

DEPARTMENT OF ECONOMICS

OxCarre

Oxford Centre for the Analysis of Resource Rich Economies

Manor Road Building, Manor Road, Oxford OX1 3UQ

Tel: +44(0)1865 271089 Fax: +44(0)1865 271094

oxcarre@economics.ox.ac.uk www.economics.ox.ac.uk



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Christa N Brunnschweiler

(CER-ETH Center of Economic Research at ETH Zurich)

Erwin H Bulte

**(Development Economics Group, Wageningen University,
and Dept. of Economics, Tilburg University)**

Fractionalization and Fighting over Natural Resources: Ethnicity, Language, Religion, and the Onset of Civil War

*Christa N. Brunnschweiler*¹ and *Erwin H. Bulte*²

¹ CER-ETH Center of Economic Research at ETH Zurich, Switzerland, and OxCarre,
University of Oxford, UK

Email: cbrunnschweiler@ethz.ch

² Development Economics Group, Wageningen University, and Department of Economics,
Tilburg University, Netherlands, and OxCarre, University of Oxford, UK

Email: Erwin.bulte@wur.nl

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Abstract: We use three different measures of fractionalization (with varying potential for members of one fraction to “mendaciously” pass for a member of another) to revisit the correlation between natural resources and the onset of conflict. The combination of ethnic fractionalization and resource wealth seems to translate into a greater risk of war, but the same is not true for linguistic and religious fractionalization. This is consistent with the “greed hypothesis” as a driver of conflict. However, we also find that the direct effect of resource wealth tends to attenuate the risk of war, and the net effect of resources on conflict is ambiguous.

Keywords: Civil war, conflict, natural resources, fractionalization.

1. Introduction

The positive correlation between natural resources and (certain types of) civil conflict has become an important and lively field of research (e.g., Collier and Hoeffler 1998, 2004; Fearon and Laitin 2004, Ross 2004). Two prominent explanations as to why resources might invite war are “greed” and “grievance” (see the ‘special issue’ of *Journal of Conflict Resolution* in 2005). While the greed perspective focuses on the temptation of resource rents as a driver of rebellion, the grievance explanation emphasizes issues like relative deprivation, social exclusion and inequality (triggered by insufficiently compensated land expropriation, environmental degradation, etc.). However, the relation between resources and conflict is contentious. Some authors dispute the nature of the causality implied by the conventional literature (e.g. Ross 2006, Brunnschweiler and Bulte 2008) and others argue in favor of resource scarcity as a driver of conflict, not abundance (e.g., Homer-Dixon 1999).

In this paper we further examine the link between resources and conflict, linking the resource-conflict literature to ongoing work on fractionalization. In a recent paper, Caselli and Coleman (2006) analyze whether engaging in conflict over future benefits – government jobs, land, resource rents – is worthwhile for a coalition of potential rebels. Their “greed-based” theory of (ethnic) conflict centers around the insight that conflict only “pays” when victors can identify and exclude the losers from sharing in the spoils of the victory. If the winning coalition (for example a rebel movement) is unable to prevent losers from infiltrating their ranks, the gains from victory will be diluted, and as a consequence the incentives to engage in conflict are attenuated.¹

The scope for identifying losers depends on the characteristics which distinguish the winning coalition from the rest of the population. To capture this idea, we use three measures of fractionalization advanced by Alesina *et al.* (2003): ethnic, religious and

¹ See Hodler (2006) for a related look at the interplay of fractionalization and natural resource abundance and their effects on income. In his model, membership of a certain fraction is exogenously given for individuals, and fighting over resource rents adversely affects institutional quality.

linguistic fractionalization. Fractionalization is believed to reduce the provision of public goods (e.g., Alesina et al. 2003, Habyarimana et al. 2007). While some earlier papers also documented a positive association between fractionalization and the onset of civil war, the more recent literature suggests this effect is much less robust (e.g. Fearon and Laitin 2003, Hegre and Sambanis 2006, and Ostby 2008). Importantly, for the Caselli and Coleman mechanism, the *nature* of fractionalization determines the scope for losers to ‘mimic’ the winners and infiltrate the winning coalition—thereby eroding the benefit of coalition membership. For example, while a schism along religious lines may be equally salient and insurmountable as one along racial lines, hiding one’s religious denomination can be relatively easy, and history provides telling examples of this phenomenon. Overcoming linguistic barriers is harder, but parents can encourage their offspring to adopt the winning coalition’s language. Arguably, it is most difficult to mimic winners when coalition membership is along ethnic lines—changing features associated with physical appearances is often not feasible.

