Conflict Management and Peace Science, 24:201–218, 2007

ISSN: 0738-8942 print / 1549-9219 online
DOI: 10.1080/07388940701468468

Routledge
Taylor & Francis Group

Resource Wealth and the Risk of Civil War Onset: Results from a New Dataset of Natural Resource Rents, 1970–1999

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The existing literature identifies natural resource wealth as a major determinant of civil war. The dominant causal link is that resources provide finance and motive (the "looting rebels" model). Others see natural resources as causing "political Dutch disease," which in turn weakens state capacity (the "state capacity" model). In the looting rebels model, resource wealth first increases, but then decreases the risk for civil war as very large wealth enables governments to constrain rebels, whereas in the state capacity model, large resource wealth is unambiguously related to higher risk of war. This research note uses a new dataset on natural resource rents that are disaggregated as mineral and energy rents for addressing the resources-conflict relationship. We find that neither a dummy variable for major oil exporters nor our resource rents variables predict civil war onset with a 1000-battle-death threshold coded by Fearon and Laitin (2003) in the period after 1970 for which rents data are available. However, using a lower threshold of 25 battle deaths, we find that energy wealth, but not mineral wealth, increases the risk for civil war onset. We find no evidence for a nonlinear relationship between either type of resources and civil war onset. The results tentatively support theories built around state capacity models and provide evidence against the looting rebels model of civil war onset.

Introduction

Recent scholarship finds that natural resource wealth is a cause of civil war (Ballentine & Sherman, 2003; Berdal & Malone, 2000; Collier et al., 2003; Fearon, 2005; Fearon & Laitin, 2003; Klare, 2001; Ross, 2003; Ross, 2004). From a growing amount of literature,

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one can generally cull two distinct and prominent models explaining the link—finance for rebellion and weak states. They differ with respect to the effect of high natural resource dependence on the risk for civil war.

Our original contribution to this literature is that we introduce a new and arguably superior measure of natural resource wealth to check the robustness of the results and to provide some hints as to which model might be more persuasive at explaining the link between natural resources and civil war. Our new dataset on resource rents is disaggregated as mineral and energy rents, both as a share of gross national income (GNI). Rents are basically net profits from resource extraction, defined as the product of price minus average cost times the amount of resources extracted. The data cover a large number of countries spanning three decades (1970 to 1999).[1] They measure the value of natural resources to an economy more precisely, providing a much less ambiguous measure of resource dependence compared with those used previously, such as primary commodity exports, oil exports, and reserves. The rents data tell us the value of the resources in the open market relative to the productivity of the economy, and indirectly, the value of capturing them. Conversely, if it is state capacity that matters, rents tell us the nature of a government's dependence on extraction, hence its propensity to suffer "political Dutch disease."

The "finance for rebellion" model is based on research by Collier (2000a, 2000b) and by Collier and Hoeffler (2001, 2004) that links resources to conflict via motive of rebels to loot and the opportunity it provides for financing large-scale violence.[2] However, higher resource wealth increases the risk for civil war only initially. After a certain threshold is reached, a government's control over natural resources enables it to outbid rebels for labor and raise the costs of rebellion prohibitively (Collier, 2000b).[3] Others argue instead that resources affect conflict via state capacity (Fearon & Laitin, 2003; Herbst, 2000; Humphreys, 2003; Snyder, 2002). Natural-resource-dependent countries have a lower level of bureaucratic capacity than their level of per capita income would suggest (Fearon & Laitin 2003) and, in extreme cases, suffer from socioeconomic and political breakdown. This could be either because dependence on natural resources weakens states or because natural resource abundance allows states to become *rentier* economies, with few incentives for the ruling elites to develop the broader economy as would rulers of natural-resource-poor economies that are forced to provide broad public goods in order to raise productivity. Natural resource abundance might induce leaders to foster corruption, patronage and rent-seeking behavior rather than effectiveness, efficiency, and competence. Fearon (2005) finds that oil exports, not general primary commodity exports, matter most. This supports the state capacity model since oil is generally regarded as the resource most directly associated with weak state capacity, an important ingredient of the famous "resource curse" afflicting natural-resource-dependent countries (Auty, 2001; Karl, 1997).

The question of whether state capacity or lootability accounts for the resources-conflict link is not merely academic. The implications from each entail quite different policy prescriptions. Recent studies have attempted to explore the empirical, case-study-based literature to pinpoint the exact links, but these efforts have provided mixed results (Ross 2004). Our study investigates the resources-conflict connection with a more thorough operationalization of resource wealth. In short, our results support the notion that high resource rents increase the risk for civil war onset and do not support the notion that this risk plateaus

[1]The rents data are available to 2001, but Collier and Hoeffler's (2004) and Fearon and Laitin's (2003) replication dataset contains data only up to the year 1999.

[2]See Fearon (2005) for details of how influential the Collier and Hoeffler model and findings are in the scholarly and policy realms.

[3]The argument is that the government will be able to tax natural resources more effectively to devote to defence (Collier, 2000b).

at very high levels of resource wealth. However, it is energy rents that matter, not mineral rents, and energy rents raise the risk for civil war only if a more inclusive measure of civil war is used with a threshold of 25 annual battle deaths. With Fearon and Laitin's measure of civil war applying a threshold of at least 1000 battle deaths over the course of conflict with a yearly average of at least 100, neither energy nor mineral rents have any effect on the risk for civil war onset for the period between 1970 and 1999. Even Fearon and Laitin's (2003) dummy variable for oil exports has no effect on their measure of civil war onset if the sample is restricted to be the same, which suggests that their result is not robust to the time period tested and does not hold for the post-1970 period. This is a curious finding, given that resource wealth should have had its highest impact on politics after the price shocks of the 1970s, when rents grew substantially.

How Does Natural-Resource Wealth Cause Conflict?

