THE SPOILS OF NATURE:

ARMED CIVIL CONFLICT AND REBEL ACCESS TO NATURAL RESOURCES*

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ABSTRACT

Why is armed civil conflict more common in resource-dependent countries than in others? Several studies have attempted to unravel mechanisms on why natural resources are linked to armed conflict but no coherent picture has yet emerged. This article seeks to address this puzzle by concentrating on the issue of how rebel access to natural resources affects conflict. It uses new data on gemstone and hydrocarbon localities throughout the world and controls for the spatial and temporal overlap of resources and conflict. The results show that the location of resources is crucial to their impact on conflict duration. If resources are located inside the actual conflict zone, the duration of conflict is doubled. Interestingly, oil and gas reserves have this effect on duration regardless of whether there has been production or not. In addition, a country-level analysis suggests that oil production increases the risk of conflict onset when located onshore; offshore production has no effect on onset. These results support the assertion that natural resources play a central role in civil wars because of the incentives and opportunities they present for rebel groups.

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INTRODUCTION

This article assesses whether rebels' access to natural resources affects armed civil conflict. Several studies have argued that natural resource wealth alters considerably a rebel group's motivation to emerge and its opportunities for survival. Few studies, however, have demonstrated this convincingly. A major drawback of the analyses to date is that they have not been able to control for the location of resources, thus leaving room for the argument that other channels account for the perceived link between resources and conflict. This article, by using new data on localities of hydrocarbon fields throughout the world, shows that crude oil and natural gas directly affect rebel movements. It also confirms earlier results that easily extractable resources, such as gemstones, have an effect on rebel groups.

Countries rich in natural resources appear to be engaged in armed civil conflict more often than resource-poor countries. Although there is ample evidence that this may be the case, there is less agreement on why resource-rich countries descend into civil strife. Two main lines of explanation have emerged: first, natural resources, especially those that are easily exploited, provide motivation and means for rebel uprisings. Greedy rebels may use conflict to satisfy their material aspirations. Access to resources may also enhance the odds of rebel success and survival because they provide financing for the rebellion. Others see a causal link through the state: abundant natural resources lead to poor policy choices and a weak state, exposing the society to violent conflict. The idea of conflict as a financing method for rebels was introduced by Collier & Hoeffler (1998, 2004). The main empirical result of the Collier & Hoeffler (2004) article was severely criticized by Fearon (2005), who in turn argues strongly for the state-capacity model (Fearon & Laitin, 2003).

Subsequent research on the detrimental effect of resource abundance on peace has revolved around the two hypotheses presented above. Unfortunately, only a few measures are available to estimate rebel access to resources or resource revenues accruing to the state. In fact, proponents of both arguments tend to use very similar measures in their analyses.[1] This is a major weakness, because in practice the same variables are used in support of competing explanations.

This article seeks to clarify some aspects of this debate by assessing empirically how the location of natural resources affects armed civil conflict. It especially analyzes

[1] Share of (specific) natural resource exports, rents, or production volume to total exports or size of economy are commonly used variables.

whether rebels' access to resources affects the duration of conflict. Indeed, the presence of secondary diamonds, other gemstones, or hydrocarbons in the conflict zone more than doubles the conflict duration. Resources located outside the conflict region do not have a prolonging effect on the duration. Analysis of conflict onset further suggests that the resource location is important; onshore oil production increases the risk of conflict onset by 50% while offshore production has no effect. These results imply that resources significantly alter the opportunities and incentives available for rebel groups. If the detrimental effect of natural resources on peace worked only through the weak-state channel, the relative location of resources should not matter.

The duration analysis shows that production is not necessary for prolonging the conflict; the mere presence of hydrocarbons inside the conflict zone lengthens the conflict. This is further evidence for the view that the presence of hydrocarbons affects the rebel group directly, because the revenue flows that potentially could affect the state are not always present. It also suggests that rebels are forward looking and engage in conflicts with promise of future revenues.

Besides finding support for the rebel-financing argument, this article also sheds new light on the question of how resources affect conflict. Based on qualitative and quantitative research conducted up to 2004, Ross (2004a) concludes that oil is salient for conflict onset but not for duration. Further, he argues that evidence suggests that lootable resources affect only duration but not the risk of conflict onset. In contrast to these arguments, this article finds that oil substantially prolongs conflict when located inside the conflict zone. In addition, I show that secondary diamond production increases the risk of conflict onset by more than 40%.

FROM NATURAL RESOURCES TO CONFLICT: THE DIFFERENT MECHANISMS

Natural resources can increase the conflict propensity through several channels. These can be roughly divided into two main groups: those that have a direct effect on rebel movements and those that work through their effect on the state, its institutions, and the economy.[2] In this section the indirect mechanisms are introduced. Next, the question of how natural resources may provide motivation and financing for a rebel group is presented and a method for testing this assertion is proposed.

[2] For a more detailed discussion of each potential mechanism in these two main groups see, for example, Humphreys (2005) and Ross (2004a,b, 2006).

Indirect Mechanisms: Economic and Political Dutch Disease and a Weak State

Dependence on natural resource production and exportation may have an adverse effect on the economy, political institutions, and state strength. Since the early 1960s most resource-rich countries have underperformed compared with resource-deficient countries and per capita incomes have grown two to three times faster in resource-poor countries (Auty, 1998; Sachs & Warner, 1995, 2001). Low income level, in turn, has been shown to increase the likelihood of conflict (Collier & Hoeffler, 2004; Miguel, Satyanath & Sergenti, 2004). Abundant resources also provide easily accruable rents that can sustain political structures, such as corruption and nepotism, which would not persist without those resources (Auty, 1998; Auty & Gelb, 2001). Political and economic inequality are likely sources of grievance, and low income level may lower the opportunity cost of joining a rebellion; these are both factors that may contribute to the outbreak of armed conflict.

The odds of rebel success depend on the state's strength, especially its military power to defend itself. State capacity, in turn, may be affected by the country's natural resource base. Fearon & Laitin (2003) and Fearon (2005) argue that GDP per capita is a good proxy for state capacity and that, generally, poorer states are weaker financially and militarily. Further, they argue that oil producers face a higher risk of conflict onset because oil production may lead to weaker capabilities for the given per capita income level because of corruption, neglect of the military, and bad policy choices.

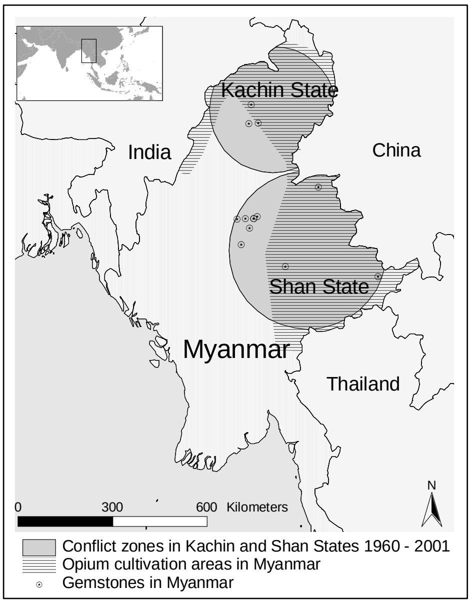
Direct Mechanisms: Greedy and Aggrieved Rebels and Viable Uprisings

A rebel group needs motivation for fighting. Most rebel groups claim to fight for "noble" causes such as human and political rights, equality, and the end of corrupt governments. Some groups, however, may have goals that are more dubious: they seek to accumulate private wealth under the disguise of objectives that are more acceptable. Work by Collier & Hoeffler (1998, 2004) has been crucial in highlighting the economic motivation behind civil conflicts. Collier & Hoeffler argue that a rebel movement can be seen as any other economic entity; people fight when it pays better than their alternative sources of income. This payoff from resources may be contingent on successful rebellion, for example, in the form of achieving greater autonomy as in the case of Southern Sudan. Conflict itself, especially those with low intensity, may be beneficial to those rebels who are able to exploit resources during the conflict. For example, in Sierra Leone, rebels were, for longer periods, able to concentrate more on diamond mining and terrorizing civilians than on fighting the army.