The main objective of this paper is to assess whether resources in combination with different types of fractionalization trigger civil wars over resource rents, and evaluate whether the results are consistent with the greed-based theory of Caselli and Coleman (2006). Since the scope for winners to enjoy rents depends on the ability for losers to mimic winners, we hypothesize that greed-based conflicts over resources are more prevalent in countries that combine resource abundance with a high degree of ethnic fractionalization. In contrast, language and religious fractionalization should matter less, or not at all, since excluding non-members is difficult along such lines. Obviously, we cannot rule out that grievances might matter as well. If ethnic cleavages are more likely to invite polarization and social tensions than religious or linguistic ones—an open question, until now—then distinguishing between

greed and grievance requires additional theory and data. Exploring these arguments is left for future work.

2. Data and Empirical Strategy

We construct a panel dataset including nine five-year periods from 1960-2004, to perform pooled logit regressions with a zero-one dummy for civil conflict onset as the dependent variable. The estimated equation reads as follows:

$$(1) \quad warstart_{it} = \alpha_0 + \alpha_1 * X_{it} + \alpha_2 * F_{ij} + \alpha_3 * RA_{it} + \alpha_4 F_{ij} RA_{it} + v,$$

where $warstart_{it}$ is our conflict dummy for country i in period t , X is a vector of the usual controls (measures of income and growth in the previous period, population size, the degree of mountainousness, and a polity variable), F_{ij} is the relevant fractionalization index (j = ethnic, linguistic or religious), and RA measures resource abundance. Finally, v is an error term. The main coefficient of interest is α_4 .

The conflict dummy is based on the Armed Conflict Database (ACD) compiled by Gleditsch et al. (2002), and includes ‘minor’ conflicts (more than 25 battle-related deaths per year, at least 1000 deaths over the entire conflict) as well as major ones (more than 1000 battle-related deaths per year). We treat ongoing conflicts as missing variables, and control for years of peace so as not to confuse conflict onset with its duration. We also use the Correlates of War (COW) database by Gleditsch (2004) in separate estimations, which considers all organized military conflicts with at least 1000 battle-related deaths, of which at least five percent must be inflicted by the weaker party.

Fractionalization data are from Alesina *et al.* (2003), who sought to distinguish between ethnic, religious and linguistic heterogeneity. Although language is one of the criteria ethnologists and anthropologists use to define ethnicity in some areas of the world (e.g. Africa), and therefore inevitably enters any ethnic fractionalization measure, the authors

improve on other fractionalization variables by explicitly distinguishing the language component in a separate measure. “It would be wrong to interpret our ethnicity variable as reflecting racial characteristics alone, but it does reflect these characteristics to a greater extent than our language variable, and it should thus be expected to bear a different relationship to economic variables” (Alesina *et al.* 2003, p.160). The correlation between the language and ethnic fractionalization variables is obviously significant, but the correlation coefficient of 0.69 also suggests that the ethnic fractionalization measure picks up additional information. This forms the basis of our identification strategy.²

To what extent are there significant somatic differences between different ethnic groups, or to what extent is ethnicity observable? Not surprisingly, ethnic identification varies according to the complexity of the ethnic demography, but experimental evidence suggests people can often correctly gauge other people’s identity. Habyarimana et al. (2004, 2007) report correct identification scores varying from 50% (in urban Kampala) to 70-90% (among Los Angeles-based undergraduates).

