How Ethnicity Conditions the Effect of Oil and Gas on Civil Conflict: A Spatial Analysis of Africa from 1990 to 2010☆

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Abstract

In this article we investigate whether natural resource endowments, specifically oil and gas, and the political status of ethnic groups interact to increase or decrease armed conflict risk. We argue that political exclusion of ethnic groups should amplify, while monopoly power of ethnic groups should reverse the effects of oil and gas on conflict, as these groups can use revenues for patronage or repression. We use highly spatially disaggregated grid data from Africa (1990-2010) and match conflict events, oil and gas deposit locations and the political status of local ethnic groups to test our hypotheses. We find that differences in group status matter. While there is no strong amplification effect of ethnic group exclusion on oil and gas, above and beyond their conflict-increasing constituent effects, we find very clear and strong evi-

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dence for a conditioning effect for groups with a monopoly over national-level political institutions: Oil and gas in grid cells with powerful, nationally represented groups reduce conflict risk, while otherwise increasing the probability of violent conflict onset.
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Introduction

What role do natural resources and ethnicity play for violent conflict? In many conflicts warring factions form along ethnic and other identity lines and political exclusion of ethnic groups seems to especially increase conflict risk (Cederman, Wimmer & Min, 2010). At the same time, a huge body of literature has focused on natural resources - particularly oil and diamonds - as determinants for the onset, duration, and recurrence of civil wars (Ross, 2012, e.g.). Surprisingly little research though has investigated the interplay between these two factors.

We investigate whether the potential conflict-increasing effects of oil and gas, identified in the "resource curse" literature (Ross, 2004), are conditional on the political status of local ethnic groups.[1] There are many examples, in which both ethnicity and natural resources have seemingly contributed to fueling the flame of conflict: Ethnic and other identity groups in Nigeria (Igbo and Ijaw) or Indonesia (Acehenese) have demanded a greater share of oil and gas revenues from the central government and often protested negative side-effects of production. In contrast, in many Middle Eastern, oil-rich Rentier states politically dominant groups were able to minimize violent opposition through a combination of state largesse and repression (Le Billon, 2001b; Smith, 2004).

We derive explicit hypotheses about the potential interplay between ethnic group status and oil and gas for conflict. We argue that political exclusion of local, proximate ethnic groups is likely to *amplify* the conflict-increasing effects of oil and gas, due to the added ability to overcome collective action and coordination problems. On the other hand, for ethnic groups that enjoy a monopoly over state power, oil deposits in their settlement area are expected to *reduce* the likelihood of conflict. Monopoly groups will protect strategically important regions, using oil and gas revenues to buy off the support of critical elements of the population or finance an effective repressive apparatus (Basedau & Lay, 2009). Our perspective highlights the importance connecting aspects of political geography, i.e. the location of oil and gas, with ethnic group-state relations to better understand outbreaks of political violence and the "resource curse" more generally.

For our empirical analysis we forego typical cross-national research designs, since existing measures of ethnic group status and natural resource abundance do not contain information on the spatial overlap of each factor. Instead, we follow a recent wave of research in political science and geography that relies on spatially disaggregated data (Buhaug & Rød, 2006; Gleditsch & Weidmann, 2012). Specifically, we use highly disaggregated grid-cell data from the African continent from 1990 to 2010, provided through the PRIO-GRID data structure (Tollefsen, Strand & Buhaug, 2012). We join information on violent conflict events in each grid-cell-year (Melander & Sundberg, 2011) with data on local oil and gas deposits (Lujala, Rød & Thieme, 2007), the national political status of local ethnic groups (Cederman et al., 2010) and a number of important control variables. We implement a series of statistical models to test for an interaction between ethnic group status and oil, as well as a host of robustness checks to ascertain the validity of our findings.

Overall, we find that the political status of ethnic groups matters for the effect of oil and gas on conflict. In line with theoretical expectations from the "resource curse" and ethnic conflict literature, we document independent conflict-enhancing effects of oil and gas and ethnic exclusion. While we do not find strong evidence for a meaningful amplification of the oil and gas effect through the political exclusion of ethnic groups, political control over the state does strongly condition oil's conflict increasing tendencies. We are able to show a robust interaction between the presence of groups with a monopoly of political power and oil: Grid cells that are home to groups without controlling access to national-level political institutions are more likely to experience violent conflict events if oil and gas are present; for grid cells with local groups that do enjoy a monopoly of political power, oil and gas strongly reduce the likelihood of conflict.

Our paper makes several valuable contributions to the existing literature. First, we contribute to the cross-fertilization between two major research programs in the conflict literature and geographic research on violence. Second, we offer empirical evidence for an interaction based on grid-cell data in Africa, adding to the growing body of work using disaggregated units of analysis to investigate conflict. Third, our findings on the conditional effects of oil and gas and the access to state power by ethnic group status help to connect and contextualize existing findings in both literatures. In particular, our results help to shed light on the controversy about the existence of a "resource curse" for conflict. Existing empirical work on the link between natural resources and conflict offers contradictory findings. Our analysis suggests that the role of oil and gas is affected by the relationship and access of ethnic groups to the state, furthermore implying a spatial logic to traditional Rentier state arguments. This highlights the importance of considering the confluence of geographic and social factors for understanding violent conflict.

Natural Resources, Ethnicity, and Violence

A large literature deals with the link between natural resources and conflict. Generally, natural resources can promote violence through three major causal mechanisms (Ross, 2004; Le Billon, 2008): resource-related motivations, favorable opportunity structures, and indirect effects. For example, grievances over the inequitable distribution of resource revenue or ecological damage from extraction can provide motivation to take up arms. Collier and Hoeffler (2004) argue that the availability of primary commodities increases the likelihood of civil war onset, by providing the opportunity for armed rebel activity and the related motive of "greed" rather than by spurring conflict-promoting grievances – such as the political and economic deprivation experienced by, for instance, ethnic or religious groups. Resource dependence can also have detrimental indirect effects through weakening socio-economic development (Auty, 1993) or state institutions (Mehlum, Moene & Torvik, 2006).

Numerous quantitative studies have tried to demonstrate that natural resources increase the risk of civil war onset; however, their results vary (Ross, 2004; Lujala, Gleditsch & Gilmore, 2005; Smith, 2004; Humphreys, 2005). Some studies have found evidence for a conditional effect of natural resources (Fjelde, 2009) or an inverted U-shape (Basedau & Lay, 2009). Research that tries to address issues of endogeneity between national-level measures of resource abundance and civil conflict fails to identify conflict-increasing effects (Brunnschweiler & Bulte, 2009; Cotet & Tsui, 2013). The majority of scholarly work has focused on oil and gas and not other resources as potential conflict risk. Empirical studies do suggests that oil and gas (and to a certain degree diamonds) play the most relevant role for conflict (Lujala, 2010; Ross, 2012).

Geographers such as Rick Auty, Philippe Le Billon and Michael Watts have further analyzed the conditions under which the resource-conflict link materializes. The contribution of geographic research is at least threefold (for a succinct conceptual summary see Korf (2011)). First, at a theoretical level, geographers have argued that the location and production type of resources conditions the resource-conflict link (Auty, 2004; Le Billon, 2001b, 2012). According to Le Billon (2012, p.179) a resource is more accessible, or "lootable", to (potential) rebels, when less labor, financial and technological capital are required for exploitation and when the price-per-volume ratio facilitates transport. Alluvial diamonds and onshore oil are hence much more accessible to rebels than offshore oil production. Lootability further increases when resources are spread over a vast territory, in a terrain favorable for insurgency and when the stocks are close to international borders. Second, geographers have made the case that empirical studies need to "account for scale" and study the sub-national level (Buhaug & Lujala, 2005).