We first examine the most widely cited account of how resource wealth causes civil conflict, which focuses explicitly on motive and opportunity for organizing violence against a state (Collier, 2000a, 2000b). Civil war is costly for participants and bystanders, which means that violence only occurs when conditions allow some (most often rebels) to overcome collective action problems for mounting a challenge to the status quo (most often states). Civil war occurs and recurs because some (participants) "can do well out of war." The private gain to rebels helps them overcome collective action problems, whereas the majority "bystanders" face huge obstacles to maintaining peace. Thus, civil war is "quasi-criminal activity" because the motive is private gain or greed (self-serving behavior), not the provision of justice to alleviate grievances (selfless behavior), as much of the political science literature on conflict has proposed. Lootable natural resources, therefore, supply the motive (private gain) and the opportunity (finance of large enough force) for organizing violence.[4] The finance provided by natural resources might explain the long duration of civil wars even in cases where the start of conflict had nothing to do with natural resources and might have instead been caused by a "grievance." In other words, the "greed" argument might be a stronger predictor of conflict duration and outcome than of conflict onset, but since we focus here on onset, we do not pursue this issue further.[5]

The theoretical propositions are supported by several empirical analyses, which use the share of primary commodity exports in total exports as a proxy for "lootable income" (Collier & Hoeffler, 1998, 2004; Elbadawi & Sambanis, 2000). The relationship between this proxy and conflict, however, is supposed to be curvilinear. Countries with larger resources have a greater risk for civil war, but at some point the risk starts diminishing. Collier and Hoeffler (2001, 2004) report that at roughly 33% of primary commodity exports per total exports, government control over natural resources acts as a constraint on rebel finance because it prohibitively raises the costs of rebellion. The curvilinear result with share of primary commodities as a proxy is relatively neglected in the literature (see, however, Ross, 2004 and Fearon, 2005). However, the import of the theoretical argument presented by Collier (2000b) that government control of resources at very high levels of dependence deters rebellion has serious implications. Does high resource dependence actually increase state capacity because it deters rebellion? Or, is high resource dependence a cause of weak

[4]For Collier, rebels are the sources of conflict since by definition governments have monopoly on the use of force.

[5]The evidence for resource wealth and the duration of conflict is mixed. Some argue that resources prolong conflict because it leads to "disorganized" rebellion (Weinstein, 2005). Others find that resource wealth actually leads to shorter wars with one side likely to win decisively (Humphreys, 2005).

state capacity as Fearon and Laitin (2003) claim? The controversy can only be addressed by using a continuous measure of resource wealth, which we undertake with the disaggregated rents data.

What might account for the decrease in the risk for civil war after the threshold has been reached? One may think of the government and the rebels as competing for labor, so that higher levels of resource availability allow governments to outbid rebels for manpower, thereby dissuading larger organizations from forming. In other words, resources increase the chance of rebellion only up to a point, after which government control over these resources allows it to maintain peace since rebellion will be less viable. The crucial argument of Collier and Hoeffler is that rebels are able to easily extort finances within countries dependent on primary commodity exports—the goods themselves invite "looting"—but after some threshold states can outspend rebels by deterring larger organizations from forming.

Fearon and Laitin (2003) provide a contrary view on the impact of resource wealth on the risk for civil war. Whereas Collier and Hoeffler suggest that an increasing share of primary commodities in total exports *reduces* the risk for war after the threshold or turning point has been reached, Fearon and Laitin (2003) contend that a higher dependence on oil exports *increases* the risk for civil war. According to Fearon and Laitin (2003: 85), countries that derive at least one third of their exports from oil double their risk for conflict. They propose, however, that unlike the Collier-Hoeffler model of looting rebels, the mechanism is likely to be that state strength is weaker under conditions of oil extraction than the country's per capita income would suggest because of "political Dutch disease" working through negative effects of resource wealth on state institutions. Apparently, oil, unlike most other resources, has special, corrosive effects on state institutions, allowing patterns of patronage and weak political control. Without strong institutions, the base of taxation remains small and focused on natural resource extraction, the provision of public goods is low and the state's ability to weather temporary economic and political shocks is weak (Chaudhry, 1997; Karl, 1997).[6] Moreover, Fearon and Laitin (2003) find no evidence for a connection between Collier and Hoeffler's primary resource export measure and civil war in their study, while Fearon (2005) specifically demonstrates that the primary resource export measure's statistical significance is highly sensitive to model specification. Using non-parametric estimation techniques, he finds that evidence from Collier and Hoeffler's (2001, 2004) own dataset suggests that primary commodity exports increase the risk for civil war at a decreasing rate rather than first increasing and then decreasing the risk, which would suggest that the log of primary commodity exports, rather than the combination of a linear and squared exports terms, is better suited to model the relationship.

Several recent studies, using alternative specification of models and varying definitions of oil dependence, confirm that oil production and exports make countries more prone to conflict (de Soysa, 2002; Fearon & Laitin, 2003; Humphreys, 2003). Even Collier and Hoeffler (2001, 2004) enter an interactive term between a dummy for oil export dependence and the squared term of primary commodity exports and find a positive effect, concluding

[6]Richard Snyder (2002) argues that state failure and conflict or state durability by means of dictatorship or democracy depend on how institutions of joint extraction of natural resources evolve. He demonstrates how some states with lootable income, such as Sierra Leone and Zaire (now the Democratic Republic of Congo) were able to remain stable for long periods of time. The same may be said for many of the oil sheikdoms in the Middle East and elsewhere that have maintained social peace. Others have also shown how inhospitable climates, in places such as the Belgian Congo, discouraged large enough colonial settlements, and thereby promoted institutions that reflected the need to extract wealth, rather than build representative ones, which may explain conflict in resource-wealthy countries through weak institutions with long historical antecedents rather than resource wealth per se (Acemoglu, Johnson, & Robinson, 2001; Easterly & Levine, 2002).

that oil increases the risk of conflict linearly. On the other hand, at least one recent study has challenged the pervasive view that oil leads to regime instability. Using oil exports as a proxy for oil wealth, Smith (2004) reports that there is little evidence for regime instability from 1960 to 1999. Oil's effects on political stability, thus, is not wholly uncontested and requires further systematic empirical inquiry, particularly with the use of alternative measures that better capture the economic value of resources in an economy.

Both Collier and Hoeffler's (2001, 2004) and Fearon and Laitin's (2003) operationalization of resource wealth can be contested on several grounds. Collier and Hoeffler's use of the share of primary commodity exports in total exports as a proxy for the availability of lootable natural resource wealth is problematic. As some argue, point-source resources that are mined, such as oil, copper, bauxite, and kimberlite diamonds may affect conflict differently compared with diffuse resources, such as crops, drugs, timber, or even alluvial diamonds.[7] The primary commodity share in exports aggregates agricultural products with extractable natural resources. Treating all primary commodities as the same is not very convincing, since agriculture might affect the risk for civil war onset differently, if at all, from natural resources. Some recent estimates do indeed suggest that dependence on agricultural exports net of oil wealth is also risky (Humphreys, 2005). Indeed, in their reply to Fearon (2005), Collier and Hoeffler (2005) use total natural resource rents together with the log of primary commodities export dependence. We believe that resource rents should not be included together with primary commodities exports as the two are supposed to measure essentially the same underlying concept of natural resource wealth. We propose to test the Collier and Hoeffler (2005) findings against those of Fearon and Laitin's (2003) even more comprehensively, not only by disaggregating total resource rents into energy and mineral resource rents, but also by using alternative specifications of models and definitions of civil war.