Our resource abundance measure is taken from World Bank estimates (World Bank 1997) of the net present value of resource rents (in USD per capita) of a country’s total natural capital stock, including subsoil assets (fuel and non-fuel minerals), cropland, pastureland, timber and non-timber forest resources, and protected natural areas. This measure is available for around 90 countries for the year 1994. We mainly use the (log of) the total natural resource value: the original hypothesis does not distinguish between different types of resources, as both mineral and land resources are deemed to be more expropriable than, for example, human capital. In additional estimations, we also distinguish between the two main components, namely subsoil and land-based resources, to test whether effects are

² Arguably, a case can be made that if we find support for the Caselli-Coleman mechanism using this relatively weak distinction between race-based and language-based ethnic identity, results would be biased against us and would probably be much stronger if we had a more narrowly defined ethnic variable at our disposal. Note that the correlation coefficient between ethnic and religious fractionalization is a mere 0.18.

resource-specific (as suggested by some of the recent literature distinguishing between so-called point and diffuse resources).

The way fractionalization and resource abundance are defined implies that, unlike many conventional resource variables that are scaled by income, they are essentially exogenous variables with respect to the onset of conflict (see Brunnschweiler and Bulte 2008).³

3. Regression Results and Robustness Analysis

Our results are reported in Table 1. Columns (1)-(3) show estimations where the various interaction terms enter separately. Consistent with the literature, we find negative correlations between population size and the onset of conflict, and between income and conflict (albeit far from robustly significant). Note that the fractionalization terms themselves do not enter significantly.

More interestingly, and consistent with a Caselli-Coleman-style interpretation of the greed hypothesis, we find that the interaction term of ethnic fractionalization and resource abundance enters positively and significantly (col. 1), but that the same is not true for the two alternative fractionalization measures (cols 2 and 3). While ethnic fractionalization – with limited scope for losers to mimic winners – promotes conflict in the presence of resource wealth, this is not the case when gains from conflict can be diluted through infiltration. The type of fractionalization – what divides the various fractions in a country – thus matters for behavior and economic outcomes.

Interestingly, there also appears to be a direct effect of resource abundance on conflict, but it runs counter to the conventional “resource curse” theories. Resource wealth

³ The resource abundance variable reflects cumulative extraction and exploration effort, and is therefore unlikely to be truly invariant with respect to (the threat of) conflict. A fully exogenous resource variable is unlikely to exist. Nevertheless, our basic results are robust with respect to using alternative resource abundance variables such as estimates of mineral or hydrocarbon stocks (details available on request).

attenuates the risk of conflict (Brunnschweiler and Bulte 2008), but the mechanism is unclear. The negative coefficient may be due to an income effect, or may be explained by the notion that resource rents enable governments to either bribe the populace or more effectively suppress them (Azam 2001). Summing up the two effects at mean levels of ethnic fractionalization (around 0.46, roughly the level of Mauritius), increasing total resource wealth by one standard deviation (0.92) would have reduced the risk of conflict by 0.12.

Recalling the ambiguous nature of the ethnic fractionalization variable (which overlaps with linguistic fractionalization, hampering clean identification of the Caselli-Coleman effect), it is no surprise that the estimated effects are not very strong statistically. If there is a conflict-enhancing effect of the combination of resource wealth with high ethnic fractionalization, then it is only marginal. However, we can reject the possibility that resource wealth, ethnic fractionalization, and their interaction term are jointly insignificant at the 10% level.

In column (4) we combine our measures of ethnic and religious fractionalization, (due to the multicollinearity between ethnic and language fractionalization it makes little sense to include all three fractionalization measures in one model), and note that the interaction of natural resources with ethnic fractionalization again enters significantly (and that the coefficient is now 30% larger than before). This confirms that greater ethnic division in the presence of abundant natural resources increases the risk of conflict. Ethnic fractionalization on its own now enters with a negative and significant sign, but resource abundance is not significant.

As a robustness analysis we repeat column (1) using the COW database to define our measure of conflict. The new regression results, shown in column (5), indicate that the combination of ethnic fractionalization and resource abundance is no longer significant (but resources themselves again attenuate the risk of war). Sensitivity of cross-country results

with respect to the specification of conflict is not uncommon, and can be easily explained if resource conflicts are relatively mild (so that they do not cross the 1000 deaths threshold) or if the number of war events is reduced considerably (from potentially 149 in the ACD to 93 conflicts in the COW database, see the data appendix for more details).