Quantitative studies that disaggregate the location and extraction mode of resources find that conflicts over state control are more likely in regions that are near diamond fields (Buhaug & Rød, 2006) and that more lootable resources increase the risk of local conflict (Lujala, 2010). Third, qualitative case studies have contextualized the geography of resources in conflict. Le Billon's (2001a) analysis of the Angolan civil war demonstrates how the government used oil money to create a precarious political stability in its territory while rebels upheld their insurgency through the trade in (mostly alluvial) diamonds. Watts (2004; 2007) has studied "governable spaces" in Nigeria's oil-rich Niger-Delta. He shows how oil has initially created local (ethnic) community protest against the oil industry that led to insurgency and then degenerated into organized crime (Watts, 2007).

A separate literature deals with the effects of ethnicity on violent conflict. While ethnic diversity per se might not necessarily lead to violent conflict (Hegre & Sambanis, 2006), three major mechanisms connecting ethnicity to conflict risk are frequently cited in the literature: Instrumental mobilization of ethnic identities by group leaders for their own political or financial aims (Blimes, 2006); Group grievances through (perceived) relative deprivation (Gurr, 1970, 2000) or horizontal inequalities (Cederman, Weidmann & Gleditsch, 2011; Stewart, 2008b; Østby, 2008, e.g.); Indirect effects on conflict operating through slower growth in ethnically diverse societies (Mauro, 1995) or lower levels of public goods provision (Habyarimana, Humphreys, Posner & Weinstein, 2007).

The quantitatively oriented debate has largely resorted to testing which particular ethno-demographic constellations are most conflict-prone. Overall the evidence remains far from conclusive.[2] Lars-Erik Cederman and co-authors, using a new dataset on Ethnic Power Relations (EPR) which contains systematic information on groups' access to power in the post-WWII period, have convincingly shifted the scholarly attention away from demographic constellations back to questions of political grievances of ethnic groups. Specifically, they emphasize the political inclusion or exclusion of ethnic groups at the national level as an important factor contributing to civil violence (Cederman, Buhaug & Rød, 2009; Wimmer, Cederman & Min, 2009).

We contend that our understanding of both literatures can be improved by considering the interaction between oil and gas and ethnicity. Explicit research on the *combined* effects of these two factors though is relatively scarce. Contemplating the ethnic divisions in Angola, Le Billon (2001b), stresses the significance of resources in conflicts. Fox and Swamy (2008) have examined the interplay of resources and ethnicity in some Asian conflicts, attaching great importance to relative deprivation. Aspinall's (2007) study on Aceh states that other resource-rich Indonesian provinces did not experience secessionist violence because of the absence of an "appropriate identity-based collective action frame" (Aspinall, 2007, p.950).

Collier and Hoeffler (2005) have investigated the determinants of (often ethnic) secession at the country level, but consider secession to be driven mainly by economic opportunity and do not specifically test the geographic location of resources and ethnicity as such. Some studies have investigated the interaction between regional relative deprivation and the presence of natural resources for conflict. Hegre, Østby and Raleigh (2009) construct disaggregated data on welfare and socio-economic inequalities between and within subnational units in Liberia and find that region-relative deprivation in assets, combined with natural resource abundance, does foster internal violence. Similarly, Østby, Nørdas & Rød (2009) find for sub-national regions in 22 sub-Saharan African countries an interaction between natural resource endowments and relative economic deprivation. Wegenast and Basedau (2013) investigate for a broad set of countries the interaction of ethnic fractionalization and resource abundance at the country-level. A study by Sorens (2011) on ethnoregions shows that local mineral abundance encourages the pursuit of territorial secession, but not the struggle for central government control by ethnic groups, having a net zero effect on the risk of intrastate conflict. All these studies suggest a potential important relationship between natural resources and ethnic politics, but overall we see several lingering shortcomings in the existing literature: First, a common lack of explicit theoretical and empirical focus on the interaction of ethnic group status and resources; Second, an absence of appropriate data to investigate the overlap and interaction of ethnic group status and natural resources; Third, if disaggregated data have been used, a narrow geographical focus on single countries or regions. We aim to improve on these dimensions by identifying explicit hypotheses about the interaction between ethnicity and oil and providing evidence based on highly-disaggregated data with wider geographic coverage.

The Conditional Effect of Natural Resources on Violence

Our argument is simple: the relationship between local ethnic groups and the state conditions the effect of oil and gas on conflict. Specifically, we propose two distinct effects. Both the political exclusion of ethnic groups and oil can provide motive and opportunity that increase the risk of armed conflict. If geographically and politically combined, this mutually reinforces risks. On the other hand, ethnic groups that are politically monopolizing the state at the national level do not experience the same amplification effect. We hypothesize they use oil and gas revenues to safeguard their hold on power and limit violence in strategically important oil-rich regions.

Staging an insurgency against the state is a non-trivial challenge. Starting a rebellion faces a number of collective action and coordination problems (Olson, 1965; Kalyvas & Kocher, 2007). Natural resources and oil specifically are seen as a conflict risk because they produce systematic economic, political or social inequalities between groups, created by the unequal distribution of resource rents, forced migration, environmental damage or loss of land rights (Ross, 2004; Gurr, 2000; Stewart, 2008b; Murshed & Gates, 2005). Oil and gas are often an important motivational factor that help to overcome the collective action problem of rebellion. Second, the "lootability" of on-shore oil can provide the necessary financial means for rebellion, solving problems of individual incentives and technical feasibility (Ross, 2004; Le Billon, 2001b). Similarly, facilities of resource extraction can serve as fruitful military targets on which violent collective action centers.

We argue this logic of oil as a conflict-risk can be further differentiated by considering the conditioning effects of ethnic identity. Ethnic identity can serve as a strong frame for mobilization. Ethnic groups provide recruitment pools of individuals with strong social ties. Furthermore, the *political marginalization* of ethnic groups represents a powerful motive for the rank-and-file, that, joined with the organizational prowess of ethnic groups, can be capitalized on by ethnic political entrepreneurs and lead to violence (Cederman et al., 2009, 2010; Wimmer et al., 2009).

The presence of oil and gas without the existence of strong, but politically excluded ethnic identities that can foment resource-related grievances and foster collective action, might only create an aggrieved, but rather disparate local population. If combined though, ethnic political exclusion and oil abundance together can produce a particularly fertile ground for violence (Hunziker & Cederman, 2012). The subnational geographic overlap of nationally excluded ethnic groups and local abundance of oil and gas is particularly likely to create the conditions to ease the motivational and coordination problems of violence: When a country's resources are located, if not concentrated, in an area of a distinct ethnic group, it is likely that resource related motives (e.g. contested revenue distribution) will form along ethnic lines (Østby, 2008). Disaffected groups may use commodities concentrated in their territory as grounds on which to seek secession or demand stronger representation at the national level (Tadjoeddin, Suharyo & Mishra, 2001) – as secessionist conflicts with resource-rich regions in Indonesia (Aceh) or Nigeria (Biafra/Niger Delta) exemplify. Natural resources can amplify existing claims by ethnic groups (Brown, 2008) or finance ethnic insurgencies. Conversely, resource-related grievances attached to ethnic groups might be especially likely to remain unaddressed by the government, if that group is politically excluded at the national level. In turn, oil and gas make the political or institutional exclusion and marginalization of ethnic groups more likely (Acemoglu et al., 2004).