The major problem with Fearon and Laitin (2003) is that their use of a 33% cutoff point to create a discrete variable measuring export dependence on oil (oil exports/GDP) does not allow them to explore any nonlinearities in the relationship between oil wealth and conflict. Perhaps oil-dependent states are peaceful and stable only at very high levels of dependence as some suggest (Smith, 2004). Another problem is that oil is not the only important natural resource. The "resource curse" literature argues that heavy dependence on natural resources can be detrimental to state capacity not only in the case of oil, but also for other energy resources such as natural gas and, indeed, for mineral resources (Auty, 2001).

As the discussion above illustrates, it is not clear whether greater resource dependence unambiguously increases the risk for civil war or lowers the hazard after a certain threshold has been reached. If resource wealth weakens a state, then it may fail to or be incapable of deterring rebellion. But great resource wealth might enable a state to buy off opposition and thus to maintain peace. Of course, another possibility is that the two effects could offset each other. Resolving this matter is not merely an academic question, it carries serious policy implications—does policy focus on constraining rebels, or should it focus on states and state capacity-building measures? Research as it currently stands does not allow us to tackle

[7] Michael Ross (2004a) provides some empirical evidence on lootability using disaggregated data on resources. Using tabulations, he finds that indeed all types of resources predict conflict, but that lootable resources may promote nonseparatist conflict whereas nonlootable resources promote separatist wars. These results are intuitively persuasive but the analyses do not control for important factors, such as peace history, growth rates, regimes types, etc. Drug production, for example, more often than not follows the breakdown of authority rather than causes it (Ross 2004a). Moreover, the conflicts in northern Sri Lanka, the Basque region in Spain, Northern Ireland, Kashmir, Chittagong, etc. are examples from among the few long-running separatist wars where resource rents play little role if any. Nor do these analyses tell us about any nonlinear relationships.

this question. In looting models, rebels have access to easy loot, and private gain galvanizes force. In state capacity models, resource wealth weakens state institutions according to an internal logic based on rent extraction and distribution. Policies aimed at avoiding problems may focus on rebels—the "blood diamonds" solution—or they may address governance issues by encouraging better institutions, such as independent funds that minimize politicization of resource wealth, using UN agencies or the World Bank as gatekeepers and managers of resource wealth, implementing schemes that earmark a certain share of wealth for development, fiscal decentralization schemes, local participatory planning, etc. Beyond these measures, others argue that poor countries dependent on primary commodities should diversify their economies so as to escape price shocks and other manifestations of the "resource curse" (Collier, 2002; Collier et al., 2003).

A New Measure of Natural Resource Rents

We submit that our new approach toward measuring resource dependence can shed further light on the question of resources and civil war and may dispel some ambiguities.[8] Extending the work of Fearon and Laitin (2003), we move away from using a simple dichotomous measure and use a continuous measure of resource dependence, thus allowing us to test for nonlinearities. Extending the work of Collier and Hoeffler (2001, 2004), we distinguish between the two most relevant types of resources, namely mineral and energy resources. This may mitigate to some extent the problem of Collier and Hoeffler's measure, which is an aggregation of all primary commodities. As at least one scholar has admonished recently, quantitative researchers should test alternative models, vary samples, and use alternative data so as to increase our faith in theories, rather than just test specific models with similar data (Smith, 1998).

We derive our measure of the relative economic importance of natural resources in countries, measured as resource rents divided by Gross National Income (GNI), from the World Bank's dataset on genuine savings, also called adjusted net savings.[9] The dataset represents the most ambitious and comprehensive attempt yet at estimating the value of natural resource extraction. It covers 149 countries, both developed and developing, over the period from 1970 to 2001. It includes two categories of natural resources: minerals and energy. Energy consists of oil, gas, and coal, whereas minerals encompass bauxite, copper, iron ore, lead, nickel, phosphate rock, tin, zinc, gold, and silver. Note that the World Bank does not directly publish any subcomponents of the energy rents variable, but oil dominates energy rents with an average share of 64%, whereas no similar dominance exists for the mineral rents variable.[10]

The value of natural resource extraction is generally computed as unit rent, that is price minus average extraction cost, times the amount of resource extracted.[11] For minerals, the unit rent is computed as the world price of the resource minus mining, milling, benefication, smelting, and transportation to port costs, minus a "normal" return to capital. For oil, gas,

[8] In a recent reply to their critics, Collier and Hoeffler (2005) do in fact refer to the rents data.

[9] The data can be downloaded from the following site: http://lnweb18.worldbank.org/ESSD/envext.nsf/44ByDocName/GreenAccountingAdjustedNetSavings

[10] In principle, the dataset also contains data on forestry, which refers to the production of fuelwood, coniferous softwood, nonconiferous softwood and tropical hardwood. However, we do not use it mainly because the computation method for forestry does not measure the value of wood production, but only of wood production exceeding the natural increment. This makes sense for the green accounting context, for which the data have originally been constructed. It does not, however, capture the true extraction value of forestry.

[11] For details, see Bolt, Matete, and Clemens (2002).

and coal, the unit rent is the world price minus lifting costs. For some resources, such as natural gas, where, strictly speaking, there is no single world price, a shadow world price is computed as the average free-on-board price from several points of export.

The unified calculation methodology and its comprehensive coverage represent the greatest advantage of the dataset; however, there are also some shortcomings. For example, diamonds, an important "lootable" natural resource, is not included due to data problems (Hamilton, 2001). The use of uniform world prices overstates the value of resource extraction for countries with lower-grade resource deposits. Both prices and extraction costs often need to be estimated. Extraction costs are sometimes only available for a region rather than countries and only for a number of years, which means that missing values need to be interpolated.

These problems notwithstanding, the data are of sufficiently good quality that the World Bank publishes them now both on its website and as part of the World Development Indicators available annually on CD-ROM. Compared to the commonly used primary exports variable these data have a number of advantages. First, rents from production represent a more comprehensive measure of the relative economic importance of natural resources than exports for judging arguments about state capacity. Natural resources can be harmful to state capacity because of the enormous rents they generate so it is better to measure these rents directly, rather than indirectly with exports data. Second, the data are explicitly focused on a clear set of natural resources. The World Bank's "Ores and metals exports" variable, which forms part of the primary commodity exports variable, on the other hand also includes such items as crude fertilizer and scrap metal. These resources are not readily identifiable as easy financing opportunities for rebel groups, nor are they extractive activities that supposedly weaken states.

