The Environmental Spoils of War

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Abstract

Why is armed civil conflict more common in resource-dependent countries than in others? This chapter examines how rebel access to natural resources affects conflict. Using data on gemstone and hydrocarbon localities throughout the world and controlling for the spatial and temporal overlap of resources and conflict, results indicate that when 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 production status. In addition, a country-level analysis suggests that onshore oil production increases the risk of conflict onset; offshore production has no effect on onset. These results support the assertion that natural resources play a central role in armed civil conflicts by providing incentives and opportunities for rebel groups.

Introduction

Although there is evidence that countries rich in natural resources appear to be engaged in armed civil conflict more often than resource-poor countries, there is less agreement on why these resource-rich countries descend into civil strife. Two primary explanations have emerged: first, natural resources (especially those that are easily exploited) provide motivation and means for rebel uprisings; second, the abundance of natural resources leads to poor policy decisions, weakens state-capacity, and ultimately, invites conflict. These competing theoretical explanations have driven the majority of scholarship on the topic of civil unrest, accounting for direct mechanisms of conflict (i.e., greedy and aggrieved rebels) and indirect mechanisms (i.e., economic and political contributions to a weak state). Unfortunately, only a few measures are available to estimate rebel access to resources or resource revenues accruing to the state. As a result, proponents of both of these theoretical arguments tend to use similar measures in their analyses;[1] this is a major weakness, as the same variables are used in support of competing explanations.

As will be discussed, this chapter contributes to this theoretical debate by providing evidence that natural resources affect rebel movements *directly*. Using new data on localities of hydrocarbon (crude oil and natural gas) fields throughout the world and locations of gemstone resources, this chapter examines whether 1) valuable natural resources directly affect armed civil conflict and 2) the location of those resources (i.e., within or outside of conflict zones) influences the length of conflict duration.

Direct & Indirect Mechanisms of Rebel Conflict

Valuable natural resources can affect conflict directly by providing the rebels or the rebel group leaders a source for personal enrichment or by financing rebellion efforts. Further, grievances resulting from unequal distribution of natural resource rents may create conditions for rebel conflicts, especially if a region with abundant natural resources is deprived of revenue flows but must bear extraction costs (e.g., pollution and degradation of land). For example, the Bougainvilleans' secessionist civil conflict

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

in Papua New Guinea began with an attack on the local gold and copper mine in in 1989 after the authorities and company refused to compensate for the pollution on the island (Le Billon, 2003).

While most rebel groups claim to fight for “noble” causes (e.g., human and political rights), some of them may hold more dubious goals: they seek to accumulate private wealth under the guise of more acceptable objectives. Ascribing to this explanation, rebel movements can be seen as any other economic entity; people fight when it pays better than their alternative sources of income (Collier & Hoeffler, 1998; 2004). Payoff from resources may be contingent on successful rebellion (e.g., in the form of achieving greater autonomy as in the case of Southern Sudan). Alternatively, the conflict itself, especially those with low intensity, may be beneficial to those rebels able to exploit resources during the conflict. For example, in Sierra Leone, rebels were afforded longer periods to concentrate on diamond mining and terrorizing civilians than on fighting the army.

Collier and Hoeffler (2005) consider the funding of rebel movements as the most likely explanation for the perceived link between primary commodity exports and conflict than greed**.** Unless rebel leaders are able to raise sufficient funds to feed, clothe, and arm group members, a conflict is unlikely to start no matter how severe their grievances. Furthermore, continuous financing is likely crucial to the survival of a rebel movement for an extended period. In many prolonged conflicts, rebels have had access to easily extractable natural resources (Fearon, 2004) (e.g., access to opium cultivation and gemstone mines supported rebel conflicts for decades in the Kachin and Shan States of Myanmar).