Finally, we also disaggregate our main resource abundance variable into its two components, namely subsoil (fuel and non-fuel minerals) and land-based (crop- and pastureland, forests and protected areas) resources. The results are shown in columns (6) and (7), respectively.⁴ Interestingly, our main result that resource abundance attenuates conflict, but its combination with ethnic fractionalization increases the risk of conflict, is confirmed for land-based resources, but not for subsoil resources. Moreover, we can reject the possibility that land abundance, ethnic fractionalization, and their interaction are jointly insignificant at the 6% level. While land-based resources enter negatively in model (7), supporting the hypothesis that land scarcity may be a driver of civil conflict (e.g. Andre and Platteau 1998), the positive interaction term suggests ethnic-based conflict is more likely when there are considerable land rents to be fought over. However, such an hypothesis clearly necessitates further research.

4. Discussion and Conclusions

Caselli and Coleman propose that the ability to identify and exclude non-members of a winning coalition affects the incentive of coalition formation and collective action.

Specifically, if infiltration of non-members threatens to erode the future gains from engaging in conflict, the reason for undertaking collective action in the first place may disappear.

Using data on civil war and various measures of fractionalization – allowing varying degrees of membership identification – we find some support for this rational actor approach to

⁴ For space reasons, we only show results of two specifications with ethnic fractionalization.

explaining conflict. Interestingly, it appears as if ethnic conflict is more likely to break out when land-based resource rents are contested (rather than subsoil resource wealth). While our results do not enable us to be an arbiter in the ongoing debate between “greed” or “grievances” as drivers of conflict, they are consistent with greed-based motives for fighting. However, the net effect of resources, combining both greed and income effects, is not robustly negative or positive.

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Data Appendix

Income and growth Per capita real GDP at the beginning of the period and annual growth rates of real GDP per capita during the previous period are based on the Penn World Tables (PWT) 6.2.

Mountainousness Percent of total land area covered by mountains, taken from Fearon and Laitin (2003).

Natural resource abundance Data on total natural resource wealth, as well as the two disaggregated measures, were taken from World Bank (1997). The measures estimate the net present value in USD per capita of rents from natural resources (see World Bank (1997) for more details).

Peace Number of years since the last civil war, or since the end of WWII.

Polity Polity2 indicator from the Polity IV dataset. This measures a regime on a scale from -10 (institutionalized autocracy) to +10 (institutionalized democracy).

Population Total population at the beginning of the period, taken from PWT 6.2.

Ethnic, linguistic and religious fractionalization Measures of fractionalization are taken from Alesina et al, (2003). They range from 0 (totally homogeneous) to 1 (completely heterogeneous).

Warstart The main measure is taken from the Armed Conflict Database (ACD) compiled by Gleditsch et al. (2002). The alternative measure is based on the Correlates of War (COW) database by Gleditsch (2004).

Countries in sample:

Argentina^a, Australia, Austria, Bangladesh^a, Belgium, Benin, Bhutan*, Bolivia^a, Botswana, Brazil, Bulgaria*, Burkina Faso^a, Burundi^{a,C}, Cameroon^a, Canada, Central African Rep.^a, Chad^{a,C}, Chile^a, China^C, Colombia^{a,C}, Congo^{a,C}, Costa Rica, Côte d'Ivoire^a, Denmark, Dominican Rep.^{a,C}, Ecuador, Egypt^a, El Salvador^{a,C}, Ethiopia^{a,C,*}, Fiji*, Finland, France^a, Gabon^{a,*}, The Gambia^a, Germany, Ghana^a, Greece, Guatemala^{a,C}, Guinea-Bissau^{a,C}, Haiti^a, Honduras, Hungary*, India^{a,C}, Indonesia^{a,C}, Iran^{a,C,*}, Ireland, Israel^{a,*}, Italy, Jamaica, Japan, Jordan^C, Kenya^a, S. Korea, Lesotho^a, Madagascar^a, Malawi, Malaysia^a, Mali^a, Mauritania, Mauritius, Mexico^a, Morocco^{a,C}, Mozambique^{a,C}, Namibia, Nepal^{a,C}, Netherlands, New Zealand, Nicaragua^{a,C}, Niger^a, Nigeria^{a,C,*}, Norway, Pakistan^{a,C}, Panama^a, Paraguay^a, Peru^{a,C}, Philippines^{a,C}, Portugal, Romania^{a,C,*}, Rwanda^{a,C}, Saudi Arabia^a, Senegal^a, Sierra Leone^{a,C}, South Africa^{a,C}, Spain^a, Sri Lanka^{a,C}, Swaziland*, Sweden, Switzerland, Syria^{a,*}, Tanzania, Thailand^a, Togo^a, Trinidad and Tobago^a, Tunisia^a, Turkey^{a,C}, United Kingdom^a, United States^a, Uruguay^a, Venezuela^a, Zambia, Zimbabwe^{a,C}.