In total, this suggests an amplification instead of a mere additive effect:

H1: The political exclusion of ethnic groups amplifies the conflict-increasing effects of oil and gas.

Hypothesis 1 focuses on the amplification of oil and gas related grievances and opportunities when combined with ethnic groups excluded from state power. Do things change when ethnic groups in regions with oil and gas have access to the state, or more specifically are in control of state institutions? One may argue that it changes little regarding conflict risks: The relatively privileged in terms of oil and gas may initiate conflict as they have both the material means to stage attacks against poorer groups, as well as the motivation, as they may not want to share their wealth (Stewart, 2008a; Østby, 2008). Cederman, Weidmann and Gleditsch (2011) show that conflict risks increase for relatively wealthier as well as relatively poorer groups. Second, groups that dominate or monopolize the state – and the benefits from resources – are likely to be challenged by the relatively deprived groups (ibid.). Resource rich regions might be even preferable military targets as challengers will seek their control for both material and strategic ends.

However, there is at least equally justified reason to believe that ethnic groups with state control will be able to reduce the likelihood of violence when they additionally control oil and gas resources. At the nation-state level, such groups are unlikely to initiate violence in order to monopolize resource gains. They are already in command and secession is typically initiated by politically marginalized groups (Stewart, Brown & Langer, 2008, p.294-5). Moreover, the logic of the Rentier state (Mahdavy, 1970; Smith, 2004) provides insights on the potential mechanisms through which hegemonic groups can minimize conflict risks. Natural resource revenue, paired with state control, allows incumbent groups to buy-off support in the population and sustain a powerful security apparatus (Le Billon, 2001b; Fjelde, 2009). In addition, vast oil reserves may attract "greedy outsiders" that support the regime, increasing collective action problems for would-be rebels. A number of peaceful Rentier states, mostly in the Middle East but also in Africa (e.g. Equatorial Guinea, Gabon), have managed to maintain peace through a combination of distribution, repression and outside protection (Basedau & Lay, 2009). Consequently, we expect that control over the state not only mitigates, but reverses the conflictual effects of oil and gas, reducing the likelihood of conflict.

These conflict-reducing effects will have a distinct sub-national geographic impact. Monopoly groups have to strategically invest scarce resources of state control (e.g. local public goods, patronage or military power) across the state's territory. Kalyvas (2006) argues that violence in civil wars is least prevalent in areas entirely controlled by the state (or rebels). Most likely, the resource rich regions are those regions under firm government control: their control is of key strategic interest for the government, ethnic differences can hardly be used to mobilize opposition, and the resources themselves provide the means to apply the aforementioned mechanisms to buy peace or repress military threats in these regions. Outsiders may assist in protecting the resource extraction facilities. The civil war in Angola illustrates this logic. The MPLA government used revenues from oil to maintain a (precarious) stability in its ethnic support area; oil facilities were protected by Cuban military (Le Billon, 2001a, p.65). In sum, we expect a second conditional effect of oil and gas:

H2: The political monopoly of ethnic groups reverses the conflict-increasing effects of oil and gas.

Importantly, the outlined logic applies most if a group exercises firm control over state institutions. If several groups share political control, competition and rivalry over the use of oil revenues mitigates the effective deployment of state resources to hinder the outbreak of violence.

Research Design, Data and Model Specification

To test our hypotheses we need to explicitly consider interactive effects between oil and gas and the political status of ethnic groups. Furthermore, while the vast majority of empirical studies rely on highly aggregated country-level data, our research question demands spatial disaggregation to adequately measure the confluence of ethnicity and natural resources. Related work by Sorens (2011) uses ethno-political regions to assess the role of local mineral abundance on the type of claims and conflicts are issued against the state. In a working paper, Hunziker & Cederman (2012) argue a similar point and opt instead for the use of group-dyads, augmented by information on petroleum deposits in an ethnic group's settlement area.

For this paper we propose a more geographic approach, relying on spatially disaggregated units of analysis. Focusing on small spatial units allows us to match information on the geographic location of oil and gas with information on local group identities and their national political status. Such an analysis of spatial units contains more fine-grained information on the geographic location of conflict and whether this corresponds with our two independent variables of interest. An analysis of group-dyads, while having some advantages, runs the danger of attributing conflict between an ethnic group and the government to the presence of oil, even if the spatial locus of conflict does not coincide with the location of natural resources. Fighting far from resource endowments but inside the ethnic groups settlement area might be completely unrelated to resource-related motivations. Our analysis of spatial units avoids this problem, but at the same time runs the danger of neglecting conflict events motivated by ethnic grievances and resources that take place in other locations due to strategic reasons.[3]

We present evidence on the interaction between oil and gas deposits and ethnic group status at the local level for the whole African continent. By doing so, this paper contributes to the growing set of studies utilizing spatially disaggregated data for conflict analyses. In particular, our unit of analysis is a spatial grid cell from the PRIO-GRID project (Tollefsen et al., 2012). The PRIO-GRID overlays a grid of 0.5 x 0.5 decimal degree (roughly 55km by 55km at the equator) cells over the world and records a number of important covariates for each grid cell. We restrict our analysis to the African continent to take advantage of the detailed geo-referenced violent event data from UCDP-GED (Sundberg, Lindgren & Padskocimaite, 2011; Melander & Sundberg, 2011).[4] This leaves us with 10,674 African grid cells from 1990 to 2010. The UCDP-GED dataset records for Africa in this time period all violent events with at least one death involving the government and a rebel group, one-sided violence or violence between non-state actors. Individual events are only included for which the entire conflict generated more than 25 battle deaths (Sundberg et al., 2011, 5). We use the coordinates for each event to match them to grid cells.[5]

We create our main variable of interest, a dummy indicator of *conflict onset*, based on grid-cell events.[6] Conflict onset is determined by first identifying *conflict incidence* in each grid cell, i.e. a dummy that takes the value 1 if in that year *any* violent event was recorded for the grid cell and zero otherwise. We drop consecutive observations with conflict to focus purely on actual onsets within each grid cell. For our African grid cells in the 1990 to 2010 time period about 1.7% of all grid cell-years experience conflict onset. We also create alternative conflict indicators that distinguish between different forms of violence, as recorded in the UCDP-GED dataset. Specifically, we construct onset indicators that only rely on violence between rebel groups and the state, one-sided violence against civilians and non-state violence. Since our theoretical argument stresses the importance of oil and gas under varying ethnic group statuses for violence against the state, we expect our findings to vary by conflict type.

Figure 1 shows the location of conflict events in Africa throughout the 1990 to 2010 time period, as well as the location of on-shore oil and gas deposits. The map makes clear that there exists important spatial variation in conflict on the African continent. Furthermore, some conflicts do seem to cluster around oil and gas fields, as in Algeria, Angola, Congo, Nigeria and Sudan. Figure 2 shows the example of Angola in more detail. The plot shows the grid cells for Angola, shading the areas with monopoly groups for the year 1990, and marking armed conflict locations for the years 1990-2002. The map shows that conflict clusters in regions with excluded groups and oil (Cabinda), but also takes places in regions with monopoly groups. For the two grid cells with recorded oil and gas deposits in the monopoly group's settlement area, no conflict events took place. The statistical analysis will discern whether this is a more general pattern.