Unequal distribution of natural resource rents may create severe grievances, especially if a region with abundant natural resources is deprived of revenue flows but must bear extraction costs such as pollution and degradation of land. Le Billon (2003) shows that in Papua New Guinea in 1989, the Bougainvilleans attacked the local gold and copper mine after the authorities and the company refused to compensate for the pollution on the island. The attack grew to a secessionist civil conflict.

The resource base may also create opportunities for conflicts that have their roots in noneconomic causes. To feed, clothe, and arm its members, a rebel group needs money. Unless the rebel leaders are able to raise sufficient funds, a conflict is unlikely to start no matter how severe the grievances. Continuous financing is also crucial to the survival of a rebel movement; if a rebel group is unable to meet the financial requirements, the conflict is unlikely to continue for an extended period. In fact, Collier and Hoeffler now find the viability of rebel movements as a more likely explanation for the perceived link between primary commodity exports and conflict than greed (Collier & Hoeffler, 2005)**.** Partial support for the feasibility argument is provided by Fearon (2004), who finds that in many prolonged conflicts rebels have had access to easily extractable natural resources. For example, rebels in the Kachin and Shan States in Myanmar have had access to opium cultivation and gemstone mines, and they have been able to engage in conflicts lasting for decades (for an illustration, see Figure 1).

Figure 1. Gemstone Mining, Opium Cultivation, and Shan and Kachin Conflicts in Myanmar, 1960–2002



NOTE: The conflict in Kachin was active 1961–1992.
SOURCES: Resource data: Flöter, Lujala & Rød (2007) and Lujala (2003). Conflict data: Gleditsch et al. (2002).

Several channels, both indirect and direct, may work simultaneously. It is relatively widely accepted that dependence on resource production and exportation is related to the conflict onset and that the indirect route is valid (see, for example, Fearon & Laitin, 2003; Humphreys, 2005; de Soysa & Neumayer, 2007). There is more controversy about resources' effect on the rebel movement itself because few empirical studies can convincingly show any link—or, indeed, the absence of such a link. When, for example, Collier & Hoeffler (2006) argue that oil exports are essentially related to secessionist conflict, they are not able to control for whether or not oil production is actually located in the seceding region. Therefore, they are unable to clarify whether major oil-exporting countries in general are more likely to experience a conflict over territory or whether it is the location of oil in the seceding region that is directly related to the conflict.

This article seeks to provide evidence that natural resources affect rebel movements directly. Do rebellions that take place in regions with hydrocarbon reserves or gemstones last longer? Do resources located outside the resource region have the same effect on duration? Do onshore and offshore hydrocarbon production have the same effect on conflict onset? In other words, does the location of resources matter, and if so, is the rebels' access to resources crucial?

Where natural resources are located should not matter if the indirect channel is the only explanation for the perceived detrimental effect of resources on peace. Revenue flows from different sources and regions should have the same effect on the state. There is no reason to expect that, for example, revenues from offshore oil in Nigeria should have a different effect on state institutions than revenues from onshore production.

By contrast, to have a direct effect on rebel movements, natural resources must in most cases be located near the (potential) rebel groups. Rebels that rely on looting resources to accumulate private wealth or to finance warfare need to have access to those resources and therefore the fighting is likely to center near valuable and easily extractable resources. For example, in Sierra Leone the rebels had control over diamond mining areas in the Kono, Kenema, and Kailahun districts. Rebels may also engage in conflicts that center around future exploitation rights.

In general, we would expect that, if natural resources have an effect on a rebel group, resources that are located in a conflict zone should have an effect on conflict. By contrast, resources located outside the conflict zone should have a different or no effect on conflict. Before turning to the data and analysis to test this assertion, the next section briefly summarizes how the resource base has been measured in earlier conflict studies.

MEASURING NATURAL RESOURCE BASE IN EMPIRICAL STUDIES

It is extremely difficult to distinguish among the different mechanisms linking resource abundance to armed conflict. This is partially because only a few choices are available to measure the resource base.

The most widely used measures commonly take the export value of natural resources or specific resource type and normalize it with respect to the size of the economy or total exports (Ross, 2004a). Others use rent estimates instead of export value (de Soysa & Neumayer, 2007). These measures are either used directly or a dummy is created for countries that score above a specific cutoff point. Although these studies have shown that natural resources are likely to have a detrimental effect on peace, the measures have been criticized on several grounds (Ross, 2006) and the findings are not always robust (Sambanis, 2004; Hegre & Sambanis, 2006). Humphreys (2005) collects and uses more detailed data on oil production and reserves. He confirms that oil production is linked to conflict onset. By using the new data, Humphreys is also able to distinguish between the direct and the indirect mechanisms. He finds support for the weak-state mechanism although his interpretation of the results has been challenged (Collier & Hoeffler, 2005).

Others have looked at resources that are spread out over a wider area and can be exploited by individuals. These resources are likely to generate for the state revenue flows that are more moderate because they are more difficult to control even during peacetime. Moreover, lootables can be extracted by rebels during conflict. Therefore, if these resources are related to conflict, they are more likely to affect the rebels than the state. This is the approach taken in Lujala, Gleditsch & Gilmore (2005), who study the effect of diamonds on the onset of conflict. They find evidence that secondary diamonds are linked to the onset of larger civil wars for the post-1985 period. They are not, however, able to control for whether the rebels had access to diamonds. For example, they are not able to exclude cases such as the conflict in Chechnya that probably has very little to do with diamonds in Siberia.

Fearon (2004) is the first to code conflicts in which rebels are known to have exploited lootable resources (gemstones, drugs). He finds that these conflicts tend to last substantially longer. This approach, however, fails to account for cases where lootable resources were available in the conflict region but, for one reason or another, rebels did not exploit them (or there is no outside knowledge of exploitation). It is also possible that the conflict ended before the rebels could or needed to utilize the natural resources. Therefore, it is possible that contraband is involved in prolonged conflicts precisely because they are long and the rebels are forced to exploit natural resources; use of natural resources may be merely an indication of prolonged conflict but not the cause. In fact, Ross (2006) states that in many cases the rebel groups did not begin to sell contraband until several years after the conflict started. Therefore, it would be more correct to identify all cases in which rebels had access to lootable resources, and investigate whether these conflicts last longer.

DATA

Resource Data

This article analyzes how the location of natural resources affects the conflict. For these data, I use PETRODATA, a new dataset of hydrocarbon (crude oil and natural gas) reserves throughout the world (Lujala, Rød & Thieme, 2007).[3] The dataset assigns geographic coordinates for each region with hydrocarbon reserves and production, and also identifies whether oil, gas, or both are present. The dataset includes temporal information on when hydrocarbons were first discovered in each region and it states the first production year. PETRODATA covers the period 1946–2003 and includes 885 onshore regions and 379 offshore areas. In total, there are confirmed hydrocarbon fields in 111 countries, 98 of which had produced gas, oil, or both by 2003.

For the duration analysis, six conflict-specific dummies are coded from PETRODATA. Both the conflict zones and the resource regions can be viewed in ArcGIS software, which ensures the spatial and temporal overlap of conflict zones and resource localities. The following example illustrates the coding procedure. In Southern Sudan hydrocarbons were discovered in 1979 and production began in 1996. The first civil war in the region took place 1963–72 and the second 1983–2001. Therefore, the hydrocarbon reserve dummy is coded 0 for the first war and 1 for the second.[4] The hydrocarbon production dummy is coded 0 for the first conflict and until 1995 for the second, but as 1 from 1996. The same procedure is repeated for each conflict in the dataset. To study whether gas and oil have the same effect, dummies for oil and pure gas reserves and production are coded separately, following the same procedure.[5]

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[3] PETRODATA and DIADATA are available from http://new.prio.no/CSCW-Datasets/.
[4] The reserve dummy indicates whether there are hydrocarbons in the conflict zone regardless of the production status.
[5] The oil dummy also includes cases in which both oil and gas have been discovered in the conflict zone.