Our measures of mineral rents and energy rents are correlated at 0.29 and 0.68, respectively, with Collier and Hoeffler's (2004) primary commodity exports variable and correlated at –0.12 and 0.74, respectively, with Fearon and Laitin's (2003) oil exports dummy variable. Figure 1 presents a scatter plot of period average values with World Bank country codes as labels, plotting the mineral and energy resource rents against the primary commodity exports variables and the oil exports dummy variables, respectively. By and large, countries with high values on primary commodity exports have also a high value of either mineral or energy resource rents. Obviously, mineral resource-rich countries without large energy resources (like Mauritania and Papua New Guinea) will not be detected as resource-rich by the oil exports dummy. The one strange outlier is Tajikistan, which is indicated as having large energy rents, but is known not to be a major energy producer or exporter. This is quite possibly a coding error in the World Bank data, but since dropping Tajikistan from the models made practically no difference to the results, we decided to keep it in our analysis.

Methods, Variables, and Results

For reasons of comparability, we replicate Collier and Hoeffler's (2004) and Fearon and Laitin's (2003) preferred results and then replace their measures of natural resource dependence with our new resource rents measures. Collier and Hoeffler (2004) use Correlates of War data to code civil war onset during the period from 1960 to 1999. For an armed conflict to qualify as civil war it must have reached at least 1000 battle deaths per year with both government forces and a rebel group suffering at least 5% of these fatalities. Collier and Hoeffler (2004) use 5-year period averages, but there is no compelling reason for this, and to increase the efficiency of estimation we use Fearon's (2005) extension of Collier and Hoeffler's (2004) dataset to the country-year setting, which has fewer missing data. Fearon and Laitin (2003) do not use Correlates of War data, but create their own dependent

variable, coding the onset of a civil war using a threshold of 1000 battle deaths over the course of conflict with a yearly average of at least 100 deaths following initial onset. As explanatory variables, we use the same as in Collier and Hoeffler (2004) and in Fearon and Laitin (2003), respectively, see their papers for detailed explanation and description of sources. The main model in Collier and Hoeffler's (2004) is column 6 in table 5 and is

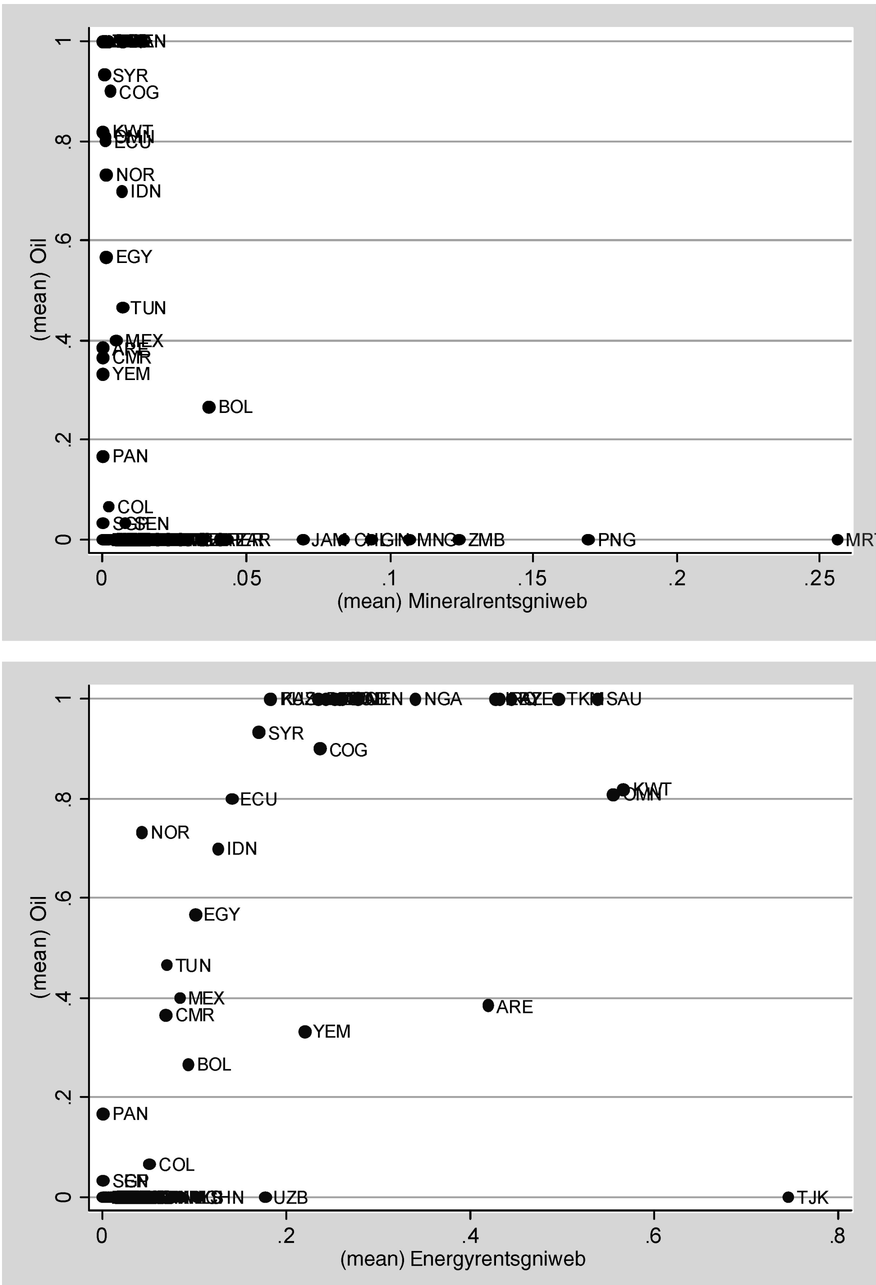

FIGURE 1 Scatter plots of resource rents versus primary commodity exports and oil export dummy (period averages).

