inter-group conflict and separatism. Our theory predicts that if the ethnic minority group is very resource rich relative to the rest of the country and at the same time geographically very concentrated (which makes secession "easier" than centrist conflict), this given ethnic group is more likely to be involved in inter-group conflict or in secessionist rebellion. Hence, we expect a group's relative resource abundance to induce a larger risk of conflict, and this in particular when the group is geographically concentrated. In other words, we expect the resource abundance (A) and its interaction term with concentration (C) to be jointly positive and significant. This is indeed the case. Similarly, our theory predicts that increases in group concentration (B) lead to a higher conflict risk, and the more so when the group's homelands are relatively resource rich. This is indeed the case, given that (B) and (C) are jointly positive and significant. All the results are robust to the inclusion of various control variables (described in Appendix D).

Table 2 includes first country fixed effects and then group fixed effects, with the goal of addressing unobserved heterogeneity and omitted variable bias.[24] As before, more resource abundance when groups are concentrated, and more group concentration when their regions are resource abundant, will both continue to fuel the risk of conflict, even when country fixed effects are included.

The group concentration variable is not time-varying on the group level. Therefore, when we include group fixed effects (from column (3) onwards) this variable drops. But group fixed effects allow us to check if resource unevenness continues to matter under very demanding conditions. We find that relative resource abundance of a given ethnic group remains a statistically significant predictor of inter-group conflict. In column (4) we show that it is really the relative and not absolute resource abundance of the ethnic group that matters and in column (5) we show that the results are also robust if only oil (without gas) is included in the regressions.

6 Conclusion

This paper has proposed a simple model to capture how the geographical distribution of natural resources within a country can affect the risk of civil conflict of different types. We have allowed for uneven resource abundance and two different forms of conflict, secessionist and centrist, and found that bargaining fails to prevent costly conflict if an ethnic minority group is situated in a region that is particularly rich in natural resources (relative to the rest of the country) and if its winning probability for the case of secessionist conflict is substantially larger than for centrist conflict. This

[24] Note that in table 2 we focus exclusively on inter-group conflict as dependent variable, given that the separatism index used in columns (4) and (5) of table 1 is not time varying on the group level. Similarly, some control variables that are not time varying on the country or group level are dropped in table 2.

leads to the presence of two relevant threat points for war, which cannot be addressed at the same time by bargaining.

The new simple theory of bargaining breakdown due to multiple types of conflict is not only interesting per se, in our opinion, but it is also shown to fit very nicely with most existing empirical findings and with the estimations on our newly constructed data set with detailed geographic information about ethnic groups and resources.

Future research could explore the implications of the dynamic extension of our game theoretic framework, making the wealth and capacity stocks depend also on the accumulation of saved resource rents and past wars. In such a dynamic setting we would expect that over time the world moves from fewer and heterogeneous states to more and homogeneous states, in contrast with the indications that one could draw by introducing economies of scale and the like (see e.g., Alesina and Spolaore, 1997). Even though the dynamic analysis is beyond the scope of this paper, the simplicity and tractability of our model should suggest that indeed this path of future research is feasible and desirable, lending additional positive externality value to the present paper.

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Appendix A: The Optimal Alpha in the Frictionless Model

Define the threshold $\overline{\alpha} \equiv p_c + \frac{dw_j n_j}{r_1+r_2}$, as an upper bound of government concessions that would still make group j prefer peace to centrist conflict.

Group i weakly prefers peace to centrist conflict if $\alpha \geq \underline{\alpha}_c \equiv p_c - \frac{dw_i n_i}{r_1+r_2}$. Note that $\underline{\alpha}_c < \overline{\alpha}$ always holds. Hence if only centrist conflict were considered as a possibility, there would be an obvious Pareto frontier of intermediate values of α between these two that would avoid war if the two players could bargain about α.