[FIGURE 1 & 2 ABOUT HERE]

Our theoretical interest in the interaction between oil and ethnic group status requires us to use geo-referenced data to match with the PRIO-GRID structure. To measure the presence of oil and gas we rely on the PETRO-DATA dataset (Lujala et al., 2007). PETRO-DATA provides coordinates of all known oil and gas deposits around the world. We focus on African on-shore oil and gas deposits and code for each grid cell a simple dummy variable on whether any type of deposit is present[7]. PETRO-DATA furthermore distinguishes between active and inactive oil and gas deposits. Active deposits are currently under exploitation, while inactive ones represent only confirmed deposits. A variable based on the total count of deposits provides an indirect proxy for expected net-present value of certain localities, while a measure based on only active deposits is more directly related to "lootability" and access to current revenue in grid cells. For our analysis we will exploit both alternative measures. The simple binary indicator is time-invariant, but offers superior geographic precision over other measures commonly used in cross-country analyses. To further improve the over-time variation in our oil and gas measure, we combine information on the location of oil and gas deposits with the real price of oil in some of our models, i.e. identification of the effect of oil and gas on violence will come from the spatial variation between regions with and without oil and overtime variation in the value of oil deposits.[8]

Wucherpfennig et al. (2011) provide spatial data on the settlement patterns of ethnic groups around the world that has been matched to the PRIO-GRID. Based on the group identifiers provided by Wucherpfennig et al. (2011) we can match information on the political status of local ethnic groups from the Ethnic Power Relations (EPR) dataset Cederman et al. (2010). The EPR dataset provides information on how an ethnic group is in- or excluded politically at the national level, which we can use to measure local groups' relationship with the state. Specifically, the EPR data contain a measure of general exclusion at the national level.[9] Excluded groups are not represented at the national level and according to Hypothesis 1 should amplify the effect of oil. EPR also provides information on groups with more access to the state. The data distinguish between groups that are part of power-sharing arrangements, either as junior or senior partners, groups that are politically dominant and groups that have a monopoly of power. To test Hypothesis 2 we rely on monopoly groups, since it relates most clearly to our theoretical argument.

For both of these ethnic group-state relationship classifications we code a variable that records the share of local groups in a grid-cell year that has a certain group status[10]. This allows us to trace the varying effects of ethnic group status on violence in the presence of oil and gas. To avoid any egregious forms of reverse causality we lag each ethnic group status measure by one year.

While our measure of oil presence is plausibly exogenous, the same cannot be said for ethnic group status, which is determined in a political process affected by prior levels of violence, observable covariates and unobservable country characteristics. We consider a number of other covariates in an attempt to control for omitted variable bias.

We always include population counts for each grid cell, based on the Center for International Earth Science Information Network (CIESIN) "Gridded Population of the World" dataset (2005), because the majority of existing research has established a link between population size and conflict.[11] Furthermore, we include two measures of distance. For one, distance to the capital city is likely to have a negative effect on conflict because rebel groups strive to overtake the government (Buhaug & Rød, 2006). Similarly, we include the distance to the nearest border as a covariate because fighting often takes place close to international borders (Buhaug & Rød, 2006). Distance to the nearest border is measured in kilometers from the cell centroid to the border of the nearest contiguous neighboring country, distance to the capital is also expressed in kilometers from the cell centroid to the national capital (for more details see the PRIO-GRID Codebook).

In addition we include controls for the percent of mountainous terrain in each grid cell. Seminal work by Fearon & Laitin (2003) has identified the advantages of difficult terrain for guerrilla warfare. From a theoretical standpoint, difficult terrain provides important opportunities to negate any resource advantages government forces have over ill-equipped rebel forces. Information on mountainous terrain for our grid cells is provided by the UN Environment Programme (UNEP-WCMC World Conservation Monitoring Centre, 2002). We alternatively consider the degree of forestation in each grid cell. Dense forests can also be used as safe havens for rebel groups and serve as functional equivalents to mountainous terrain. Including this measure of difficult terrain has no impact on our main variables of interest. We also control for the percent of area in a grid cell that is equipped for irrigation (Siebert, Döll, Hoogeveen, Frenken, Frenken & Feick, 2007). Since the majority of agriculture in sub-Saharan Africa relies on rain-fed irrigation (You, Ringler, Wood-Sichra, Robertson, Wood, Zhu, Nelson, Guo & Sun, 2011), regions with active irrigation infrastructure can compensate for rainfall shocks, which are potentially associated with conflict (Hendrix & Salehyan, 2012; Theisen, Holtermann & Buhaug, 2012).[12]

Violent conflict is often thought to be more likely in poorer regions, creating economic grievances while keeping the substitution costs to engage in violence low (Collier & Hoeffler, 2004). Data on local GDP per capita is provided by the G-Econ dataset (Nordhaus, 2006). We use the per capita GDP for 1990, 1995, 2000 and 2005.[13]

We focus on the time period from 1990 to 2010, but the UCDP-GED data also record violent events in 1989, which we use to construct a proxy for prior levels of violence in each grid-cell.[14] Last, since we are working with highly spatially disaggregated data, there exist serious concerns of spatial dependence for our analysis. Figure 1 clearly shows spatial clustering of conflict events through time, suggesting a violation of the assumption of independence for our grid cells. The analysis of spatial dependencies has received increased attention in the wider literature (Beck & Gleditsch, 2006; Hays & Franzese, 2007). Failure to properly address the interdependence of observations can lead to biased and inconsistent parameter estimates LeSage & Pace (2009). Many researchers utilize spatial lag models under the given circumstances. A spatial lag is the weighted average of the dependent variable in "neighboring" units. The neighborhood structure is defined through a spatial weights matrix that is based on a sensible connectivity concept. In our analysis a spatial lag furthermore mitigates the problem of violence that originated in grid cells with oil and gas endowments and excluded ethnic groups, but spread to cells with vastly different covariate profiles due to tactical and strategic reasons. Since the spatial lag accounts for the spread of conflict across locations, it will improve our ability to ascertain the onset effects of our two variables of interest and their interaction. Importantly, using spatial lags for binary dependent variables involves often prohibitive computational problems (Weidmann & Ward, 2010). In lieu of a fully specified spatial lag model, we rely on a temporally lagged spatial lag to circumvent the simultaneity issue in the model. Alternatively, a series of geographic dummy variables can absorb some of the spatial dependence and improve inferences. For our models we will employ both country-level dummy variables and a temporally lagged spatial lag of conflict incidence based on a four nearest neighbor connectivity matrix. To vary the size of the neighborhood we also created spatio-temporal lags based on eight nearest neighbors. Summary statistics for all variables are included in the following table.

The conflict onset dummy for each grid cell i in year t is defined as:

$$y_{it}^{onset} = \begin{cases} 1 & \text{Conflict Onset} \\ 0 & \text{otherwise} \end{cases}$$

In the standard generalized linear model framework the probability of conflict onset $P(Y = y|X) = \mu = g(\eta)$ is determined by the linear predictor η and an appropriate link function $g(\cdot)$ (here the Probit link). The linear predictor η is a function of covariates in the following way:

$$\eta_{it} = \mathbf{x}_{it}'\beta + o_i\omega + e_{it}\gamma + (o_i \times e_{it})\theta$$

Where $\mathbf{x}_{it}$ contains our control variables and a cubic polynomial of peace years to account for duration dependence (Carter & Signorino, 2010). The parameters ω and γ estimate the constituent effects of oil (o_i) and ethnic group status (e_{it}) respectively, while θ captures the possible interaction. The parameters ω, γ and θ will be the focus for testing hypotheses H1 and H2. It will be of particular importance to simulate the effect of oil under varying conditions of ethnic group status to assess the statistical and substantive importance (Brambor, Clark & Golder, 2006).