For the onset analysis the hydrocarbon dummies are coded at the country level. Time series for each country indicating when hydrocarbons were first discovered and produced are constructed from PETRODATA. The reserve dummy is coded 1 for the discovery year and for each subsequent year. The production dummy is coded 1 for the first production year and for each year thereafter. Both the reserve and the production dummies are coded separately for onshore and offshore fields. As for the duration analysis, dummies for both oil and gas are also coded separately. Thus, for example, there are dummies for onshore and offshore oil production, which can be aggregated to one oil dummy that does not distinguish between onshore and offshore location.[6]

To test the effect of a more lootable natural resource, a dummy variable for secondary diamond production is coded. This dummy takes the value of 1 for the first year that secondary diamonds were produced and for each following year. The data are coded at both the conflict and the country level. Diamond data come from the DIADATA dataset, which provides coordinates for more than 1000 diamond deposits throughout the world (Gilmore et al., 2005). Dummies for primary diamond production, which requires considerable investment in technology, are also constructed from DIADATA. Other gemstones, such as rubies, sapphires, and opals, are relatively easily extractable, and therefore I construct a similar dummy for gemstone production.[7] These data come from Flöter, Lujala & Rød (2007).

Dependent Variable 1: Duration of Armed Civil Conflict

The empirical analysis uses conflict data for the period 1946–2003 from the annually updated UCDP/PRIO Armed Conflict Dataset (Gleditsch et al., 2002; Harbom & Wallensteen, 2007). The dataset has a relatively low inclusion criterion (25 battle-related deaths during a year). Therefore, the low-intensity conflicts are included in the analysis. From the dataset, all internal and internationalized internal conflicts are included and merged together. An extension to the UCDP/PRIO dataset assigns exact start and end dates for conflicts in the dataset (Gates & Strand, 2004). The duration is measured in days, although the year is kept as the observation unit because no other variable is measured for a shorter period. A reactivation of a conflict that has been

[6] The dataset does not include estimates for production or reserve size, so only dummy variables are constructed. By considering simply whether there is production, the model is less susceptible to endogeneity. For example, the oil production dummy is insensitive to changes in production volume due to conflict.

[7] Various techniques are used to mine gemstones, but many of the deposits can be mined using simple methods with the help of a pick, spade, shovel, and basket. Gem gravels are exposed either by removing the topsoil or, if located more than a couple of meters deep, by digging shallow shafts (up to 10 meters or more) to access gems. Gems are also located in existing riverbeds. Naturally, more sophisticated methods can be and are used, but most deposits can be mined with more primitive methods as well (Keller, 1990).

inactive for more than two calendar years is treated as a new conflict. A new conflict is also coded if there has been a total change in the opposite side. Conflicts that were active in 2001 are censored as are conflicts that ended in 2001 but revived during the following 24 months. In total, dates are available for 252 distinct conflicts for the period 1946–2001. In duration analysis it is desirable to control for the location of conflict, which is available from the same dataset.

Dependent Variable 2: Onset of Armed Civil Conflict

Onset is also coded from the UCDP/PRIO Armed Conflict Dataset and covers the period 1946–2003. The dataset includes several countries with simultaneous civil conflicts. For example, Myanmar had several ongoing conflicts in the 1990s with six conflict onsets in total. As a country with an ongoing conflict obviously may experience an outbreak of another civil conflict, it would not be correct to censor the following conflict years. Further, such a deletion strategy may lead to a considerable loss of estimations units; in the case of Myanmar it would have resulted in removal of all country years since 1948.

In total, the dataset includes 7176 country years, although many are lost during analysis because of missing control variables. Conflict onset is a relatively rare event (238 onsets) and consequently onset is coded for only 3.3% of the country years.

The two dependent variables, onset and duration, are coded using the same criteria for conflict onset and end. The lower number of conflict onsets compared to the total number of conflicts is because 22 conflicts are not included in the onset analysis as they started in the same year as another conflict in that country. The onset analysis also includes eight conflict onsets that are not included in the duration analysis because they started in 2001 or later.

Control Variables

The control for income level (per capita income) comes from Fearon & Laitin (2003). The income variable is both lagged one year and logged. The original Fearon & Laitin variable is updated using the Penn World Tables 6.0 Heston, Summers & Aten, 2002) and World Bank Development Indicators (World Bank, 2002).[8] The logged population

[8] Fearon & Laitin (2003) use Penn World Tables 5.6 for the per capita income variable in which the income figures are available up to 1992. They extended this series to 1998 by using World Bank Development Indicators. To extend the variable until 2002, I use the new version of Penn World Tables (6.0), which have per capita income levels until 2000. As the two versions are not directly comparable, the per capita income growth rates were derived from the latest version of Penn World Tables and these rates were used to extend the Fearon and Laitin data from 1992 to 2000. For the two remaining years, growth rates from World Bank Development Indicators were used.

data come from Fearon & Laitin, and are updated from World Bank Development Indicators. Fearon & Laitin is also the source for the continent and former colony dummies. Incompatibility comes from the UCDP/PRIO Armed Conflict Dataset and is coded 1 for territorial conflicts and 0 for governmental.

To control for social fractionalization I use Alesina et al.'s (2003) data on linguistic fractionalization, which give the probability that two randomly selected individuals are not from the same linguistic group. The measure varies between 0 and 1, 1 indicating a totally heterogeneous country. I use a lagged Polity IV variable (Marshall & Jaggers, 2002) to measure the level of democratization. It varies from –10 to 10, in which –10 denotes the most autocratic and 10 the most democratic state.

Rough terrain is measured by including the logged percentage of country covered by mountainous terrain (Fearon & Laitin, 2003). The percentages of conflict area covered by mountainous terrain (UNEP, 2002) and by forest (FAO, 1999) are calculated for the duration analysis.[9] A dummy for a rainy season is estimated from rainfall maps published by GPCP (2002), and a conflict zone receiving more than 8 mm of rain daily for a month or more is coded with a rainy season dummy.

Controls for Simultaneous Conflicts and Time Dependence in Onset Model

To include all conflict onsets, the conflict years following the onset are not deleted. To control for the possibility that a country with ongoing conflict is inherently more likely to experience an onset than a country without ongoing conflict, a dummy for ongoing conflict is included. I also include a variable that counts the years since the last outbreak of conflict, as suggested by Beck, Katz & Tucker (1998), to control for time dependence and correct for bias in standard errors. All analyses are clustered on country to calculate robust White Standard errors. STATA 9.0 is used in all analyses.

DURATION ANALYSIS

In the UCDP/PRIO Armed Conflict Dataset the mean conflict duration is 6.9 years. Incompatibility has a clear effect on the mean duration; conflicts over government last on average five years but secessionist conflicts last for more than nine years. The distribution of duration is skewed; the median survival time is two years, and 75% of all conflicts end in eight years. Figure 2 shows the Kaplan–Meier estimates for conflict

[9] All area calculations are conducted in ArcGIS 8.0 from Environmental System Research Incorporated (ESRI) based in Redlands, California. ESRI also provides a series of base maps that were used to calculate surface areas for countries and conflict zones.

duration for selected variables. Kaplan–Meier is a nonparametric estimate for the probability of conflict continuing past a specific point in time. For example, 25% of conflicts over territory continue for more than 11 years. The figure confirms that conflicts over territory last longer. Similarly, the presence of gemstones and hydrocarbons in the conflict area increases the duration. Oil production is also positively related to the duration although the effect seems to be weaker.