Considering that another type of conflict is possible, group i weakly prefers peace to secessionist conflict if $\alpha \geq \underline{\alpha}_s \equiv p_s \frac{r_1}{r_1+r_2} - \frac{dw_i n_i^1}{r_1+r_2}$. We restrict attention to the most interesting setting where $\underline{\alpha}_c > 0$, $\underline{\alpha}_s > 0$. There are three cases to consider (recall that γ=probability that group i is drawn as mover):

Case 1: $p_c > p_s \frac{r_1}{r_1+r_2} + \frac{dw_i(n_i - n_i^1)}{r_1+r_2} \Longrightarrow \overline{\alpha} > \underline{\alpha}_c > \underline{\alpha}_s > 0$

$$E(\pi^j(\alpha = 0)) = \gamma\left[(1-p_c)(r_1+r_2) - dw_j n_j\right] + (1-\gamma)(r_1+r_2)$$

$$E(\pi^j(\alpha = \underline{\alpha}_c)) = (1 - \underline{\alpha}_c)(r_1 + r_2)$$

Group j would select $\alpha = \underline{\alpha}_c$ iff the following condition holds (and $\alpha = 0$ otherwise):

$$-p_c(1-\gamma)(r_1 + r_2) + dw_i n_i + \gamma dw_j n_j > 0$$

This condition holds when γ is large enough. It is in this case always possible to guarantee a peaceful outcome with $\alpha > 0$, as there is only one relevant form of conflict (C), under which the sum of payoffs is below the sum of payoffs for peace.

Case 2: $p_c + \frac{dw_j n_j}{r_1+r_2} > p_s \frac{r_1}{r_1+r_2} - \frac{dw_i n_i^1}{r_1+r_2} > p_c - \frac{dw_i n_i}{r_1+r_2} \Longrightarrow \overline{\alpha} > \underline{\alpha}_s > \underline{\alpha}_c > 0$

$$E(\pi^j(\alpha = 0)) = \gamma\left((1-p_s)r_1 + r_2 - dw_j n_j^1\right) + (1-\gamma)(r_1 + r_2)$$

$$E(\pi^j(\alpha = \underline{\alpha}_s)) = (1 - \underline{\alpha}_s)(r_1 + r_2)$$

Group j will select $\alpha = \underline{\alpha}_s$ iff the following condition holds (and $\alpha = 0$ otherwise):

$$-p_s(1-\gamma)r_1 + dw_i n_i^1 + \gamma dw_j n_j^1 > 0$$

This condition holds when γ is large enough. It is again possible in this case to guarantee a peaceful outcome, as there is only one relevant form of conflict (S), under which the sum of payoffs is below the sum of payoffs for peace.

Case 3: $p_s \frac{r_1}{r_1+r_2} > p_c + \frac{d(w_i n_i^1 + w_j n_j)}{r_1+r_2} \Longrightarrow \underline{\alpha}_s > \overline{\alpha} > \underline{\alpha}_c > 0$

$$E(\pi^j(\alpha = 0)) = \gamma\left((1-p_s)r_1 + r_2 - dw_j n_j^1\right) + (1-\gamma)(r_1 + r_2)$$

$$E(\pi^j(\alpha = \underline{\alpha}_s)) = \gamma(1 - \underline{\alpha}_s)(r_1 + r_2) + (1-\gamma)\left[(1-p_c)(r_1 + r_2) - dw_j n_j\right]$$

Group j will select $\alpha = \underline{\alpha}_s$ iff the following condition holds (and $\alpha = 0$ otherwise):

$$-p_c(1-\gamma)(r_1 + r_2) + \gamma d(w_i n_i^1 + w_j n_j^1) - (1-\gamma)dw_j n_j > 0$$

This condition holds when γ is large enough. In this third case for both $\alpha = 0$ or $\alpha = \underline{\alpha}_s$ there will be conflict for some draws and it is not possible to guarantee peace even in the presence of credible transfers.