We consider a number of viable model specifications. All our models are estimated with robust standard errors clustered at the grid level, to account for heteroskedasticity and arbitrary serial correlation. We also consider the inclusion of year and country dummies in our Probit models to remove the effects of invariant, unobserved heterogeneity common to certain years (e.g. economic shocks) or countries.

Results

Table 1 presents the estimated coefficients of a series of Probit models, with and without country and year effects or a spatial lag. The seven columns show the different interactions of the oil dummy with varying ethnic groups status. The control variables largely perform in accordance with theoretical expectations and results of prior analyses.

The first three columns evaluate H1. The standard probit model in the first column shows that the constituent effect of the oil dummy is estimated to be positive and significant. If we add country and year fixed effects or a spatial lag (Columns 2 and 3), the coefficient stays positive but loses statistical significance at standard levels. This indicates some support for an effect of oil for regions without excluded groups. The constituent term for excluded groups is positive and significant (below the 5% to 0.01% level) across all three models, i.e. in the absence of oil and gas, ethnic exclusion of groups increases the likelihood of conflict. The interaction term is also estimated to be positive, but just misses standard levels of significance, especially in the fixed effects and spatial lag models. While the signs of the coefficients match Hypothesis 1, the larger standard errors make it difficult to separate the effect of oil with and without excluded ethnic groups.

The results are much clearer with regard to Hypothesis 2. Columns 4-6 show estimates for the models that focus on the conditioning effect of groups with a monopoly. Across all three models we find a highly statistically significant and positive constituent effect of oil on conflict (below the 0.1% level). Grid cells with ethnic groups that are not holding a monopoly over national state institutions are more likely to experience conflict in the presence of oil and gas. Similarly, the constituent effect of monopoly groups is also highly significant and positive (below the 0.1% level). Grid cells with monopoly groups, but without oil and gas, are more likely to experience conflict, e.g. because non-monopoly groups will challenge their political dominance. The interaction effect in all three models is estimated to be negative (and significant below the 1% level), which indicates support for Hypothesis 2, i.e. oil and gas paired with monopoly group status reduces conflict risk. The last column of Table 1 shows estimates of a model that includes both the excluded group and monopoly group variables and their respective interactions with the oil dummy. Model 7 confirms the prior findings: oil and gas increase conflict risk, when local groups do not enjoy a monopoly of power at the national level; excluded and monopoly groups both increase conflict risk, even in the absence of oil and gas; oil and gas paired with monopoly groups though decreases conflict risk.

[TABLE 1 ABOUT HERE]

To better judge the statistical and substantive effects of our interaction, we also present graphs of simulated substantive effects of oil with varying group status (Brambor et al., 2006). For ease of interpretability we focus on plots of first differences. Figure 3 shows the simulated effect of the oil and gas dummy on the probability of conflict onset, as we vary the ethnic group status.[15]

[FIGURE 3 ABOUT HERE]

The left panel in Figure 3 shows that oil and gas increase the probability of conflict onset for grid cells with and without excluded ethnic groups. The mean effect is slightly larger in the presence of excluded ethnic groups, but the 95% confidence intervals partially overlap, i.e. we cannot clearly distinguish statistically between the two scenarios. The left plot also shows that the increase in conflict risk associated with the presence of oil and gas lies on average around 1 to 1.7 percentage points. Given the low unconditional probability of 1.7%, this represents nearly a doubling the likelihood of conflict onset through oil and gas.

The right panel shows the simulated first difference effect of oil and gas for grid cells with groups that have and have not a political monopoly at the national level. For groups without a monopoly, oil and gas increase the conflict probability on average 1.2 percentage points. For grid cells with monopoly groups though, the effect completely reverses, *reducing* the probability of conflict by 1.7 percentage points. The effect of GDP per capita has been identified in many cross-country studies as the most important correlate of conflict (Fearon & Laitin, 2003). For comparison's sake, in our models the effect of GDP per capita is approximately a one percentage point reduction in the onset probability for an increase from the 50th to the 75th percentile of the GDP per capita distribution. Oil and gas, in conjunction with ethnic group inclusion play a much more important role for violent collective action than broad measures of local income. To further compare the substantive impact of oil and gas on conflict onset, the supplementary appendix provides a table with simulated first difference effects for all other control variables (Appendix Table 2). In total, our analysis so far shows substantial support for the assertion that ethnic group status conditions the effect of oil and gas, with particular emphasis on the ability of groups to control the state.

Robustness Checks

In this section we summarize the results of a series of additional robustness checks.[16] Detailed results and regression tables are available in the supplementary online appendix. First, we implemented an alternative approach that relies on OLS to estimate linear probability models (Appendix Table 3). For these models we can clearly confirm the strong support for Hypothesis 2 across all models, while evidence for Hypothesis 1 remains weak (not significant at the 5% level).

Next, we exploit alternative information contained in the underlying measure of our dependent variable. While the main models presented in the prior section rely on standard conflict onset models, we could alternatively use conflict counts as our dependent variable. Using the UCDP-GED data to construct a conflict count for each grid-cell year, we estimate simple fixed effect OLS models for the log-transformed values of the counts.[17] We generally confirm the findings from our initial analysis: we find no clear support for Hypothesis 1, but strong evidence for a statistically significant interaction between natural resources and monopoly group status that reverses any conflict-increasing effects of natural resources (Appendix Table 4).

Our models in Table 1 also rely on a time-invariant oil and gas variable. To further probe the effects of oil and gas and exploit some over time variation, we repeat the analyses using a variable that multiplies the oil and gas dummy with the real price of oil (lagged by one year). With this oil value variable we again confirm the same pattern of results as in Table 2 (see Appendix Table 5). We also repeat the oil and oil value analysis, just relying on oil and gas deposits classified as active in the PETRO-DATA (Appendix Tables 6-7). Again our findings are robust to these changes. Similarly, changing the neighborhood structure for the spatial lag from four to eight nearest neighbors has no effect on the results (Appendix Tables 8).[18]

Our main analysis does not distinguish between different types of violence. Using the classification of UCDP-GED of events involving the state, non-state violence and one-sided violence, we create new conflict indicators for each type of violence and re-estimate all our models (Appendix Tables 9-14). Importantly, while the argument spelled out in our theoretical section should apply to state-based and one-sided violence, the same is not true for non-state violence. Importantly, our results confirm this expectation. We can confirm our prior findings for violence between the state and rebel groups, as well as one-sided violence by the state against civilians. For violence between non-state actors though, while we still find for most models a positive and significant constituent effect for oil and gas and excluded groups, the constituent effect for monopoly groups is now not significant. The interaction between monopoly group status and the presence of oil and gas cannot even be estimated because there are no non-state violent events in grid-cell-years with an overlap between these two factors. This divergence of findings strongly supports the robustness of our theoretical argument.