Figure 2. Kaplan–Meier Survival Estimates for Conflict Duration, 1946–2001

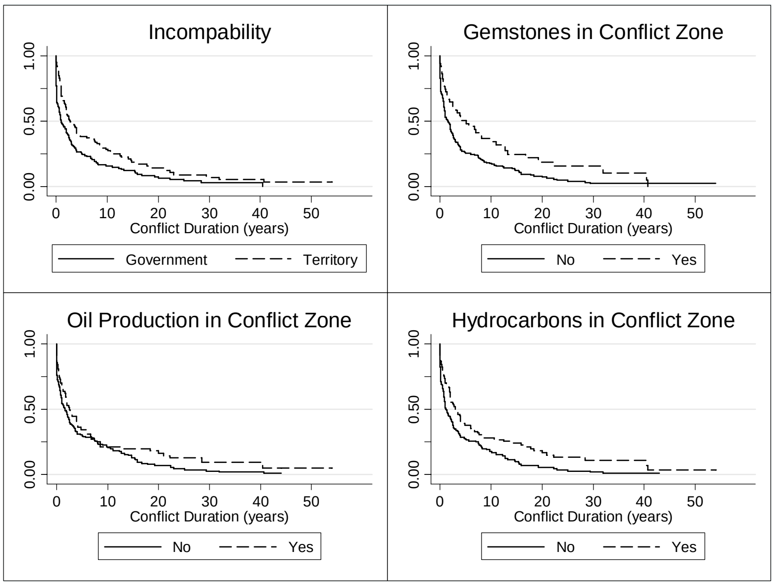

Figure 3 shows the smoothed estimate for the hazard of peace. Immediately after a conflict starts, the probability of peace increases for the first two years. However, the downward slope for the following years is clear; as time passes, peace becomes less likely. There is an increase in hazard rate for the longest conflicts but, as very few conflicts last longer than 35 years, the confidence intervals for the right-hand tail are large. The figure suggests that the correct survival model could have lognormal or log-logistic form. A Weibull model is also possible although it imposes a monotonically decreasing hazard function on the conflict data. All the models presented here have been analyzed by using the three different distributions. The tables in the article show the results by using the Weibull distribution for four reasons. First, the results in hazard ratio form can be compared to Cox estimates to verify that the coefficients are correct. Second, when the Weibull and lognormal models are compared to the gamma model, the lognormal distribution is rejected at the 10% level. Third, the Akaike Information

Criteria choose the Weibull as the slightly preferred model. Finally, Weibull reports the most conservative coefficients. However, the results are robust to the choice of distribution. The Weibull is preferred to the Cox model because it performs better.[10]

Figure 3. Smoothed Hazard Estimate for the Event of Peace

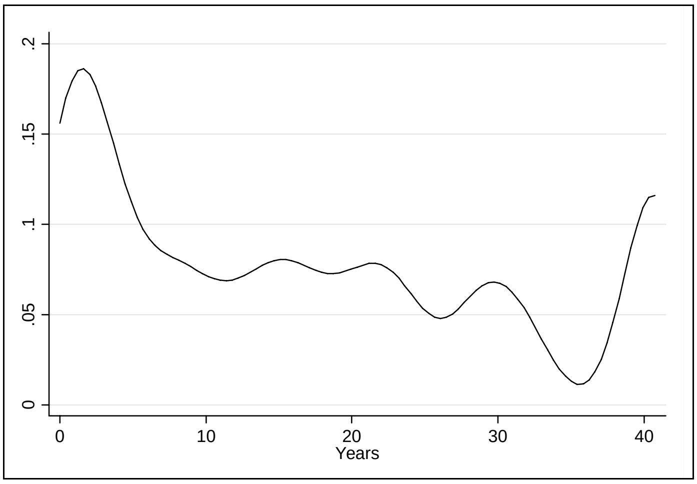

Table I shows the results for the bivariate Weibull survival analyses. The coefficients are reported in time ratios, which are easily interpreted; the coefficient shows the multiplicative change in duration for one unit change in the independent variable. For example, if oil reserves are located in the conflict area, the conflict is predicted to last 2.2 times longer than a conflict without oil reserves inside the conflict zone. The bivariate analysis shows that resources located inside the conflict zone seem to prolong civil conflict. Oil and gas reserves both increase the duration, but it seems that gas production is not related to the conflict length.[11] Secondary diamonds and gemstones also increase the duration. As their effect seems to be similar, they are aggregated to one single variable (All gemstones) to reduce the number of variables in the multivariate analysis. Primary diamonds are only weakly related to conflict. In the subsequent multivariate analysis, their effect is always insignificant, and the variable is dropped from the analysis.

[10] Appendix 1 shows the base model using the lognormal and log-logistic distributions and compares the Weibull coefficients to the Cox model. The appendix also includes other models discussed in this section but that are not included in Table II.

[11] Reserve dummy codes all the years after discovery. Production dummy includes only the years after production started.

Table I. Bivariate Duration Analysis of Armed Civil Conflict, 1946–2001

Oil reserves,	2.171	Oil production,	1.79
Conflict zone	(2.60)	Conflict zone	(1.74)
	0.009		***0.082***
Gas reserves,	1.687	Gas production,	0.876
Conflict zone	(2.01)	Conflict zone	(0.40)
	0.044		*0.688*
Hydrocarbon reserves,	2.556	Hydrocarbon production,	1.752
Conflict zone	(3.34)	Conflict zone	(1.71)
	0.001		***0.088***
Secondary diamond prod.,	1.939	Gemstone production,	4.667
Conflict zone	(2.38)	Conflict zone	(4.96)
	0.017		***0.000***
Primary diamond production,	2.238	All gemstones,[a]	3.164
Conflict zone	(1.49)	Conflict zone	(4.37)
	0.137		***0.000***

NOTE: The table shows the time ratio form for bivariate Weibull survival analyses. For the description of the variables and the sources, see the text. Absolute robust z-values, adjusted over countries, in parentheses. p-values in italics. p < 0.1 in bold.

[a] The "All gemstones" variable does not include primary diamonds

Table II shows the main results for the duration analysis. Model 1 includes the dummies for the presence of hydrocarbon reserves and all gemstones, including secondary diamonds, in the conflict zone. The results are in line with bivariate analysis; gemstones and hydrocarbons in the conflict zone more than double the conflict duration, and the effect is highly significant.

Model 1 also includes various measures for rough terrain. Mountainous terrain and forest cover are expected to benefit rebels, for example, by providing hiding places, and thus to increase the length of conflict. Rainy season may damage roads and thus isolate rebels and military forces from each other, causing natural breaks in fighting. This is assumed to benefit the rebels, who can use the breaks to rearm and regroup. Two of the three rough terrain variables have the expected effect (mountainous terrain and rainy season) but forest cover actually seems to decrease the length of conflict.

In Model 2 a dummy for incompatibility (secessionist/governmental) is added to the model. The effect is highly significant and, as predicted by the Kaplan–Meier estimate, conflicts over territory last three times longer than governmental conflicts. Model 2 also includes an intensity dummy for conflicts that had a relatively high casualty rate for at least one year.[12] Finally, in Model 3 the level of democracy is added

[12] For the conflicts in the UCDP/PRIO Armed Conflict Dataset, 75% of the conflict-country-years have less than 1600 battle-related deaths (Lacina & Gleditsch, 2005). This figure is used as a cutoff point and a dummy for conflicts that exceeded this threshold for at least one year is included in the analysis. The dummy is used because the model is likely to omit variables that explain high levels of casualties.

to the analysis. The results show that democracies tend to fight longer wars; one explanation could be that they are less likely to use overly brutal methods to bring a rebellion to an end (Lacina, 2005).

In general, the inclusion of control variables weakens the effect of the hydrocarbon dummy but strengthens the effect of the gemstone variable. Conflicts in which rebels have access to gems (including secondary diamonds) tend to last more than 2.5 times longer. These findings are in line with Fearon (2004), who finds the same positive effect for rebellions that profit from contraband production or trafficking.[13] As secondary diamonds are frequently mentioned as a culprit for long conflicts, Model 4 tests the secondary diamond dummy alone. The results show that the dummy is highly significant and the effect is similar to the dummy that includes other gemstones also.