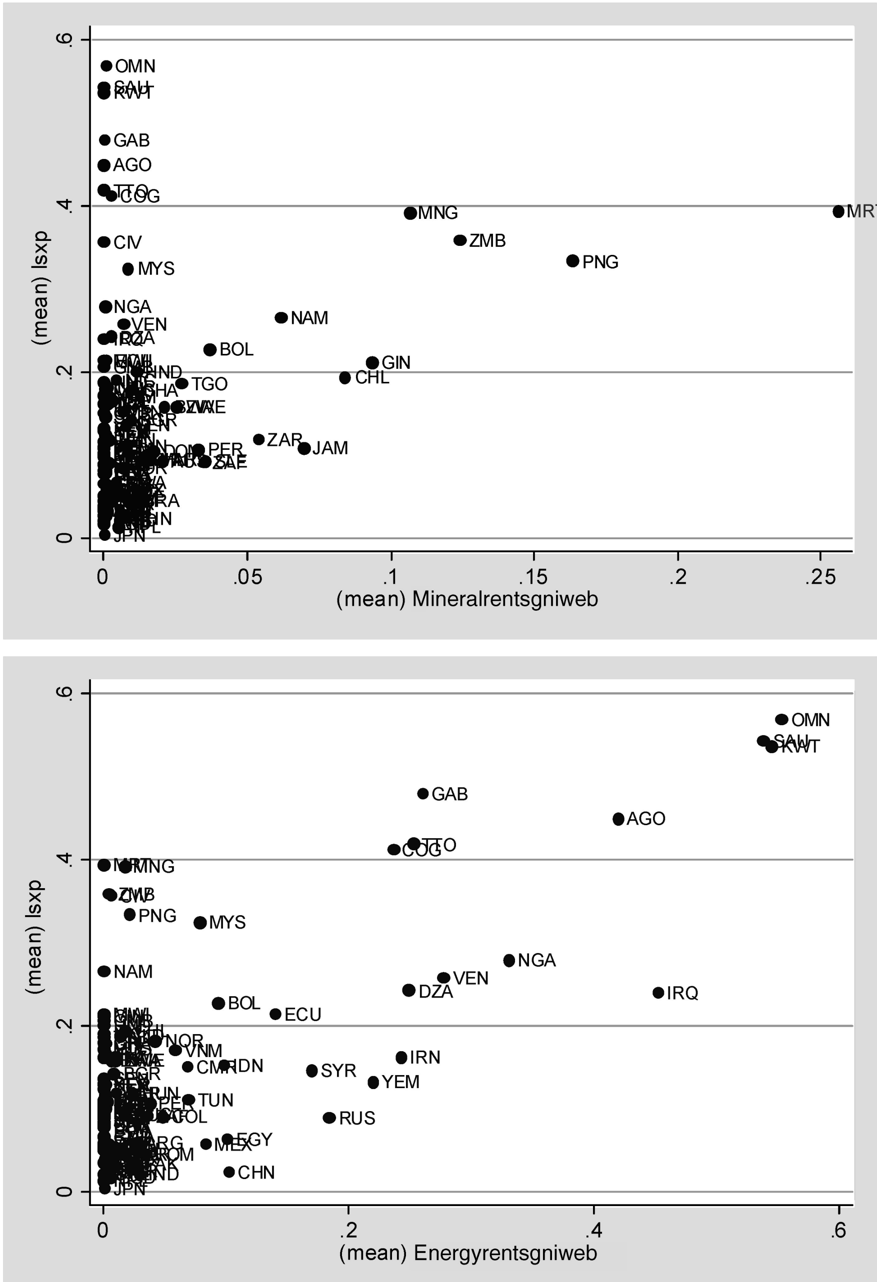

FIGURE 1 (Continued)

as follows:

$$\begin{aligned}\text{Civil war onset} = {} & \beta_0 + \beta_1 \text{ (primary commodity exports)} \\ & + \beta_2 \text{ (primary commodity exports)}^2 \\ & + \beta_3 \text{ fincome (ln)} + \beta_4 \text{economicgrowth(t} - 1) \\ & + \beta_5 \text{ peaceduration} + \beta_6 \text{geographicdispersion}\end{aligned}$$

$$+ \beta_7 \text{ population (ln)} + \beta_8 \text{ social fractionalization}$$
$$+ \beta_9 \text{ ethnicdominance}$$

Fearon and Laitin's (2003) preferred model is column 3 in Table 1:

$$\begin{aligned}\text{Civil war onset} = {} & \beta_0 + \beta_1 \text{ priorwar} + \beta_2 \text{ income (t} - 1)\\ & + \beta_3 \text{ population (t} - 1)\text{(ln)} + \beta_4 \text{ \%mountainous (ln)}\\ & + \beta_5 \text{ noncontiguousstate} + \beta_6 \text{ oilexporter}\\ & + \beta_7 \text{ newstate} + \beta_8 \text{ instability (t} - 1)\\ & + \beta_9 \text{ ethnicfract.} + \beta_{10} \text{ religiousfract.}\\ & + \beta_{11} \text{ anocracy (t} - 1) + \beta_{12} \text{ democracy (t} - 1)\end{aligned}$$

We first replicate the estimation results from these models and then replace the primary commodity exports and the oil exporter dummy variables, respectively, with our mineral and energy rents variables. Table 1 provides summary descriptive variable information.

Table 2 presents results using the Collier and Hoeffler (2004) data. Column 1 exactly replicates column 6 in Table 5 of their paper that uses the 5-year data setup. In column 2, we present estimation results from extending their dataset to the country-year format, replicating exactly column 3 of Table 2 in Fearon (2005). Instead of just 52 civil war onsets, there are now 69 such onsets in the sample. The main differences in estimation results are that social fractionalization is no longer statistically significant and that the squared primary commodity exports term is only statistically significant at the 10% level, whereas it had been significant at the 5% level. In column 3, we replace the primary commodity exports data with our resource rents data, to start with only in linear form. Rents from mineral resource extraction have no effect on the risk of civil war onset, but rents from energy resource extraction increase the likelihood of civil war. In column 4, we add squared resource rents terms to the model. However, we find no evidence for a nonlinear effect. Thus, with Collier and Hoeffler's data and models, oil predicts conflict in the period between 1970 and 1999, for which we have rents data. Interestingly, most of the other controls (e.g.,

TABLE 1a Summary descriptive variable information (Collier and Hoeffler [2004] models)

Variable	Obs	Mean	S. D.	Min	Max
Civil war onset	4466	0.02	0.12	0	1
Primary comm. exp./GDP	4466	0.16	0.15	0	2.14
Energy rents/GNI	2738	0.01	0.04	0	0.52
Mineral rents/GNI	2738	0.05	0.13	0	0.95
ln(GDP per capita)	4466	7.73	1.04	5.37	11.11
GDP growth (t-1)	4466	0.02	0.04	−0.15	1.06
Peace duration	4466	342.18	165.43	0	640
Geographic dispersion	4466	0.59	0.21	0	0.97
ln(Population)	4466	8.77	1.64	4.83	14.03
Social fractionalization	4466	1816.50	1947.98	12	6975
Ethnic dominance	4466	0.46	0.50	0	1

TABLE 1b Summary descriptive variable information (Fearon and Laitin [2003] models).