The indirect mechanisms from valuable natural resources to conflict focus on the state: dependence on natural resource extraction and exportation may have adverse effects on the economy, political institutions, and state, leading to poor policy choices and exposing the society to violent conflict (Fearon & Laitin, 2003). Since the early 1960s, most resource-rich countries have underperformed compared with resource-deficient countries. Abundant resources provide easily accruable rents that can sustain detrimental political structures, such as corruption and nepotism, which would not persist without those resources (Auty, 1998; Auty & Gelb, 2001). Furthermore, per capita incomes have grown two to three times faster in resource-poor countries (Auty, 1998; Sachs & Warner, 1995, 2001). Low income levels, in turn, have been shown to increase the likelihood of conflict (Collier & Hoeffler, 2004; Miguel, Satyanath & Sergenti, 2004; Brunnschweiler & Lujala 2017a,b). Political and economic inequality are likely sources of grievance, and low income levels may lower the opportunity cost of joining a rebellion; these are both factors that may contribute to the outbreak of armed conflict. State capacity (especially its military power to defend itself) influences the odds of rebel successes, and in turn, may be affected by the country's natural resource base.

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). Controversy still exists 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. For example, Collier & Hoeffler (2006) argue that oil exports relate to secessionist conflict; however, they are unable to control for whether or not oil production is actually located in the seceding region and, thusly, 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.

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, as 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; therefore, the fighting is likely to center near valuable and easily extractable resources.

Measuring Natural Resource Base in Empirical Studies

Distinguishing among the different mechanisms linking resource abundance to armed conflict presents challenges, as there are relatively few ways to measure the resource base. Commonly, the export value of natural resources or specific resource type is normalized with respect to the size of the economy or total exports (Ross, 2004a); alternatively, rent estimates are used instead of export value (de Soysa & Neumayer, 2007). Despite showing that natural resources are likely to have a detrimental effect on peace, these measures have weaknesses (Ross, 2006) and findings are not always robust (Sambanis, 2004; Hegre & Sambanis, 2006). Importantly, they do not control for whether rebels had access to these resources.

To address this, Fearon (2004) coded conflicts in which rebels are known to have exploited lootable resources (e.g., gemstones, drugs). Despite finding that these conflicts tend to last substantially longer, this approach fails to account for cases where lootable resources were available in the conflict region, but where rebels were not known to exploit them or where conflict ended before the rebels could or needed to utilize them. Therefore, it is possible that use of natural resources may be merely an indication of prolonged conflict but not the cause, as rebels are forced to exploit natural resources to sustain long durations of fighting.

Resource Data

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. To evaluate how the location of natural resources affects conflict, the analysis in this chapter uses datasets of hydrocarbon reserves and diamond occurrences throughout the world.

PETRODATA[2] assigns geographic coordinates for each region with hydrocarbon reserves and production, identifies whether oil, gas, or both are present, and includes temporal information on when hydrocarbons were first discovered and produced in each region (Lujala, Rød & Thieme, 2007). 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. For the onset analysis, the hydrocarbon dummies are coded at the country level.

To test the effect of a more lootable natural resource, a dummy variable for secondary diamond production is 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 thus, a similar dummy for gemstone production was created using GEMDATA (Flöter, Lujala & Rød, 2007).[3]

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 includes conflicts with a minimum of 25-battle

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[2] PETRODATA and DIADATA are available at http://www.prio.no/CSCW/Datasets/Geographical-and-Resource.

[3] 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).

related deaths in a one year period, capturing the low-intensity conflicts in the analysis. 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 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 be incorrect to censor the following conflict years. In total, the dataset includes 7,176 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 percent of the country years.

The two dependent variables, onset and duration, are coded using the same criteria for conflict onset and end. Twenty-two conflicts are not included in the onset analysis, as they started in the same year as another conflict in that country. The onset analysis considers eight conflict onsets not included in the duration analysis, because they started in 2001 or later.

Control Variables

Included in the models are the following control variables: income level, as per capita income (Fearon & Laitin, 2003); a dummy for continent (Fearon & Laitin, 2003);

a dummy for former colony (Fearon & Laitin, 2003); incompatibility, coded as territorial (1) or governmental (0) conflict type from the UCDP/PRIO Armed Conflict Dataset; social fractionalization, which uses linguistic heterogeneity (1 on a scale of 0-1) as a proxy (Alesina et al., 2003); level of democratization, using a continuum of autocratic (-10) to democratic (10) (Marshall & Jaggers, 2002); rough terrain, as a logged percentage of country then conflict area covered by mountainous terrain (Fearon & Laitin, 2003; UNEP, 2002); forest cover, as a percentage of conflict area covered by forest (FAO, 1999)[4] ; and a dummy for rainy season, assigned for the region once 8mm of rainfall daily in a month is recorded (GPCP, 2002).