The most interesting results concern the hydrocarbon dummy. The results are new and striking. Presence of hydrocarbons in the conflict area strongly increases the length of conflict; petroleum riches more than double the duration. The positive effect of lootable resources on duration has been argued and documented elsewhere, but so far there has been less evidence that nonlootables may also prolong conflict.

Surprisingly, production is not necessary for this effect. Model 5 includes a hydrocarbon production dummy, which is not significant at the 0.1 level. Although the oil production dummy fares better (Model 7), the effect of production is weaker and less significant, as suggested by the Kaplan–Meier estimates and the bivariate analysis. The oil reserve dummy (Model 6) also performs weaker than the combined hydrocarbon measure. I also run the model with a dummy that includes only the years between the discovery and the start of production. This has a similar effect on duration and is significant at the 0.05 level (results not shown). This further illustrates that production is not necessary for the prolonging effect of hydrocarbons.

These results imply, first, that the presence of gas and oil lengthens the conflict. The effect is not confined to oil, although its effect seems to be more salient. Second, production is not necessary for the adverse effect on duration; it is enough that hydrocarbon fields are located in the conflict region. Therefore, it seems that the duration is lengthened not necessarily only by the financing available to rebels but also by the promise of future revenue flows originating from the region. For the rebels the effort and investment in fighting may be justified by the chance of winning control over resources located in the area the rebels originate from. These rebels may seek outright

[13] I also try a dummy for drug cultivation in the conflict zone (coca bush, opium poppy, and cannabis), but is not associated with the duration of conflict (data from Lujala, 2003).

autonomy, to oust the present government or to strengthen their position in negotiations over how the revenues from the local resources should be shared. The issue of revenue sharing from oil exploitation has been central, for example, in Sudan and Chad (Gary & Reisch, 2005; Humphreys, 2005).

The above analysis controls for the location of resources and conflict, but it is still possible that resource-rich countries generally tend to have longer conflicts and the analysis is picking up this effect. To rule this out, I test whether natural resources measured at the country level have the same effect on duration. If the impact of resource revenues on conflict operates only through their effect on government and other state institutions, we would expect the country-level measures for resources to have a similar effect on conflict duration as that of the conflict-level measures. Model 8 includes dummies for hydrocarbon and gemstone production at the country level. The results show that these have no effect on conflict duration. Therefore, resources matter for conflict duration only when they are located inside the conflict area, implying that the prolonging effect of natural resources mainly works through their effect on rebel movements.

A residual analysis reveals three clear outliers.[14] Removal of the outliers has little effect on the gemstone and hydrocarbon reserve dummies; the hydrocarbon dummy gains marginally in both effect and significance, and gemstones' effect on duration stays unchanged (see Appendix 1). Mountainous terrain is no longer significant and the democracy score gains in significance but the exclusion of outliers does not affect its time ratio.

The main results are also fairly robust to inclusion of continent dummies and a dummy for former British and French colonies (see Appendix 1). The dummy for all gemstones declines in magnitude, but its impact on duration is still strong, more than doubling the length of conflict. The dummies do not have any effect on the impact of hydrocarbons. In contrast, the continent and colony dummies have a drastic effect on the rough terrain variables that all become insignificant. The dummies themselves are insignificant.

[14] The three conflicts are Ethiopia (governmental) 1976–91, Myanmar (territorial, Karen) 1948–2003, and Uganda (governmental) 1994– (ongoing in 2004).

Table II. Duration of Armed Civil Conflict, 1946–2001

	1	2	3	4	5	6	7	8
ln Mountainous terrain,	1.124	1.104	1.092	1.099	1.096	1.092	1.094	1.122
conflict zone	(2.20)	(2.22)	(1.88)	(1.99)	*(1.99)*	*(1.91)*	*(1.98)*	(2.50)
	0.028	***0.027***	***0.060***	***0.046***	***0.046***	***0.056***	***0.048***	***0.012***
ln Forest cover,	0.928	0.899	0.889	0.898	0.887	0.885	0.885	0.891
conflict zone	(1.43)	(1.95)	(2.04)	(1.88)	*(2.12)*	*(2.13)*	*(2.18)*	(1.83)
	0.152	***0.051***	***0.041***	***0.060***	***0.034***	***0.033***	***0.029***	***0.067***
Rainy season,	1.915	1.806	1.548	1.897	1.697	1.615	1.703	1.930
conflict zone	(1.91)	(1.83)	(1.38)	(1.97)	*(1.64)*	*(1.48)*	*(1.65)*	(1.99)
	0.056	***0.067***	*0.168*	***0.049***	*0.102*	*0.140*	***0.100***	***0.046***
Incompatibility		3.356	3.135	2.901	3.333	3.270	3.338	2.470
		(4.58)	(4.47)	(4.15)	*(4.64)*	*(4.56)*	*(4.66)*	(3.44)
		0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.001***
Intensity		3.506	3.709	4.125	3.755	3.815	3.781	4.227
		(4.88)	(5.30)	(5.50)	*(5.33)*	*(5.39)*	*(5.38)*	(5.27)
		0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***
Democracy (lag)			1.050	1.052	1.049	1.051	1.050	1.052
			(1.99)	(2.06)	*(1.97)*	*(2.02)*	*(2.02)*	(2.16)
			0.047	***0.039***	***0.049***	***0.044***	***0.043***	***0.031***
All gemstones,[a]	2.632	3.149	2.938		2.937	2.884	2.934	
conflict zone	(3.65)	(4.49)	(4.34)		*(4.21)*	*(4.22)*	*(4.24)*	
	0.000	***0.000***	***0.000***		***0.000***	***0.000***	***0.000***	
Secondary diamonds,				2.400				
conflict zone				(3.21)				
				0.001				
Hydrocarbon reserves,	2.357	2.059	2.013	2.028				
conflict zone	(3.21)	(2.66)	(2.60)	(2.61)				
	0.001	***0.008***	***0.009***	***0.009***				
Hydrocarbon production,					1.595			
conflict zone					*(1.50)*			
					0.135			
Oil reserves,						1.798		
conflict zone						*(2.07)*		
						0.038		
Oil production,							1.679	
conflict zone							*(1.66)*	
							0.096	
All gemstones,[a]								1.506
country level								*(1.15)*
								0.251
Hydrocarbon production,								1.286
country level								*(0.82)*
								0.415
p	0.473	0.505	0.511	0.506	0.508	0.509	0.508	0.499
	(11.45)	(10.87)	(10.82)	(11.10)	(11.13)	(11.05)	(11.10)	(11.57)
	0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***
No. of conflicts	252	252	248	248	248	248	248	248
Log-likelihood	-564.30	-547.12	-531.33	-533.63	-533.32	-532.43	-533.06	-537.90
Akaike Information Criteria	1142.60	1112.20	1082.70	1087.30	1086.60	1084.90	1086.10	1095.80

NOTE: The table shows the time ratio form for Weibull duration analysis. Absolute robust z-values, adjusted over countries, in parentheses. p-values in italics. P < 0.1 in bold.

[a] The "All gemstones" variable does not include primary diamonds.

Clustering on conflict instead of country has only a marginal effect on significance levels of the resource variables. An additional check for frailty does not reveal any significant changes in coefficients and significance levels. I also run the base model using lognormal and log-logistic distributions instead of the Weibull. Results are similar to the Weibull estimations except for gemstones, incompatibility, and intensity, which all gain considerably in magnitude. Finally, I compare Weibull hazard ratios to the Cox model. The hazard ratios are reasonably similar, confirming that the Weibull estimates are correct. Of all the distributions, the Weibull reports the most conservative results for the resource variables (for the results, see Appendix 1).