Appendix B: Simultaneous Move Basic Model

The Escalation Case

Assume that groups move simultaneously, with the minority group i having the strategy space $\{p, c, s\}$ and the ruling group j having strategy space $\{p, c\}$. The profile $(p, p) \rightarrow$ peace; $(s, p) \rightarrow$ secessionist conflict; in all other cases there is centrist conflict. This is because it is always possible to escalate a secessionist war into centrist all-out war. This fits well a situation where both ethnic groups are somewhat dispersed and group j can force group i to fight a centrist war (for example by "taking hostages") rather than allowing them to confine the conflict to their own territory.

Assume further that there is some noise and accordingly group i plays trembling-hand perfect strategies (or alternatively eliminates all weakly dominated strategies). In this scenario, even when group j is expected to play c, group i will still select the action corresponding to its preferred outcome (as there is a chance that group j deviates and plays p, in which case group i's action matters). As before, the thresholds $\underline{\alpha}_c$ and $\underline{\alpha}_s$ correspond to the lower bound for which group i prefers peace, while $\overline{\alpha}$ represents the upper-bound of α for which group j prefers peace to centrist conflict.

Case 1: $p_c > p_s \frac{r_1}{r_1+r_2} + \frac{dw_i(n_i - n_i^1)}{r_1+r_2} \Longrightarrow \overline{\alpha} > \underline{\alpha}_c > \underline{\alpha}_s > 0$

In this case for $\alpha = 0$ the outcome is C, while for $\alpha = \underline{\alpha}_c$ the outcome is P. As, $\overline{\alpha} > \underline{\alpha}_c$ we know that group j will select $\alpha = \underline{\alpha}_c$ in equilibrium and the outcome will be P.

Case 2: $p_c + \frac{dw_j n_j}{r_1+r_2} > p_s \frac{r_1}{r_1+r_2} - \frac{dw_i n_i^1}{r_1+r_2} > p_c - \frac{dw_i n_i}{r_1+r_2} \Longrightarrow \overline{\alpha} > \underline{\alpha}_s > \underline{\alpha}_c > 0$

By symmetry, whenever group i prefers S to C (like in this second case), group j is better off in C than in S (for simplicity we focus here on the case where also $p_s \frac{r_1}{r_1+r_2} > p_c + \frac{dw_j(n_j - n_j^1)}{r_1+r_2}$ holds). Thus, for $\alpha = 0$ the selected profile is (s, c), leading to C; whereas for $\alpha = \underline{\alpha}_s$ the outcome is P. Hence, as $\overline{\alpha} > \underline{\alpha}_s$ we obtain in equilibrium $\alpha = \underline{\alpha}_s$ and P.

Case 3: $p_s \frac{r_1}{r_1+r_2} > p_c + \frac{d(w_i n_i^1 + w_j n_j)}{r_1+r_2} \Longrightarrow \underline{\alpha}_s > \overline{\alpha} > \underline{\alpha}_c > 0$

For $\alpha = 0$ the selected profile is (s, c), leading to C; whereas for $\alpha = \underline{\alpha}_s$ the actions are (p, c), resulting in C as well. Hence, we obtain in equilibrium $\alpha = \{0, \underline{\alpha}_s\}$ and C.

Bargaining failure occurs under the exact same conditions of Proposition 1.

When Secessionist Conflict Cannot Be Escalated

Now consider the alternative scenario in which $(p, p) \rightarrow P$ and secessionist conflict takes place whenever group i plays s (in all other cases there is centrist conflict). This corresponds to situations where the minority cannot be forced into centrist all-out conflict (e.g., when no "hostage taking"

is possible or effective).

Case 1: $p_c > p_s\frac{r_1}{r_1+r_2} + \frac{dw_i(n_i-n_i^1)}{r_1+r_2} \Longrightarrow \overline{\alpha} > \underline{\alpha}_c > \underline{\alpha}_s > 0$

In this case for $\alpha = 0$ the outcome is C, while for $\alpha = \underline{\alpha}_c$ the outcome is P. As $\overline{\alpha} > \underline{\alpha}_c$ we know that group j will select $\alpha = \underline{\alpha}_c$ in equilibrium and the outcome will be P.