The other natural resource considered as salient for conflict is diamonds. Diamonds are comparatively easy to smuggle, fetch a high price on international markets and have been found to play a role in conflict onset in prior analyses (Lujala, 2010). Based on the DIADATA dataset (Gilmore et al., 2005), we repeat our main analysis and find stronger support for an amplifying effect of excluded groups with diamonds. This finding is mostly driven though by non-alluvial diamonds (Appendix Table 15), which contradicts expectations based on the lootability of diamonds.[19] There is no clear evidence of a reversal effect for monopoly groups, which might be driven by the scarcity of cases in which monopoly group settlements overlap with diamond deposits.[20] Overall, these results indicate that there might be some differences in the effect of diamonds on conflict compared to oil, not driven by the degree of lootability, but the difference in results to prior research could also stem from the focus on conflict onset at the grid-cell level, as compared to the country-level.

Since the EPR data also offer alternative group status types for excluded and included ethnicities, we are able to further test the reach of our argument (Appendix Table 16). We find that groups that are actively discriminated against have independent, conflict-increasing effects, but equally show little amplifying effects for natural resources. Powerless groups are less likely to be associated with violence and also do not interact with natural resources in a meaningful way.[21] For groups that are included in some form at the national level, we find that both dominant groups and senior partners in a power-sharing agreement reduce conflict, independently of oil and gas. While the interaction effects with oil and gas are both estimated to be negative, i.e. supporting Hypothesis 2, they fail to reach standard levels of significance. These findings nicely dovetail with our main analysis. Access to the state has the potential to transform oil and gas from a conflict-enhancing to a pacifying factor, but this effect becomes only really pronounced if groups have complete control over the state apparatus.

Although our analysis explicitly focuses on sub-national variation and we control for country-level factors through the inclusion of fixed effects, we might still miss some omitted factors at the national-level that vary over time and impact the role of oil and ethnic group status for violence. Specifically, the type of regime and regime stability might operate as confounding factors for the analysis. We repeat our estimations controlling for the level of democracy, as measured by the Polity 2 score, and the degree of regime durability (years since last regime change as recorded by Polity), with no effect on our findings (see Appendix Table 17).

Our research design explicitly focuses on the spatio-temporal patterns of violence, i.e. we relate grid-year-level factors to the occurrence of violence. One important limitation of this approach is the implicit assumption that the location of fighting and the root causes are largely identical. For example, if rebel groups are driven by the motivation to capture access to natural resource rents, but fighting for strategic considerations takes place far from the location of resources, our analysis will not capture these effects. This might lead us to underestimate the effects or interaction between ethnic group status and oil and gas. To mitigate this issue in the context of our research design, we exploit the spatial lags constructed for the analysis. To test whether ethnic group status, the presence of oil and gas and their interaction terms affect violence in the wider neighborhood of a grid cell, we estimate models that use the eight neighbor spatial lag as the dependent variable. This will give us some insight into how local factors affect violence in neighboring grid cells. The results provide further credibility for our initial findings: oil in a grid cell increases the probability of violence in its neighborhood, as does ethnic exclusion or monopoly group status; for grid cells with monopoly groups and oil though, violence is reduced in the neighborhood (see Appendix Table 19).

Given our main analysis and the additional robustness checks, we can overall confirm the theoretical expectation of Hypothesis 2, but only find evidence for the additive effects of group exclusion. Given our extensive robustness checks we are confident that our finding is unlikely to be strongly biased by reverse causality or omitted variable bias. One might worry that low violence for regions with monopoly groups might simply be due to the absence of motivations for violent collective action, but our findings actually show that this only applies to regions with monopoly groups *and* oil and gas deposits. Grid cells with monopoly groups, but without resources are actually more likely to experience conflict. Similarly, it might be possible that the pacifying effects of oil in conjunction with monopoly groups is the result of groups that obtained monopoly status through violence and then experienced peace in their settlement areas. We believe this is unlikely, since we throughout lag our measure of group status and not only exploit temporal variation in group status, but also spatial variation within countries. Furthermore, our models that utilize oil prices also add temporal variation on the resource side and confirm our findings.

Conclusion

In this paper we test whether oil and the relationship between ethnic groups and the state play an important role for violent conflict. While existing work on civil wars and violence has exerted considerable effort to discern the various potential effects of each factor separately, we investigate if theoretical and empirical leverage can be gained by focusing on the overlap between the two. This contributes to the ongoing unification and cross-fertilization of these major strands of the literature on conflict. Theoretically, the presence of oil and gas and political exclusion of ethnic groups together should be particularly suited to enable political entrepreneurs to organize rebellion, while political dominance provides incentives for groups to protect strategically important regions.

Empirically, our analysis departs from traditional studies relying on cross-national data and provides a distinct spatial perspective. We follow recent advances in the conflict field and draw on newly available, geographically disaggregated data. By analyzing the determinants of conflict at the spatial grid level in Africa from 1990 to 2010, we avoid many pitfalls of cross-national research.

Our findings provide new insights on the relationship between ethnicity, oil and gas and violent collective action. Differences in group status matter for the effect of oil and gas on conflict. We find robust evidence that both political exclusion and the presence of oil and gas have independent, conflict-increasing effects at the grid-cell-year level. We do not find convincing evidence that the overlap between these two factors amplifies or modifies conflict risk above and beyond the constituent additive effects. On the other hand, groups with a monopoly of power have a clear conditioning effect on the role of oil and gas. Grid cells without monopoly groups are more likely to experience conflict onset in the presence of oil and gas. Grid cells with monopoly groups and oil though have a *lower* probability of conflict. The size of the effect is arguably larger than the substantive importance of other predictors like GDP per capita. These findings provide a useful addition to the general conflict literature and research on the "resource curse" specifically. Our findings suggest that state-society relations play an important role for the effects of oil and gas wealth for domestic conflict, but with asymmetric effects for political in- versus exclusion. The policy discussion on the resource curse has highlighted the importance of institutional quality and transparency. Our findings suggest that political realities of ethnic politics have to be considered to understand the unfolding of political conflicts over oil and gas, adding important context information to institutional reform debates.

While promising, our results only constitute a first step in the analysis of ethnic and natural resource politics and several avenues for future research remain. For one, while our analysis suggests that monopoly groups in conjunction with oil and gas deposits are associated with lower levels of violence, additional research has to unpack the exact underlying mechanisms. Our robustness checks using data on diamonds show that it is likely not the lootability of resources that drives violence. Furthermore, our findings on one-sided violence indicate that there is also less repression by the government in oil-rich monopoly group regions. This suggests patronage as an important mechanism, for a Rentier state strategy. Relatedly, newer research on ethnic voting documents how the provision of local public goods to co-ethnics can spill over to other local groups and engender cross-ethnic party support (Ichino & Nathan, 2013). Oil-revenue could be a crucial element of a successful divide-and-rule strategy that divides excluded ethnic groups (Acemoglu, Robinson & Verdier, 2004). Understanding the interplay of rebel and state strategies to engender local support in the context of ethnic and resource-related conflicts is an important next step for providing insight into civil conflicts and the Rentier state.