ONSET ANALYSIS

PETRODATA includes locations for both onshore and offshore hydrocarbon fields. The onset analysis uses this information to study whether onshore and offshore fields contribute differently to the risk of conflict onset. Table III presents the results. The results are shown in odds ratios for logistic regressions; this provides an easy interpretation for the resource variables, which are all dummies.[15]

Resource endowment may adversely affect regime type, its stability, and income level. To avoid the possibility that my resource dummies are merely picking up these indirect effects on peace, I include these in my analysis. In addition, poor countries generally tend to fight more conflicts, which may be due to factors such as the low opportunity cost of joining a rebellion (Collier & Hoeffler, 2004) or to low state capacity (Fearon & Laitin, 2003). Level of democracy has been shown to be related to conflict onset in a parabolic way; the most autocratic and democratic states are less likely to experience a conflict onset while regime types that have characteristics of both types fare worse (Hegre et al., 2001). Therefore both the linear and the square terms for regime type are included in the analysis. Political instability[16] has also been linked to conflict (Sambanis, 2004). I also control for population size, social fractionalization, amount of mountainous terrain, and ongoing conflict.

Model 9 includes the control variables that mostly perform in coherence with the results of earlier studies. Countries that are more populous tend to have more conflict onsets. The income level has the expected negative sign but fails to be significant in this

[15] The odds ratio shows how many times the risk of conflict increases for one unit of change in the independent variable.
[16] Instability is a dummy variable that takes value 1 if the country has experienced >2 change in the Polity IV index over the previous three years.

model. Democracy variables have the expected curvilinear relationship to onset; the most democratic and autocratic countries are less likely to experience a conflict. The two variables are jointly significant. Instability is not significantly related to conflict. Linguistic fractionalization significantly predicts the conflict onset and mountainous countries tend to face a higher risk of onset. The dummy for ongoing conflict is not significant.

Model 9 also includes a dummy for countries that produce secondary diamonds. The effect of secondary diamond production is considerable and highly significant. In fact, a country with secondary diamonds faces a risk of conflict onset almost 1.5 times higher than that of a country without such production. This result complements an earlier study by Lujala, Gleditsch & Gilmore (2005). They find that secondary diamond production is related to conflict onset for the post-1985 period. When they use a longer time span (1945–1999), they are not able to document such a link. However, the conflict dataset they use (from Fearon & Laitin, 2003) excludes conflicts with less than one thousand combat deaths, which are included here. Therefore, it seems that secondary diamond production is especially salient for low-intensity conflicts.

Model 10 includes the oil production dummy. The effect of the dummy is both substantial and significant; oil production increases the risk of onset by a factor of 1.5. This result is in line with earlier studies that find that oil producers and exporters are more likely to experience conflict onset. This article, however, seeks to clarify whether production location has an effect on conflict. Therefore, Model 11 differentiates between onshore and offshore production. From the results it is clear that onshore oil production has a similar effect on conflict onset as oil production in general while offshore production fails to have any effect. Inclusion of oil dummies renders the GDP per capita significant: countries with higher income level have lower risk of conflict onset.

As rebels almost never have access to offshore production and revenues accrue to the state, offshore production can only affect the conflict onset through its effect on state institutions. If it were true that the mechanism from oil production worked only indirectly, for example, through the weak-state hypothesis, we would expect offshore oil production to have a similar positive effect on conflict onset as onshore production. There is no reason to expect that revenue flows from offshore production have a different impact on state capabilities than the flows from onshore installations. However, the analysis shows no evidence for an adverse effect of offshore production, which in turn implies that the effect of onshore production should also work through other mechanisms.[17]

However, offshore production has been substantial only during the past 20 to 30 years. Therefore, the weak and insignificant effect may be because the analysis period is too long to capture the effect. However, analysis that only includes the past 20 years (1984–2003) reveals qualitatively the same results as the analysis of the full period. In fact, the effect of onshore production actually increases in both magnitude and significance while that of offshore production stays insignificant. It could be also argued that only relatively developed countries are able to exploit offshore reserves. However, as most offshore exploitation is done by large international petroleum companies, there are few impediments for poor countries to benefit from offshore production. For example, there is offshore production in Angola and Myanmar, both among the least developed countries in the world.

Gas production has no effect on conflict onset. When the pure gas production is added to the oil dummy, all three dummies perform worse than the corresponding dummies for oil production (see Appendix 2). This implies that pure gas production does not increase the risk of conflict onset.[18] As the value of gas production has been limited until the past 10 to 20 years, the study period may be too long to capture the effect of gas. However, analysis restricted to the past 20 years does not show qualitatively different results.

Residual analysis shows five potential outliers.[19] The removal of these has no effect on the resource variables (see Appendix 2). The results are also robust to the addition of dummies for the former British and French colonies. However, when a dummy for Middle East and North Africa is included in the model, the oil variables lose in both significance and magnitude (Models 12 and 13, Table III).[20]

[17] I also estimate Models 10 and 11 using an oil reserve dummy instead of production. The effect is weaker and less significant. This suggests that production is more relevant for the onset than the mere existence of reserves. For the results, see Appendix 2.

[18] The gas dummies were also included separately in the analysis but none was found to be significant (results not shown).

[19] These are the conflict onsets in Trinidad and Tobago (1990), Nicaragua (1978), Panama (1989), Saudi Arabia (1979), and Cambodia (1967).

[20] However, if I remove the five outliers from the model, the oil production and onshore oil production dummies regain in both magnitude and significance, see Appendix 2.

Table III. Onset of Armed Civil Conflict, 1946–2003

	9	10	11	12	13
ln Population size	1.223	1.149	1.148	1.162	1.160
	(3.92)	(2.29)	(2.38)	(2.45)	(2.53)
	0.000	***0.022***	***0.017***	***0.014***	***0.011***
in GDP per capita (lag)	0.827	0.777	0.773	0.736	0.731
	(1.45)	(2.00)	(1.96)	(2.59)	(2.59)
	0.147	***0.046***	***0.051***	***0.010***	***0.010***
Democracy score (lag)	1.011	1.014	1.014	1.02	1.021
	(0.72)	(0.96)	(0.95)	(1.54)	(1.53)
	0.471	*0.335*	*0.344*	*0.123*	*0.126*
Democracy score squared (lag)	0.993	0.993	0.993	0.993	0.993
	(3.10)	(3.17)	(3.17)	(3.15)	(3.19)
	0.002	***0.002***	***0.002***	***0.002***	***0.001***
Instability (lag)	1.166	1.155	1.163	1.153	1.160
	(0.84)	(0.78)	(0.82)	(0.78)	(0.81)
	0.401	*0.433*	*0.413*	*0.434*	*0.420*
Linguistic fractionalization	2.806	3.106	3.067	3.283	3.256
	(3.23)	(3.77)	(3.72)	(4.03)	(3.99)
	0.001	***0.000***	***0.000***	***0.000***	***0.000***
ln Mountainous terrain	1.128	1.129	1.126	1.125	1.122
	(3.06)	(3.18)	(3.12)	(2.97)	(2.94)
	0.002	***0.001***	***0.002***	***0.003***	***0.003***
Secondary diamonds	1.473	1.443	1.452	1.555	1.565
	(1.94)	(1.96)	(1.96)	(2.27)	(2.26)
	0.053	***0.050***	***0.049***	***0.023***	***0.024***
Oil production		1.503		1.401	
		(2.20)		(1.73)	
		0.028		***0.083***	
Onshore oil production			1.488		1.404
			(1.93)		1.64
			0.053		*0.101*
Offshore oil production			1.060		1.046
			(0.25)		(0.20)
			0.803		*0.845*
Ongoing conflict	1.025	0.992	0.983	0.968	0.959
	(0.12)	(0.04)	(0.09)	(0.18)	(0.22)
	0.903	*0.966*	*0.930*	*0.859*	*0.825*
Constant	0.009	0.013	0.013	0.01	0.01
	(7.01)	(6.19)	(6.42)	(6.29)	(6.47)
	0.000	***0.000***	***0.000***	***0.000***	***0.000***
Dummy for North Africa and Middle East				*Yes*	*Yes*
No. of conflicts	204	204	204	204	204
No. of country-years	6322	6322	6322	6322	6322
Log-likelihood	-825.02	-822.51	-822.38	-819.37	-819.19

NOTE: The table shows the odds ratios for logistic estimations. Coefficients for time since last onset and cubic splines are not shown. Absolute robust z-values, adjusted over countries, in parentheses. p-values in italics. p < 0.1 in bold.