Case 2: $p_c + \frac{dw_j n_j}{r_1+r_2} > p_s\frac{r_1}{r_1+r_2} - \frac{dw_i n_i^1}{r_1+r_2} > p_c - \frac{dw_i n_i}{r_1+r_2} \Longrightarrow \overline{\alpha} > \underline{\alpha}_s > \underline{\alpha}_c > 0$

For $\alpha = 0$ we will observe S; whereas for $\alpha = \underline{\alpha}_s$ the outcome is P. Hence, as $\overline{\alpha} > \underline{\alpha}_s$ we obtain in equilibrium $\alpha = \underline{\alpha}_s$ and P.

Case 3: $p_s\frac{r_1}{r_1+r_2} > p_c + \frac{d(w_i n_i^1 + w_j n_j)}{r_1+r_2} \Longrightarrow \underline{\alpha}_s > \overline{\alpha} > \underline{\alpha}_c > 0$

For $\alpha = 0$ group i plays s resulting in S; whereas for $\alpha = \underline{\alpha}_s$ group i plays s (preemptive, to avoid C), which leads again to S. Hence, we obtain in equilibrium $\alpha = \{0, \underline{\alpha}_s\}$ and S.

Once again the bargaining failure condition is the same as in Proposition 1, but which conflict will be observed depends on whether escalation is possible or not.

Appendix C: Accepted Secession in the Basic Model

A necessary condition for the occurrence of accepted secession is that $dw_j n_j^1 \geq (1-p_s)r_1$. Focusing now on the cases in which this condition holds, we know that whenever group i proposes secession it will be accepted by group j. Thus, the threshold for group i preferring s to p becomes $\underline{\alpha}_a \equiv \frac{r_1}{r_1+r_2}$. Further, remember the threshold for j: $\overline{\alpha} \equiv p_c + \frac{dw_j n_j}{r_1+r_2}$. Thus, under the condition $\frac{r_1}{r_1+r_2} > p_c + \frac{dw_j n_j}{r_1+r_2}$ we obtain a similar result as in the main text, but now for bargaining failing to prevent accepted secession rather than secessionist conflict.

Appendix D: Data

This appendix describes the data used in section 5.

Country's democracy: Polity scores ranging from -10 (strongly autocratic) to +10 (strongly democratic). From Polity IV (2009).

Country's ethnic fractionalization: From Walter (2006).

Country's growth: Growth rate of GDP per capita at constant 2000 US$. From World Bank (2009).

Country's ln GDP per Capita: At constant 2000 US$. From World Bank (2009).

Country's ln population: From World Bank (2009).

Country's mountains as % territory: Percentage of territory covered by mountains. From Collier, Hoeffler, and Rohner (2009).

Group different language: Dummy taking a value of 1 if an ethnic group speaks another language than the dominant group(s) in society. From Minorities at Risk (2009) (coded as 1 if their variable Lang takes values of 2 or 3).

Group different race: Dummy taking a value of 1 if an ethnic group is of another race than the dominant group(s) in society. From Minorities at Risk (2009) (coded as 1 if their variable Race takes values of 2 or 3).

Group different religion: Dummy taking a value of 1 if an ethnic group has a different religion than the dominant group(s) in society. From Minorities at Risk (2009) (coded as 1 if their variable Belief takes values of 2 or 3).

Group's geographical concentration: Dummy taking a value of 1 if the variable Groupcon from Minorities at Risk (2009) is at least 3.

Group's oil / country's oil: Like Group's petrol / country's petrol, but excluding natural gas.

Group's petrol / country's petrol: As described in the main text.

Group population as % of country population: From Walter (2006).

Inter-group conflict: Dummy taking a value of 1 if the variable Comco from Minorities at Risk (2009) is at least 3.

Part of group's territory covered with petrol: Same sources as for Group's petrol / country's petrol, but captures the % of a group's territory that is covered by petrol.

Separatism index: Variable Sepx from Minorities at Risk (2009).