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).[5] The logged population data come from Fearon & Laitin and are updated from World Bank Development Indicators. A Polity IV variable (Marshall & Jaggers, 2002) was used to measure the level of democratization.

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. Variables that count the years since the last outbreak of conflict, as suggested by Beck, Katz & Tucker (1998), control for time dependence and correct for bias in standard errors. All analyses are clustered on country to calculate robust White Standard errors.

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[4] All area calculations are conducted in ArcGIS 8.0 from Environmental System Research Incorporated (ESRI) based in Redlands, California.

[5] 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, we 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.

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 percent of all conflicts end in eight years. Conflicts over territory, conflicts in regions with presence of gemstones and hydrocarbons, and conflicts in regions with oil production last longer than their counterparts; the latter weakly so. Figure 1 shows the Kaplan–Meier estimates for conflict duration for selected variables and confirms territorial conflicts are longer.[6]

<FIGURE 1>

Figure 2 shows the smoothed estimate for the hazard of peace. Immediately after a conflict starts, the probability of peace increases for the first two years, decreasing over time. 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 Weibull is preferred to the Cox model because it performs better.[7]

<FIGURE 2>

Table I shows the results for the bivariate Weibull survival analyses. The coefficients are reported in time ratios, showing the multiplicative change in duration for one unit change in the independent variable. For example, if oil reserves are located

[6] Kaplan–Meier is a nonparametric estimate for the probability of conflict continuing past a specific point in time.

[7] Appendix 1, which is available at http://www.prio.no/jpr/datasets together with the replication data, 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.

in the conflict area, the conflict is predicted to last 2.2 times longer than a conflict without oil reserves inside the conflict zone. Resources located inside the conflict zone seem to prolong civil conflict. Oil and gas reserves both increase the duration as do secondary diamonds and gemstones, whose effects are similar enough to be aggregated to a single variable (All gemstones). Gas production does not seem related to the conflict length,[8] and 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.

<TABLE 1>

Table II below 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. As in the 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 rainy season have the expected effect of seeming beneficial to rebels, but forest cover seems to decrease the length of conflict.

<TABLE 2>

In Model 2, the dummy for incompatibility 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.[9] Finally, in Model 3, the level of democracy is added to the analysis. The results show that democracies tend to fight longer wars.

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

[9] 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.

In general, the inclusion of control variables weakens the effect of the hydrocarbon dummy but strengthens the effect of the gemstone variable.[10] 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.[11] 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 presence of hydrocarbons in the conflict area strongly increases the length of conflict, more than doubling the duration. 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. Running the model with a dummy that includes only the years between the discovery and the start of production shows a similar effect on duration and is significant at the 0.02 level. 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, with the effect of oil seeming more salient. Second, production is not necessary for the adverse effect on duration; presence in the conflict region is sufficient. 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.

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[10] The results for the resource variables in Model 3 are very robust to the inclusion of various control variables such as per capita income level, population size, and linguistic fractionalization. These control variables themselves are not related to conflict duration.

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

To determine if the analysis is picking up the effect of resource-rich countries generally having longer conflicts, Model 8 tests whether natural resources measured at the country level have the same effect on duration. 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. If the impact of resource revenues on conflict operates only through their effect on government and other state institutions, we would have expected the country-level and conflict-level measures for resources to have a similar effect on conflict duration.

Onset Analysis

The onset analysis uses the location data for onshore and offshore hydrocarbon fields to study whether field location contributes differentially to the risk of conflict onset. Table III presents the results in odds ratios for logistic regressions.[12] Resource endowment may adversely affect regime type, its stability, and income level. To avoid the possibility that the resource dummies are merely picking up these indirect effects on peace, they are included in the 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[13] has also been linked to conflict (Sambanis, 2004). Population size, social fractionalization, amount of mountainous terrain, and ongoing conflict are also controlled for.

<TABLE 3>

[12] The odds ratio shows how many times the risk of conflict increases for one unit of change in the independent variable.