^a One or more conflict episodes according to ACD database.

^C One or more conflict episodes according to COW database.

* These countries only have natural capital data for 2000.

TABLE 1. NATURAL RESOURCES, FRACTIONALIZATION AND CONFLICT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	warstart ACD	warstart ACD	warstart ACD	warstart ACD	warstart COW	warstart ACD	warstart ACD
lnnatcap	-0.592* (-1.720)	0.186 (0.632)	-0.0536 (-0.188)	-0.520 (-1.333)	-1.312* (-1.847)		
lnsubsoil						0.145 (0.63)	
lnland							-0.756* (-1.94)
ethnicfrac	-7.398 (-1.436)			-9.975* (-1.808)	-6.872 (-0.728)	4.361* (1.73)	-7.489 (-1.38)
langfrac		0.861 (0.180)					
relfrac			-0.187 (-0.040)	5.243 (0.981)		-1.505** (-2.26)	-0.990* (-1.88)
lnnatcap*ethnicfrac	1.019* (1.658)			1.375** (2.061)	0.997 (0.840)		
lnnatcap*langfrac		0.0574 (0.102)					
lnnatcap*relfrac			-0.064 (-0.116)	-0.749 (-1.172)			
lnsubsoil*ethnifrac						-0.219 (-0.55)	
lnland*ethnicfrac							1.076* (1.63)
ln income	-0.156 (-0.889)	-0.263 (-1.440)	-0.345** (-2.148)	-0.093 (-0.510)	-0.290 (-1.163)	-0.209 (-0.90)	-0.148 (-0.85)
growth	-0.055 (-1.148)	-0.013 (-0.257)	-0.066 (-1.384)	-0.054 (-1.114)	-0.180** (-2.312)	0.0133 (0.21)	-0.09* (-1.77)
ln pop	0.219** (2.567)	0.231*** (2.577)	0.224*** (2.609)	0.242*** (2.740)	0.291** (2.355)	0.417*** (3.52)	0.260*** (2.87)
peace yrs	-0.014* (-1.647)	-0.012 (-1.296)	-0.012 (-1.337)	-0.012 (-1.401)	-0.038*** (-3.104)	-0.016 (-1.36)	-0.014 (-1.59)
mountain	0.003 (0.562)	0.008 (1.300)	0.001 (0.258)	0.001 (0.232)	0.019** (2.446)	-0.004 (-0.46)	0.001 (0.18)
polity	-0.004 (-0.207)	-0.0005 (-0.0225)	-0.003 (-0.134)	-0.003 (-0.132)	0.051 (1.605)	0.016 (0.60)	-0.0003 (-0.016)
Constant	2.073 (0.698)	-4.025 (-1.453)	-0.134 (-0.050)	0.942 (0.264)	7.438 (1.352)	-5.700** (-2.11)	3.238 (0.97)
Observations	649	630	649	649	696	464	634
Log likelihood	-229.8	-214.2	-232.3	-227.3	-116.7	-142.7	-220.6
Pseudo R^2	0.07	0.07	0.06	0.08	0.21	0.13	0.08

Notes: All estimations are pooled logit with conflict onset dummy as the dependent variable. z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.