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Figures

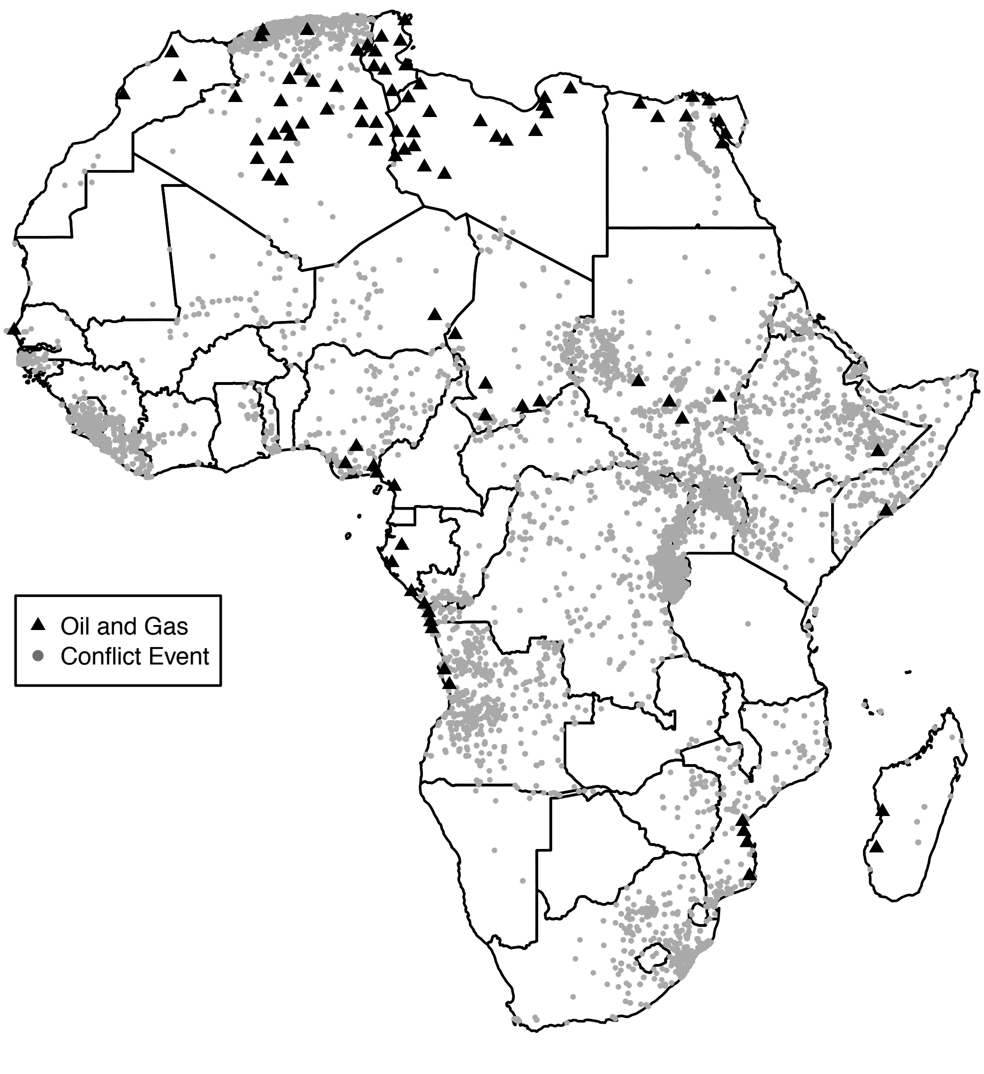


Figure 1: Location of Oil and Gas Deposits and Conflict Events, Africa 1990-2010.

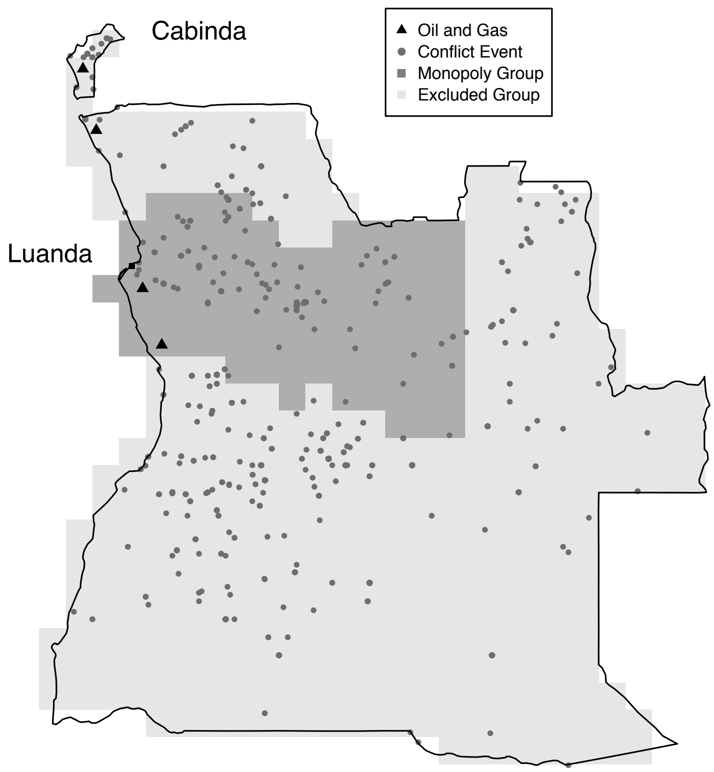
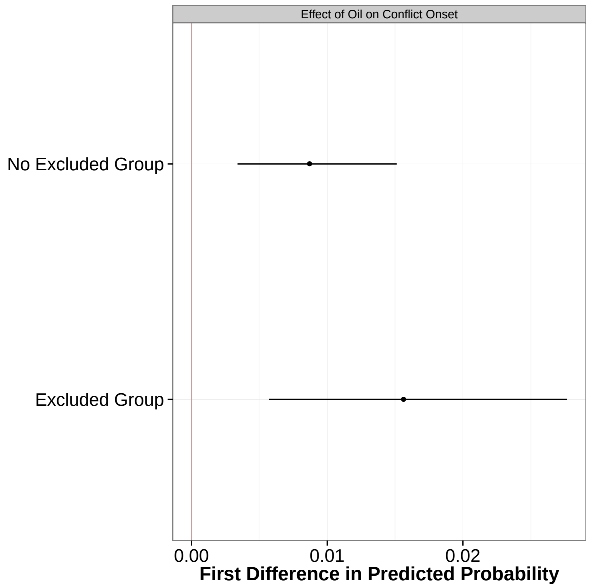
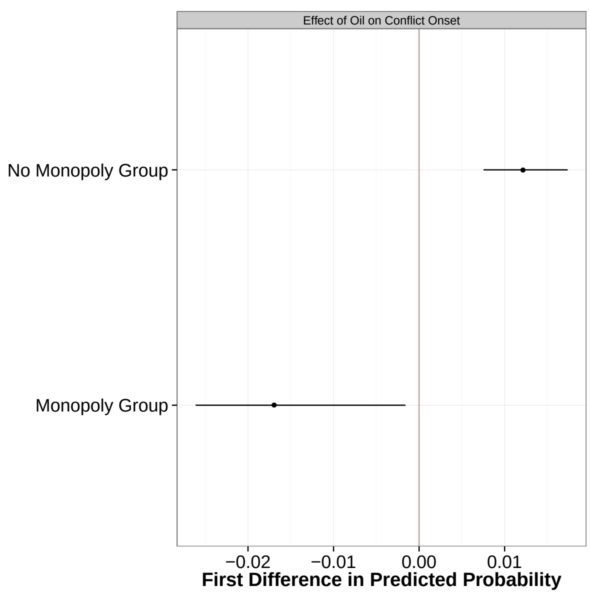


Figure 2: Location of Oil and Gas Deposits, Conflict Events and Ethnic Group Status, Angola 1990-2002.



(a) Excluded



(b) Monopoly

Figure 3: Effect of the Oil & Gas Dummy on the probability of conflict onset (and 95% CIs) for excluded and monopoly groups.