As a further robustness check, I estimate a reduced model that only includes variables that potentially are affected by the resource endowment: regime type, its stability, and income level (see Appendix 2). The removal of the other variables increases both the magnitude and the significance level of the resources dummies.[21] The base models are also robust to removal of each remaining variable at the time.

CONCLUSIONS

This article uses a new method—assessing how the location of natural resources affects conflict—to uncover whether natural resources affect rebel movement. The article uses newly collected location data on hydrocarbon reserves, diamonds, and other gemstones, which are overlapped both spatially and temporally with conflict zones. The results from the duration analysis show that rebel access to gemstones or hydrocarbons doubles the conflict duration while, at the country level, resources have no effect on duration. Moreover, I find that production is not necessary for this effect; the mere presence of hydrocarbon reserves in the conflict region is sufficient. These results imply that the prolonging effect of resources works through resources' effect on rebel movements and their viability rather than through their effect on the economy, political institutions, and state capacity.

Although onset analysis does not permit controlling for resource location, an important exception is petroleum production, which can take place both onshore and offshore. The results from the onset analysis suggest that only onshore oil production increases the risk of conflict onset. As there is no reason to expect that revenues from onshore and offshore oil production should affect the state differently, this implies that onshore oil production is salient for conflict through its impact on rebel movements. Together these results suggest that rebel access to resources crucially shapes armed civil conflict.

Conflict onset analysis reveals also that a country with secondary diamond production has a 40% higher risk of conflict onset, a result that has not been documented elsewhere. This article confirms that secondary diamond production and other gemstones are related to duration. The results are comparable to those in Fearon (2004); I find that conflicts in which rebels have access to gemstones last approximately 2.5 times longer.

The link between hydrocarbons and duration is totally new. In fact, earlier studies have concluded that oil is not linked to conflict duration (for example, Ross, 2004a; Sambanis, 2004), or that production makes conflict shorter (Humphreys, 2005).

[21] This increases the number of conflict years by 576 and the number of onsets by 18. To ascertain that the missing observations are not driving the observed changes in coefficients and error terms, I run the reduced model without the 576 observations. Model's results are robust to the elimination of the 576 observations.

However, none of these studies has looked into where hydrocarbons are located in relation to conflict. This article thus provides evidence that nonlootable resources (hydrocarbons) may have a great impact on rebel groups and their viability. There are several possible explanations for this. First, rebels may simply be willing to engage in long conflicts even when they are not able to exploit the resource base during the conflict if the future prize is large enough. Rebels may also be able to sell future extraction rights – "booty futures" – to finance the conflict (Ross, 2005). Finally, oil production may be a better financing source than previously assumed. As Nigeria shows, oil production is potentially lootable and a good revenue source. In Nigeria, crude oil is looted from pipelines in the delta area and sold to the barges hiding in the mangrove (Human Rights Watch, 2003). Illegal bunkering was estimated to amount to up to 10% of total daily production, or 200 000 barrels per day, in 2003. At that time Nigerian crude oil sold for 15–20 US$ per barrel and even after a discount for illegal oil, the profits were considerable. Rebels may also be able to raise money from oil companies through extortion, as in Colombia.

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APPENDIX 1. Robustness checks for the duration analysis

	Base model, cluster (country)	3 outliers removed	Colony and continent dummies	Cluster (conflict)	Shared frailty (country)	Shared frailty (conflict)	Log-normal	Log-logistic	Weibull (Hazard ratio)	Cox (Hazard ratio)
Mountainous terrain (log)	1.092	1.072	1.049	1.092	1.074	1.092	1.103	1.112	-0.045	-0.046
conflict zone	(1.88)	*(1.52)*	*(0.98)*	*(2.02)*	*(1.62)*	*(2.31)*	*(1.73)*	*(1.43)*	*(1.87)*	*(1.96)*
	0.060	*0.128*	*0.325*	***0.043***	*0.105*	***0.021***	***0.084***	*0.152*	***0.061***	***0.050***
Forest cover (log),	0.889	0.886	0.935	0.889	0.892	0.889	0.869	0.867	0.060	0.063
conflict zone	-(2.04)	*(2.13)*	*(1.06)*	*(2.10)*	*(1.86)*	*(2.02)*	*(2.33)*	*(2.08)*	*(2.07)*	*(2.13)*
	0.041	***0.033***	*0.289*	***0.036***	***0.063***	***0.043***	***0.020***	***0.037***	***0.038***	***0.033***
Rainy season,	1.548	1.602	1.220	1.548	1.602	1.548	1.827	1.886	-0.223	-0.267
conflict zone	(1.38)	*(1.55)*	*(0.42)*	*(1.33)*	*(1.24)*	*(1.31)*	*(1.58)*	*(1.58)*	*(1.36)*	*(1.51)*
	0.168	*0.122*	*0.675*	*0.182*	*0.214*	*0.191*	*0.114*	*0.113*	*0.173*	*0.132*
Incompatibility	3.135	3.257	3.002	3.135	3.092	3.135	5.546	4.928	-0.584	-0.614
	(4.47)	*(4.48)*	*(4.04)*	*(4.07)*	*(3.67)*	*(4.01)*	*(5.29)*	*(4.41)*	*(4.86)*	*(4.91)*
	0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***
Intensity	3.709	4.385	4.489	3.709	4.474	3.708	6.029	6.377	-0.669	-0.688
	(5.30)	*(5.93)*	*(4.91)*	*(5.15)*	*(4.43)*	*(4.50)*	*(5.28)*	*(5.17)*	*(5.45)*	*(4.79)*
	0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***
Democracy (lag)	1.050	1.059	1.055	1.050	1.047	1.050	1.070	1.073	-0.025	-0.022
	(1.99)	*(2.41)*	*(2.10)*	*(2.25)*	*(1.93)*	*(2.19)*	*(2.16)*	*(2.06)*	*(2.01)*	*(1.84)*
	0.047	***0.016***	***0.036***	***0.025***	***0.054***	***0.028***	***0.031***	***0.039***	***0.044***	***0.065***
All gemstones,[a]	2.938	2.858	2.323	2.938	2.884	2.937	4.672	4.393	-0.550	-0.633
conflict zone	(4.34)	*(4.30)*	*(3.05)*	*(3.42)*	*(2.71)*	*(3.03)*	*(4.49)*	*(4.28)*	*(4.39)*	*(4.69)*
	0.000	***0.000***	***0.002***	***0.001***	***0.007***	***0.002***	***0.000***	***0.000***	***0.000***	***0.000***
Hydrocarbon reserves,	2.013	2.280	1.967	2.013	2.223	2.013	2.322	2.393	-0.357	-0.392
conflict zone	(2.60)	*(3.11)*	*(2.46)*	*(2.97)*	*(2.61)*	*(2.49)*	*(2.49)*	*(2.46)*	*(2.52)*	*(2.51)*
	0.009	***0.002***	***0.014***	***0.003***	***0.009***	***0.013***	***0.013***	***0.014***	***0.012***	***0.012***
p; sigma; gamma	0.511	0.527	0.522	0.511	0.535	0.511	2.493	1.450	0.511	
	(10.82)	*(9.97)*	*(10.46)*	*(11.70)*	*(8.65)*	*(12.05)*	*(18.13)*	*(6.12)*	*(10.82)*	
	0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	
theta					0.122	0.000				
					(1.98)	*(0.02)*				
					0.048	*0.986*				
No. of conflcits	248	245	248	248	248	248	248	248	248	248
Log-likelihood	-531.33	-520.26	-525.12	-531.33	-530.65	-531.33	-537.43	-540.85	-531.33	-991.22
Akaike Information Criteria	1082.70	1060.50	1082.20	1082.7	1083.3	1084.7	1094.9	1101.7	1082.7	1998.4

NOTE: Table shows the time ratio form for Weibull survival analysis if not indicated otherwise. For the description of the variables and the sources, see the text. Robust z-values, adjusted over countries or conflicts, in parentheses. p-values in italics. p < 0.1 in bold.