[13] 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 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. Income level has the expected negative sign but fails to be significant in this model. Democracy variables have the expected curvilinear relationship to onset; the most democratic and autocratic countries are less likely to experience a conflict, and 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, while the dummy variable for ongoing conflict is not significant.

Model 9 also includes a dummy for countries that produce secondary diamonds, the effect of which is considerable and highly significant, making the 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), who find that secondary diamond production is related to conflict onset for the post-1985 period.

In Model 10, the oil production dummy has a substantial and significant effect; 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 chapter, 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 levels have lower risk of conflict onset.

If it were true that the mechanism from oil production worked only indirectly, for example, through the weak-state hypothesis, as access to and revenue from offshore production rarely fall to rebels, we would expect offshore oil production to have a similar positive effect on conflict onset as onshore production. There is no reason to expect revenue flows from either offshore or onshore production to have different impacts on state capabilities. 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. Models 10 and 11 are also estimated using an oil reserve dummy instead of production. The effect is weaker and less significant, suggesting that production is more relevant for the onset than the mere existence of reserves.[14]

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, an 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.

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. This implies that pure gas production does not increase the risk of conflict onset.[15] 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.

Conclusions

This chapter assesses how the temporal and spatial locations of natural resources relative to conflict zones overlap and affect conflict duration, uncovering whether natural resources affect rebel movement. This approach rectifies prior uncertainties in the identification of mechanisms through which natural resources and conflict interact. Indeed, results indicate that rebel access to 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. Interestingly, the duration analysis shows that production is not necessary for prolonging the conflict; the mere presence of hydrocarbons inside the

[14] For these and other results discussed in this section but that are not included in Table III, see Appendix 2 (available at http://www.prio.no/jpr/datasets).

[15] The gas dummies were also included separately in the analysis but none was found to be significant.

conflict zone lengthens the conflict. This is further evidence for the view that the presence of hydrocarbons affects the rebel group directly rather than through their effect on the economy, political institutions, and state capacity, because the revenue flows that potentially could affect the state are not always present. Furthermore, this suggests that rebels are forward-looking and engage in conflicts with promise of future revenues.

Besides finding support for the rebel-financing argument, these analyses also shed 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, we find that oil substantially prolongs conflict when located inside the conflict zone, and secondary diamond production increases the risk of conflict onset by more than 40 percent.

Analysis of conflict onset further suggests that the resource location is important; onshore oil production increases the risk of conflict onset by 50 percent while offshore production has no effect. 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. Furthermore, this implies 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. Together these results suggest that rebel access to resources crucially shapes armed civil conflict. By examining the locality of hydrocarbons, this chapter provides evidence that non-lootable resources may have a great impact on rebel groups and their viability. The analysis also finds that a country with secondary diamond production has a 40 percent higher risk of conflict onset: a result that has not been documented earlier.

The results of the analyses in this chapter speak not only to themes relating to the role of the environment during conflict, but also to how natural resources contribute to pre-conflict tension and conflict duration. By offering a new understanding of how natural resources directly impact the rebel groups (as opposed to weakening the capacity of the state), this chapter provides implications for post and pre-conflict management of these natural resources. For example, instead of directing resources to building state capacity, aggrieved and economically disadvantaged rebel groups might be targeted for policy interventions. Furthermore, the results described herein lay a foundation to build a greater understanding of how natural resource extraction, production, and protection drive rebellious contingencies and fractures between state and corporate representatives and local citizens. Other chapters in this book (SEE X), shed light on the potential challenges that peacebuilders will face in the future, given the projected number of economically disenfranchised and climate refugees, the continued demand for and scarcity of natural resources, and the context of locality and access to resources for states, corporations, and citizens.