Variable	Obs	Mean	S. D.	Min	Max
Civil war onset (Fearon and Laitin)	6327	0.02	0.14	0	4
Prior war (Fearon and Laitin)	6327	0.13	0.34	0	1
Civil war onset (PRIO)	6162	0.03	0.18	0	1
Prior war (PRIO)	6162	0.16	0.36	0	1
Oil exporter dummy	6327	0.13	0.33	0	1
Mineral rents/GNI	3311	0.01	0.04	0	0.52
Energy rents/GNI	3311	0.06	0.13	0	0.95
Per capita income (t−1)	6327	3.64	4.35	0.05	53.90
ln(Population) (t−1)	6327	9.06	1.46	5.40	14.03
ln(%mountainous)	6327	2.18	1.41	0	4.56
Non-contiguous state	6327	0.18	0.38	0	1
New state	6327	0.03	0.16	0	1
Instability (t−1)	6327	0.15	0.35	0	1
Ethnic fractionalization	6327	0.39	0.29	0	0.93
Religious fractionalization	6327	0.37	0.22	0	0.78
Anocracy (t−1)	6327	0.22	0.41	0	1
Democracy (t−1)	6327	0.34	0.47	0	1

GOP = gross domestic product, GNI = gross national income, SD = standard deviation.

income, per capita economic growth, and the duration of peace) remain statistically significant, with the size of population dropping out of significance in the later period (1970 to 1999).

Table 3 displays the results using the conflict definitions provided by Fearon and Laitin (2003). In column 1, we begin by replicating column 3 of Table 1 in their paper (their preferred model). As seen there, countries that derive more than one third of their export revenue from oil have a higher risk of civil war onset. In column 2, we replace the oil dummy with our continuous measures of energy and mineral rents. However, all rents measures are clearly insignificant. This remains true if we add the squared terms of the rents measures to the model (column 3). The other explanatory variables largely remain significant as before. What explains this result? In column 4, we restrict the sample size to be the same, but replace the energy and mineral rents variables with the oil dummy again. It is clearly insignificant as well. What this means is that the effect of oil or other resource wealth on the risk for civil war onset does not hold if the sample is restricted to 1970 (from whence the rents data become available) onwards. In other words, the oil effect that Fearon and Laitin base part of their theory of state capacity on is not robust to the time period tested, or to alternative measures of natural resource dependence. Curiously, population size, which became insignificant in the later time tested in the Collier-Hoeffler model, remains strongly significant in these models.

In Table 4, we explore what happens if we use, for the explanatory model of Fearon and Laitin (2003), a definition of civil wars with a lower threshold of at least 25 battle deaths per annum from the Uppsala-PRIO dataset (Gleditsch et al., 2002). The Uppsala-PRIO data identify wars where battle deaths have exceeded 25 per annum and are therefore much more comprehensive in terms of what counts as civil war. If, in fact, oil leads to short wars, as Humphreys (2005) finds, then many wars that never reach 1000 deaths may not enter

TABLE 2 Mineral and energy rents and civil war onset (Collier and Hoeffler (2004) models)

	Period			
Variable	(1)	(2)	(3)	(4)
	1960–99	1960–99	1970–99	1970–99
Primary comm. exp./GDP	16.773	8.225		
	(3.22)***	(2.11)**		
$(\text{Primary comm. exp./GDP})^2$	−23.800	−14.307		
	(2.37)**	(1.78)*		
Energy rents/GNI			3.237	6.074
			(2.95)***	(2.08)**
$(\text{Energy rents/GNI})^2$				−4.537
				(0.93)
Mineral rents/GNI			−5.014	18.404
			(0.72)	(0.80)
$(\text{Mineral rents/GNI})^2$				−211.049
				(0.81)
ln(GDP per capita)	−0.950	−0.535	−0.730	−0.796
	(3.87)***	(2.98)***	(2.87)***	(2.97)***
GDP growth (t−1)	−0.098	−14.566	−15.010	−14.266
	(2.36)**	(4.75)***	(3.53)***	(3.30)***
Peace duration	−0.004	−0.004	−0.003	−0.003
	(3.81)***	(4.40)***	(3.37)***	(3.28)***
Geographic dispersion	−0.992	−0.167	0.644	0.391
	(1.09)	(0.23)	(0.69)	(0.40)
ln(Population)	0.510	0.311	0.170	0.124
	(3.98)***	(3.37)***	(1.57)	(1.07)
Social fractionalization	−0.000	−0.000	−0.000	−0.000
	(2.70)***	(1.17)	(1.53)	(1.68)*
Ethnic dominance	0.480	0.396	0.325	0.419
	(1.46)	(1.55)	(0.94)	(1.19)
Observations	750	4466	2738	2738
Log likelihood	−146.8	−309.8	−178.5	−177.3

Z scores are presented in brackets. Constant included in all tests (not shown).
Statistical significance denoted by * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$.
GDP = gross domestic product, GNI = gross national income.

datasets. Figure 2 shows that the two studies of Civil War onset are relatively similar, except of course that there is generally a higher average risk for conflict at the 25-death threshold.[12]

Columns 1 to 4 of Table 4 replicate the models of columns 1 to 4 from Table 3, but with the alternative dependent variable measuring wars at the 25-battle-death threshold. Being a major oil exporter raises the likelihood of civil war over the period 1946 to 1999 (column 1). If we enter our measures of energy and mineral wealth, then we find that higher energy rents to GNI increase the risk for civil war over the time period 1970 to

[12]The Uppsala-PRIO dataset does not code conflict onset as such. For coding purposes, we consider a conflict as continuous if there is only one calendar year without fighting. If two or more calendar years separate two episodes of conflict then this is counted as two separate conflict onsets.