[a] *The "All gemstones" variable does not include primary diamonds.*

APPENDIX 2. Robustness checks for the onset analysis (continued next page)

	Base models[a]		Models with various hydrocarbon dummies				Base models for the period 1984–2003		Models in Table III without the five outliers				Reduced models[b]	
ln Population size	1.149	1.148	1.163	1.129	1.161	1.159	1.095	1.100	1.158	1.16	1.171	1.172		
	(2.29)	(2.38)	(2.46)	(1.94)	(2.45)	(2.57)	(1.01)	(1.03)	2.43	(2.57)	(2.59)	(2.71)		
	0.022	***0.017***	***0.014***	***0.053***	***0.014***	***0.010***	*0.312*	*0.302*	***0.015***	***0.010***	***0.009***	***0.007***		
in GDP per capita (lag)	0.777	0.773	0.787	0.74	0.784	0.781	0.771	0.762	0.767	0.767	0.725	0.725	0.653	0.641
	(2.00)	(1.96)	(1.85)	(1.93)	(1.92)	(1.88)	(1.48)	(1.51)	(2.06)	(1.97)	(2.67)	(2.62)	(4.00)	(3.91)
	0.046	***0.051***	***0.065***	***0.053***	***0.055***	***0.061***	*0.138*	*0.132*	***0.039***	***0.049***	***0.008***	***0.009***	***0.000***	***0.000***
Democracy score (lag)	1.014	1.014	1.013	1.016	1.013	1.013	0.998	0.997	1.018	1.018	1.025	1.025	1.016	1.016
	(0.96)	(0.95)	(0.88)	(1.00)	(0.93)	(0.91)	(0.10)	(0.14)	1.26	1.22	(1.88)	(1.84)	(1.05)	(1.07)
	0.335	*0.344*	*0.381*	*0.315*	*0.353*	*0.362*	*0.923*	*0.889*	*0.207*	*0.223*	***0.060***	***0.066***	*0.294*	*0.287*
Democracy score squared (lag)	0.993	0.993	0.993	0.993	0.993	0.993	0.995	0.995	0.992	0.992	0.992	0.992	0.993	0.993
	(3.17)	(3.17)	(3.11)	(3.06)	(3.14)	(3.14)	(1.05)	(1.10)	(3.46)	(3.48)	(3.42)	(3.49)	(3.12)	(3.06)
	0.002	***0.002***	***0.002***	***0.002***	***0.002***	***0.002***	*0.294*	*0.272*	***0.001***	***0.001***	***0.001***	***0.000***	***0.002***	***0.002***
Instability (lag)	1.155	1.163	1.154	1.161	1.162	1.169	1.001	1.007	1.167	1.175	1.165	1.171	1.267	1.284
	(0.78)	(0.82)	(0.78)	(0.81)	(0.82)	(0.84)	(0.00)	(0.02)	0.83	0.86	(0.83)	(0.85)	(1.29)	(1.37)
	0.433	*0.413*	*0.436*	*0.418*	*0.413*	*0.399*	*0.998*	*0.982*	*0.409*	*0.391*	*0.409*	*0.398*	*0.196*	*0.170*
Linguistic fractionalization	3.106	3.067	3.064	2.96	3.081	3.061	2.583	2.514	3.375	3.353	3.579	3.567		
	(3.77)	(3.72)	(3.71)	(3.60)	(3.74)	(3.71)	(1.98)	(1.84)	4.08	4.03	(4.38)	(4.34)		
	0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.048***	***0.065***	***0.000***	***0.000***	***0.000***	***0.000***		
ln Mountainous terrain	1.129	1.126	1.131	1.136	1.129	1.125	1.115	1.099	1.138	1.133	1.134	1.129		
	(3.18)	(3.12)	(3.20)	(3.17)	(3.16)	(3.10)	(1.87)	(1.69)	3.34	3.22	(3.12)	(3.03)		
	0.001	***0.002***	***0.001***	***0.002***	***0.002***	***0.002***	***0.062***	***0.091***	***0.001***	***0.001***	***0.002***	***0.002***		
Secondary diamonds	1.443	1.452	1.46	1.399	1.442	1.453	1.668	1.742	1.463	1.481	1.581	1.601	1.675	1.655
	(1.96)	(1.96)	(1.99)	(1.80)	(1.94)	(1.96)	(2.00)	(1.87)	2.01	2.05	(2.34)	(2.36)	(2.85)	(2.83)
	0.050	***0.049***	***0.047***	***0.072***	***0.052***	***0.050***	***0.046***	***0.061***	***0.044***	***0.040***	***0.019***	***0.018***	***0.004***	***0.005***
Oil production	1.503						1.719		1.545		1.439		1.810	
	(2.20)						(2.09)		2.33		(1.85)		(3.97)	
	0.028						***0.037***		***0.020***		***0.064***		***0.000***	
Onshore oil production		1.488						1.937		1.532		1.443		1.779
		(1.93)						(2.28)		2.04		(1.74)		(3.49)
		0.053						***0.023***		***0.041***		***0.081***		***0.000***
Offshore oil production		1.060						0.921		1.016		1.003		1.185
		(0.25)						(0.23)		0.06		(0.01)		(0.78)
		0.803						*0.821*		*0.948*		*0.988*		*0.433*

APPENDIX 2. Continued

	Base models[a]		Models with various hydrocarbon dummies				Base models for the period 1984–2003		Models in Table III without the five outliers				Reduced models[b]	
Oil reserves			1.408											
			(1.75)											
			0.080											
Onshore oil reserves				1.375										
				(1.65)										
				0.099										
Offshore oil reserves				1.358										
				(1.33)										
				0.183										
Hydrocarbon production					1.419									
					(1.91)									
					0.056									
Onshore hydrocarbon prod.						1.417								
						(1.69)								
						0.092								
Offshore hydrocarbon prod.						1.037								
						(0.15)								
						0.880								
Ongoing conflict	1.025	0.992	1.000	0.986	1.000	0.993	1.318	1.268	0.966	0.961	0.944	0.938	1.213	1.177
	(0.12)	(0.04)	(0.00)	(0.07)	(0.00)	(0.04)	(1.12)	(0.97)	(0.18)	(0.20)	(0.31)	(0.33)	(1.03)	(0.86)
	0.903	*0.966*	*1.000*	*0.943*	*0.999*	*0.971*	*0.263*	*0.332*	*0.858*	*0.841*	*0.756*	*0.738*	*0.304*	*0.392*
Constant	0.013	0.013	0.011	0.015	0.012	0.012	0.016	0.015	0.012	0.011	0.009	0.009	0.052	0.051
	(6.19)	(6.42)	(6.35)	(5.82)	(6.28)	(6.55)	(3.59)	(3.61)	(6.32)	(6.57)	(6.43)	(6.62)	(12.82)	(12.84)
	0.000	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***
5 outliers removed									*Yes*	*Yes*	*Yes*	*Yes*		
Dummy for North Africa and Middle East											*Yes*	*Yes*		
No. of conflicts	204	204	204	204	204	204	88	88	199	199	199	199	222	222
No. of country-years	6322	6322	6322	6322	6322	6322	2671	2671	6317	6317	6317	6317	6898	6898
Log-likelihood	-822.51	-822.38	-823.28	-821.42	-823.14	-823.02	-342.7	-341.89	-798.02	-798.02	-794.75	-794.65	-917.79	-916.78

NOTE: The table shows the odds ratios for logistic estimations. Coefficients for time since last onset and cubic splines are not shown. Absolute robust z-values, adjusted over countries, in parentheses. p-values in italics. p < 0.1 in bold.

[a] *Models 10 & 11 in Table III*

[b] *Corresponds to Models 10 & 11 in Table III*