Figure 1. Kaplan–Meier Survival Estimates for Conflict Duration, 1946–2001

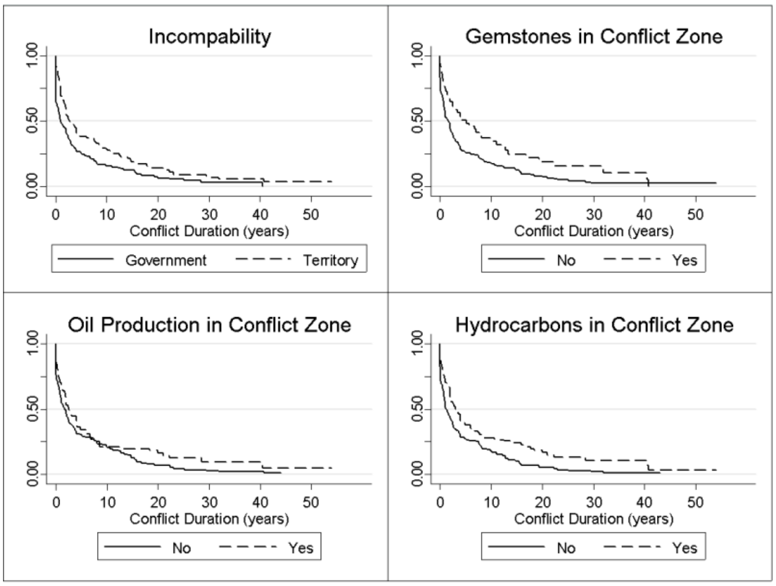

Figure 2. Smoothed Hazard Estimate for the Event of Peace

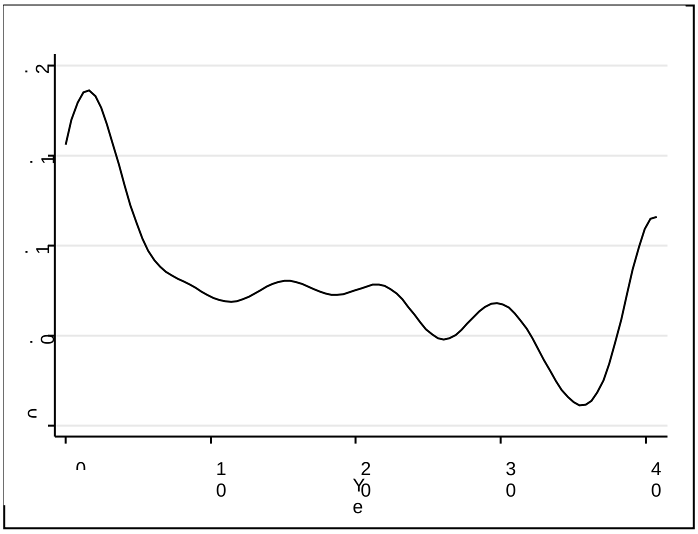

Table I. Bivariate Duration Analysis of Armed Civil Conflict, 1946–2001

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 < 0.1 in italics.

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

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	1.120
conflict zone	(2.20)	(2.22)	(1.88)	(1.99)	(1.99)	(1.91)	(1.98)	(2.46)
	0.028	*0.027*	*0.060*	*0.046*	*0.046*	*0.056*	*0.048*	*0.014*
ln Forest cover,	0.928	0.899	0.889	0.898	0.887	0.885	0.885	0.892
conflict zone	(1.43)	(1.95)	(2.04)	(1.88)	(2.12)	(2.13)	(2.18)	(1.90)
	0.152	*0.051*	*0.041*	*0.060*	*0.034*	*0.033*	*0.029*	*0.057*
Rainy season,	1.915	1.806	1.548	1.897	1.697	1.615	1.703	1.883
conflict zone	(1.91)	(1.83)	(1.38)	(1.97)	(1.64)	(1.48)	(1.65)	(1.87)
	0.056	*0.067*	0.168	*0.049*	0.102	0.140	*0.100*	*0.061*
Incompatibility		3.356	3.135	2.901	3.333	3.270	3.338	2.557
		(4.58)	(4.47)	(4.15)	(4.64)	(4.56)	(4.66)	(3.63)
		0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Intensity		3.506	3.709	4.125	3.755	3.815	3.781	4.123
		(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	1.050
			(1.99)	(2.06)	(1.97)	(2.02)	(2.02)	(2.13)
			0.047	*0.039*	*0.049*	*0.044*	*0.043*	*0.034*
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]								1.539
country level								(1.21)
								0.226
Hydrocarbon production,								1.272
country level								(0.76)
								0.445
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)	(11.53)
	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	-537.81
Akaike Information Criteria	1142.60	1112.20	1082.70	1087.30	1086.60	1084.90	1086.10	1095.60

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

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

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			1.06		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. $p < 0.1$ in italics.

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