TABLE 3 Mineral and energy rents and civil war onset (Fearon and Laitin [2003] models)

	Period			
Variable	(1)	(2)	(3)	(4)
	1945–99	1970–99	1970–99	1970–99
Oil exporter dummy	0.751			0.254
	(2.70)***			(0.64)
Energy rents/GNI		−0.064	0.161	
		(0.05)	(0.05)	
(Energy rents/GNI)^2			−0.541	
			(0.08)	
Mineral rents/GNI		−0.808	−2.902	
		(0.18)	(0.36)	
(Mineral rents/GNI)^2			9.320	
			(0.35)	
Prior war	−0.916	−1.048	−1.050	−1.047
	(2.93)***	(2.53)**	(2.53)**	(2.53)**
Per capita income (t−1)	−0.318	−0.349	−0.349	−0.361
	(4.45)***	(3.37)***	(3.36)***	(3.42)***
ln(population) (t−1)	0.272	0.290	0.288	0.290
	(3.69)***	(2.83)***	(2.73)***	(2.91)***
ln(%mountainous)	0.199	0.229	0.230	0.234
	(2.35)**	(2.07)**	(2.08)**	(2.11)**
Noncontiguous state	0.426	0.658	0.658	0.628
	(1.57)	(1.53)	(1.53)	(1.48)
New state	1.658	1.581	1.577	1.562
	(4.85)***	(1.92)*	(1.91)*	(1.92)*
Instability (t−1)	0.513	0.560	0.561	0.551
	(2.11)**	(1.72)*	(1.72)*	(1.69)*
Ethnic fractionalization	0.164	0.507	0.519	0.451
	(0.44)	(0.95)	(0.97)	(0.84)
Religious fractionalization	0.326	−0.134	−0.135	−0.071
	(0.64)	(0.19)	(0.19)	(0.10)
Anocracy (t−1)	0.521	0.602	0.600	0.625
	(2.20)**	(1.70)*	(1.69)*	(1.77)*
Democracy (t−1)	0.127	−0.033	−0.027	0.017
	(0.42)	(0.08)	(0.06)	(0.04)
Observations	6327	3311	3311	3311
Log likelihood	−478.7	−241.9	−241.9	−241.7

Z scores are presented in brackets. Constant included in all tests (not shown).
Statistical significance denoted by * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$.
GNI = gross national income.

1999, a result consistent with the Collier-Hoeffler model in Table 2 with wars coded as ≥1000 deaths. Mineral wealth, however, is insignificant (column 2). Adding squared terms does not provide evidence for non-linear resource rents effects (column 3). If we restrict the sample to be the same and replace the energy and mineral rents variable with the fuel exporter dummy, it is statistically significant with a positive coefficient also during this shorter time period (column 4). Thus, the results from the lower battle-death threshold

TABLE 4 Mineral and energy rents and civil war onset (Fearon and Laitin [2003] models with PRIO conflict data on 25 battle death threshold)

	Period			
Variable	(1)	(2)	(3)	(4)
	1946–99	1970–99	1970–99	1970–99
Oil exporter dummy	0.762			0.717
	(3.92)***			(2.98)***
Energy rents/GNI		2.147	1.690	
		(2.99)***	(1.00)	
(Energy rents/GNI)^2			0.801	
			(0.29)	
Mineral rents/GNI		−4.121	−6.439	
		(0.97)	(0.91)	
(Mineral rents/GNI)^2			12.078	
			(0.46)	
Prior war	0.006	−0.454	−0.461	−0.437
	(0.03)	(1.80)*	(1.83)*	(1.74)*
Per capita income (t − 1)	−0.157	−0.152	−0.152	−0.147
	(4.06)***	(3.41)***	(3.42)***	(3.30)***
ln(population) (t − 1)	0.296	0.232	0.236	0.250
	(5.45)***	(3.10)***	(3.09)***	(3.35)***
ln(%mountainous)	0.130	0.096	0.098	0.098
	(2.10)**	(1.16)	(1.18)	(1.19)
Noncontiguous state	0.025	0.934	0.938	0.886
	(0.12)	(3.50)***	(3.50)***	(3.34)***
New state	1.455	1.919	1.928	2.022
	(3.94)***	(2.81)***	(2.82)***	(2.99)***
Instability (t − 1)	0.196	0.191	0.189	0.208
	(1.05)	(0.75)	(0.74)	(0.82)
Ethnic fractionalization	0.864	1.418	1.436	1.317
	(3.01)***	(3.33)***	(3.35)***	(3.08)***
Religious fractionalization	−0.089	−0.766	−0.769	−0.596
	(0.23)	(1.51)	(1.52)	(1.17)
Anocracy (t − 1)	0.387	0.475	0.474	0.493
	(2.16)**	(1.82)*	(1.82)*	(1.89)*
Democracy (t − 1)	0.161	0.065	0.057	0.086
	(0.76)	(0.23)	(0.20)	(0.31)
Observations	6054	3296	3296	3296
Log likelihood	−802.2	−431.5	−431.4	−432.0

Z scores are presented in brackets. Constant included in all tests (not shown).
Statistical significance denoted by * = $p < 0.10$, ** = $p < 0.05$, and *** = $p < 0.01$.
GNI = gross national income.

clearly supports the oil-wealth/weak-states argument of Fearon and Laitin, but ironically not with their own dataset for the years that surely increased the relative importance of oil exports and energy resources (1970 to 1999). For this period, the definition of what constitutes a civil war seems to matter, as others too report from different contexts (Sambanis, 2004).

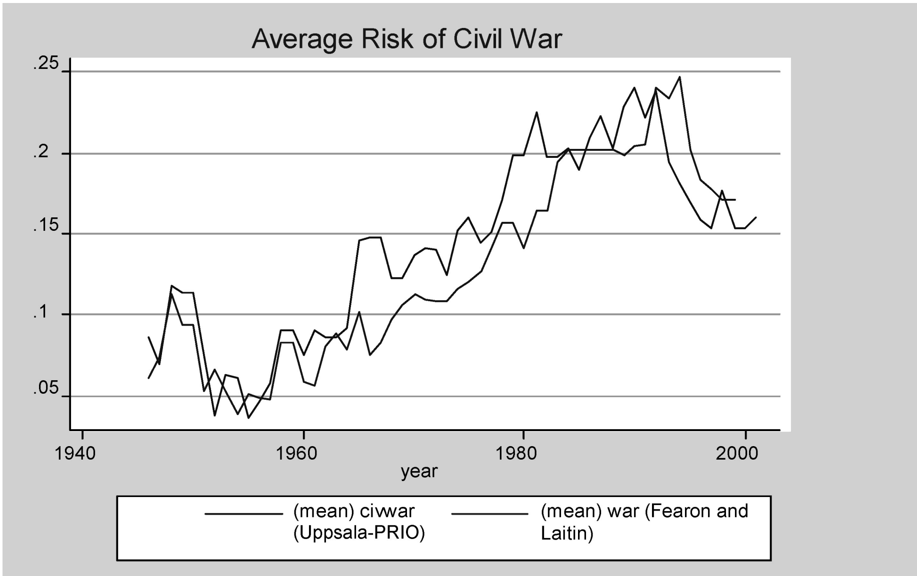

FIGURE 2 Mean annual risk of civil war in Fearon and Laitin (2003) and Uppsala/PRIO dataset.