Tables

Table 1: Oil & Gas, Group Status and Conflict, UCDP 1990-2010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Probit	Probit	Spatial Probit	Probit	Probit	Spatial Probit	Spatial Probit
Constant	-1.815***	-1.187***	-1.619***	-1.758***	-1.198***	-1.630***	-1.637***
	(-48.83)	(-8.75)	(-9.69)	(-50.60)	(-8.96)	(-9.83)	(-9.75)
Spatio-Temporal Lag			1.040***			1.040***	1.032***
			(17.46)			(17.44)	(17.30)
1989 Conflict	0.0162*	0.0103+	0.0125*	0.0169*	0.0104+	0.0125*	0.0126*
	(2.22)	(1.94)	(2.18)	(2.11)	(1.84)	(2.07)	(2.10)
Border Distance	0.0000427	-0.000227**	-0.000202**	0.000131+	-0.000230**	-0.000205**	-0.000208**
	(0.57)	(-3.10)	(-2.71)	(1.69)	(-3.10)	(-2.71)	(-2.76)
Capital Distance	-0.0000912**	-0.000135***	-0.000103***	0.00000433	-0.000101**	-0.0000744*	-0.0000899**
	(-3.14)	(-4.17)	(-3.35)	(0.15)	(-3.14)	(-2.43)	(-2.90)
Population	0.000000242***	0.000000169***	0.000000167***	0.000000264***	0.000000194***	0.000000190***	0.000000190***
	(4.17)	(3.64)	(3.94)	(5.39)	(4.65)	(4.91)	(4.87)
Mountainous	0.440***	0.392***	0.311***	0.437***	0.380***	0.300***	0.313***
	(13.37)	(9.97)	(8.18)	(13.45)	(9.56)	(7.80)	(8.20)
Irrigation	-0.00311+	0.00425*	0.00408*	-0.00296	0.00492*	0.00485*	0.00555**
	(-1.78)	(2.06)	(2.01)	(-1.52)	(2.42)	(2.43)	(2.77)
GDP per capita	-0.0000362***	-0.0000161*	-0.0000145*	-0.0000438***	-0.0000168*	-0.0000152*	-0.0000148*
	(-6.65)	(-2.30)	(-2.13)	(-7.69)	(-2.50)	(-2.32)	(-2.22)
Oil & Gas	0.241***	0.0868	0.0782	0.295***	0.186***	0.173***	0.140*
	(3.68)	(1.45)	(1.31)	(6.31)	(4.22)	(3.93)	(2.31)
Excluded Groups	0.234***	0.0738**	0.0592*				0.0839***
	(10.55)	(3.06)	(2.44)				(3.37)
Oil & Gas × Excluded Groups	0.0195	0.135	0.126				0.0647
	(0.20)	(1.63)	(1.51)				(0.77)
Monopoly Groups				0.304***	0.331***	0.296***	0.356***
				(5.13)	(5.41)	(4.52)	(5.29)
Oil & Gas × Monopoly Groups				-0.897**	-0.718**	-0.676**	-0.653**
				(-2.97)	(-3.10)	(-2.95)	(-2.77)
Time Polynomial	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year & Country FE	No	Yes	Yes	No	Yes	Yes	Yes
Observations	152420	143976	143976	152420	143976	143976	143976
AIC	26401.5	24187.0	23807.0	26512.6	24170.7	23791.0	23781.4
BIC	26540.6	24858.7	24488.6	26651.7	24842.4	24472.5	24482.7

t statistics in parentheses

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes

[1]Our empirical analysis tests the effects of oil and gas, but at points in the manuscript we simply refer to oil only for brevity's sake.

[2]Scholars have generally differentiated between demographic concepts of ethnic polarization, dominance and fractionalization. Generally, the results with respect to the effects of demographic constellations vary for all measures (Collier & Hoeffler, 2004; Fearon & Laitin, 2003; Wimmer, Cederman & Min, 2009; Hegre & Sambanis, 2006; Montalvo & Reynal-Querol, 2005).

[3]We investigate the importance of this concern in the section on robustness checks.

[4]An alternative source for georeferenced conflict data is the ACLED conflictual event data (Raleigh et al., 2010). A recent comparison of ACLED and UCDP-GED discusses advantages and disadvantages of the two data sets (Eck, 2012), raising some concerns with regard to ACLED. We opt for UCDP-GED over ACLED mainly because of the better time coverage.

[5]The UCDP-GED dataset provides coordinates for all events, but for a small subset the quality of geographic information is of low quality. The UCDP coders provide an additional variable recording the quality and specificity of the geo-spatial information for each event on a 1-7 scale. We code an alternative version of our three conflict measures that only uses events with a geographic location identified at the district or municipal level. We repeat all analyses with the new measures and find statistically and substantively the same results.

[6]Results are similar if we instead focus on conflict incidence.

[7]We disregard off-shore deposits. Prior research has found off-shore oil to have no effect on conflict (Lujala, 2010) and it is unclear how offshore deposits have to be matched to individual grid cells on the continent.

[8]Note that using international oil prices to determine the value of oil deposits is problematic. We do not know the size or quality of local oil deposits. The true value of local deposits might differ dramatically from implied values from international prices, but we believe our measure offers the best available approximation.

[9]Among the excluded groups EPR further distinguishes between groups that are ac-

tively discriminated against and groups that are excluded, but not actively discriminated (powerless). We will use both measures for further robustness checks.

[10]Since in most grid-cell years only one ethnic group is recorded, the variable consists largely of zeroes and ones.

[11]Our results are unchanged by logging the measure. Data on grid-level population counts are available for the years 2000 and 2005. For each year in the dataset we always use the most recent available year as reference.

[12]Information on this measure is only available for the year 2000 and is entered as constant in the dataset.

[13]The GDP data is originally calculated for 1 x 1 decimal degree grid cells, thus each grid cell in the G-Econ dataset contains four grid cells of the PRIO-GRID dataset. Our results are unchanged when using a logged version of the measure. We also consider the deviation of grid-cell GDP from the country mean to account for relative deprivation, confirming prior findings (Cederman et al., 2011) (see Appendix Table 18).

[14]While significant in all our models, in- or exclusion of this variable does not affect any of our findings.

[15]The plot is based on the results of the Probit model with year and country fixed effects. Effect estimates were obtained by using Clarify (Tomz et al., 2003). We set the control variables to actual values of a particular case in the dataset, picked at random from the grid-cell years that do not have excluded groups or oil and gas. Alternatively, we also repeat the simulation setting covariates to their respective means, modes and medians, without changing any of the substantive findings (see Figure 1 in the supplementary appendix).

[16]We already mentioned checks that included different transformations of control variables or just relying on "high-quality" geo-codes for the violent event data, all without influence on our results.

[17]To enable the log-transformation, we added 1 to each conflict count.

[18]We also add estimates for the oil value variable together with the 8-neighbor spatial lag in this table.

[19]Alluvial diamonds, in contrast to deep-shaft, are extractable with simple, artisanal methods. This implies easier access for rebel groups and has been linked to civil war

violence (Lujala, 2010). In Appendix Table 15 the interaction effect is significant for deep-shaft diamonds, but not alluvial diamonds.

[20]There are only 110 grid-cell-years of monopoly groups with diamonds.

[21]Powerless groups are defined by EPR as excluded groups that are neither actively discriminated against or have some limited form of regional autonomy.