In summary, we find no evidence for the view that resource wealth defined as energy wealth and minerals relate to conflict in a curvilinear manner as Collier's (2000b) theory suggests. We do find support for the view that oil matters, both in the Collier-Hoeffler data and models and the Fearon and Laitin models, but only using the ≥25 deaths threshold for the period between 1970 to 1999. The oil effect is not curvilinear, supporting the state-capacity expectation that oil exports (and rents) may increase the risk for conflict through state-capacity. Interestingly, the oil result is not significant when we use Fearon and Laitin's conflict variable, but is significant with one that is highly similar to theirs at a lower level of intensity. These results may in fact be supporting Humphrey's (2005) claim that oil reduces the duration of civil war, a result that is somehow a bit awkward to square with the notion that conflict actually occurs because states are weak. Do weak states strike bargains with rebels because they are weak? Or do they simply lose quickly? Or does oil invite coups rather than civil war? If oil leads to secessionist wars as some claim, is it likely that they end quickly? These are very interesting questions to address in future research on the links between oil, state capacity, and civil war. Yet again, many of the findings on civil war may be highly sensitive to the list of wars examined.

Conclusion

Collier and Hoeffler's curvilinear relationship using the share of primary commodity exports has been relatively neglected in critiques. Their explanation is that, at very high levels of resource dependence, governments are able to deter rebellion because they have greater control of the resource, which serves to raise the costs of rebellion. Many have simply looked at whether a resource, such as oil, exists. Others have contrasted differing outcomes based on the relative ease of lootability of some resources over others. Oil, they argue, is not lootable, but again several studies using a dummy variable for oil find that it has a potent effect on the onset of conflict, explained usually as an indication that states that extract a

high-rent-generating resource tend to have weak institutions. We address the question with a new measure of resource wealth aggregated according to mineral rents and energy rents. These data are valuable in that they refer to two important types of natural resources and allow testing of a continuous measure that may be employed to model nonlinear relationships between resources and conflict.

Our results confirm Fearon and Laitin's (2003) finding that energy wealth increases the risk for civil war. However, a statistically significant result is only found in Fearon and Laitin's (2003) model in the period after 1970 if Uppsala-PRIO's definition of civil war with an annual threshold of 25 battle deaths is used. For Fearon and Laitin's coding of civil wars with a higher threshold of 1000 battle deaths during the course of the whole conflict, neither their oil export dummy variable nor our resource rent measures have any significant effect in the period from 1970 to 1999, a curious result given the large increase in the value of oil after the oil price shocks of the 1970s. In extension to Fearon and Laitin's work, we could test for nonlinear effects due to the continuous character of our variable, but we found no evidence for such a nonlinear effect with either their dependent variable or with the PRIO-Uppsala data. Our results do not provide evidence for Collier and Hoeffler's (2001, 2004) finding of a nonlinear relationship between resource wealth and the risk for civil war onset, not even in their own model. In addition, we find that it is fossil fuels that matter, but not mineral resources. Ross (2004a: 349) concluded from a review of the then existing literature that "we do not know if non-fuel minerals pose the same problems as oil and gas." Our results suggest that they do not.

In sum, our findings provide some support for the theory that fossil fuel dependence harms a state's capacity to deter armed conflict and fail to support the looting-rebels model. Policies therefore need to focus on state capacity building under conditions of natural resource dependence. Admittedly, our energy and mineral rents measures do not cover lootable resources such as diamonds and drugs, which would relate more strongly to the looting-rebels model. However, neither are they included in Collier and Hoeffler's measure of primary commodity exports. Understanding fully how lootability of resources and the effect of resource dependence affect state capacity, and thereby violence, is crucial material for policymaking that seeks to end the scourge of civil war. We have established that oil matters, even when using alternative resource rent measures, but much also depends on definitions of what constitutes conflict and the time period analyzed. This factor requires us to think further about what we do not account for in our models.

In terms of future research, we need to understand better why energy resources can be detrimental to domestic peace, whereas mineral resources apparently are not. Furthermore, we have already mentioned that more work contrasting primary commodity exports with alternative measures of resource dependence, such as the data we have introduced here, should be undertaken. Moreover, data capturing lootable resources that are better disaggregated in terms of including valuable gemstones, such as diamonds, drug production, and even the extent of shadow economic activity (contraband) should be employed in future work to fully address exact mechanisms driving the resources-conflict relationship. In many instances, the lootability of a resource should be a function of the value of that resource on the world market. Much criminal violence even within the wealthiest states forms around such illegal activity as smuggling of alcohol, narcotics, cigarettes, and illegal prostitution, etc., but this form of violence remains crime since state capacity is strong. Thus, there is much room to investigate diachronic relationships between lootable income and state capacity in future work. Happily, several scholars have begun to test the propositions more systematically, using alternative data (Gates & Lektzian, 2005; Lujala, Gleditsch, & Gilmore, 2005).

Future work should also address how resource wealth may have encouraged superpower proxy wars during the Cold War, when many newly independent countries suspicious of Western dominance often invited Soviet support in the extractive sector, often also embroiling Western states and multinational corporations in overt and covert activities that were politically destabilizing.[13] Oil in particular could have been a central strategic objective. While these conflicts took on a discourse of ideology, perhaps resources were the causal mechanism because Soviet technology in resource extraction was often readily substitutable for existing Western technologies, a factor complementing leftist tendencies of redistribution and self-sufficiency (Kobrin, 1980). On the other hand, energy resource-rich countries were kept stable due to superpower control and strategic importance of these resources (Arbatov, 1986; Solem & Scanlan, 1986). In other words, oil may have been a factor behind the premium on peace during particular eras, such as after the oil shocks during the 1970s.

Acknowledgment

The authors thank two anonymous referees and Amanda Wooden for their constructive comments. For comments and suggestions on an earlier draft we thank James Ron, Richard Snyder, Michael Ross, Nils Petter Gleditsch, Halvard Bulhaug, and Paivi Lujala as well as the participants at the workshop "Political Economy of Conflict and Cooperation" at the European Consortium for Political Research Conference in Budapest in September 2005, where this paper was presented. Only we should be held responsible for all errors. Eric Neumayer acknowledges financial assistance from the Leverhulme Trust.

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[13]The coup instigated by the CIA and Standard Oil against the Mossadeh government in Iran stands as one clear example.

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