

Introduction

On January 6, 1999, the Revolutionary United Front (RUF) entered the capital city of Sierra Leone, Freetown, as part of an offensive to overthrow the government of the All Peoples Congress. The RUF rebels attacked the city and randomly massacred its inhabitants. The rebels gunned down fleeing civilians, burned homes, committed rape, amputated limbs, and gouged out eyes. The RUF brought down an almost arbitrary wave of ruthless terror on Freetown that claimed more than 7000 lives (Human Rights Watch 1999).

One RUF rebel stopped a Freetown inhabitant, James Kajue, at gunpoint as he was trying to flee the city in his stationwagon with his family. The rebel demanded money from Mr. Kajue before another rebel approached the scene and said, “Why are you wasting your time with these civilians? Just kill them all.” The RUF rebel then emptied his AK-47 into the car, killing six members of James Kajue’s family, including his infant grandson (Human Rights Watch 1999).

The bloody conflict that utterly decimated Sierra Leone was a civil war based on greed. Ethnic or religious lines did not divide the two adversaries. Political motivation was not a salient factor in the war that killed over 2 million people. Rather, the civil war was about control over a resource, diamonds. The two sides were fighting over control of the rich alluvial diamonds mines located in the eastern part of the country that proved to be a great source of wealth for Sierra Leone. Yet tragically, it was wealth used to finance death and destruction (Hirsch 2001).

Conflicts like this and others in Liberia, Colombia, and the Democratic Republic of the Congo have garnered much attention from the media and international community partly because all of these conflicts involve valuable natural resources. Oil, diamonds, drugs, and timber have played significant roles in these civil wars in the way of onset, duration, and intensity (Ross 2003). This relationship between natural resources and civil wars has led to a wide body of

research on the subject, however the precise connections between the two are still very unclear. This paper will be a first effort toward dissecting one aspect of civil wars. It will focus its analysis on the duration of civil war as it relates to different types of natural resources.

In general, how does the presence of various natural resources affect civil war duration? The relationship between natural resources and civil war duration may not be completely obvious. Indeed, of all the variables that are likely to affect civil war duration, natural resources hardly seem to be one meriting thorough examination. Empirical studies have shown how countries dependent on natural resources experience very poor economic and political rates of development compared to states less dependent on their natural resources (Sachs & Warner 2001). This ‘resource curse’ or Dutch Disease, named after Holland’s detrimental economic consequences once the state began relying more heavily on its natural gas sector, has brought about new theories and thinking about the general relevance of natural resources to a wide range of issues. One of these issues deals explicitly with natural resources as they relate to civil wars.

The pervasiveness of civil wars in the past 60 years exhibits just how important it is to know more about them. If we can understand why certain civil wars seem to be much longer than other civil wars, then policy can be better fashioned to mollify internal conflicts and bring them to an end more quickly. Additionally, by knowing how to bring an end to civil wars we can also raise the prospect for achieving a lasting peace, as civil war duration is highly relevant toward achieving a permanent peace. By deconstructing the relationship between natural resources and civil war duration, a link that is quickly gaining much more attention, we can further our understanding of civil wars to more effectively deal with them. Hopefully this paper will make considerable contributions to theories on how exactly natural resources fit into the complex equation that is a civil war.

Literature Review

To first begin the process of linking natural resources to civil wars, it is imperative to trace the evolution of the academic work on the subject. The literature on natural resources and civil wars has provided great insight yet also paradoxical findings on the subject matter. Works by Collier & Hoeffler, Fearon, Ross, Addison, and Lujala et al. have provide convincing conclusions on certain facets of civil wars which have opened the way for further research on a deeper and more powerful level (Collier & Hoeffler 2001). And though much of the literature has been devoted to the theory that the presence of natural resources is likely to cause civil wars, research has also been conducted on natural resources as they relate to civil war duration. The literature has also displayed a clear progression on the subject matter as the reasoning and measurements have become more refined.

A seminal piece on civil wars is James D. Fearon's *Why Do Some Civil Wars Last So Much Longer Than Others?* As the title suggests, Fearon attempts to determine why civil wars vary in length. Fearon notes that in the post-Cold War period, civil wars have been steadily increasing in duration. Drawing on a large dataset consisting of 122 civil wars occurring from 1945 to 1999, Fearon classifies civil wars into five distinct categories to compare their variation in length. Fearon divides the wars into: (1) coup or revolutionary conflicts, (2) secession/separatists conflicts, (3) civil wars resulting from the breakup of the Soviet Union, (4) 'Sons of the Soil' civil wars, and (5) civil wars fueled by contraband such as diamonds, coca, or opium (Fearon 2002).

Fearon next uses a maximum likelihood model to fit a Weibull distribution to the data because a simple mean or median of civil war duration is misleading since some cases are considered ongoing. Fearon then uses various parameters to derive estimates for the median and

mean of civil war durations, which are 7.6 and 11.9 years respectively. Fearon's study found that coups, secessions, and civil wars resulting from the breakup of the Soviet Union tended to be relatively short, while 'Sons of the Soil' wars and contraband wars tended to be rather long (Fearon 2002).

Interesting to Fearon's findings is that natural resources played a dominant role in these latter two categories. Fearon describes 'Sons of the Soil' wars as conflicts typically involving fierce and long battles between ethnic minorities and the nation's ruling ethnic majority over natural resources located on the periphery of the state. Likewise, conflicts concerning contraband are theorized to be so great in length due to the finances that the natural resources generate. Surprisingly, Fearon found that such features like ethnic diversity, levels of democracy, and ideology had no independent power in determining civil war duration. His conclusion was that economic (financing and rents), not political (democratization, ethnic fractionalization, etc), factors predominantly influence the duration of civil wars (Fearon 2002).

Fearon's work did not have the specific intention of exploring the relationship that natural resources can have in determining civil war duration. His five categorizations of civil wars are grounded primarily into political groupings, rather than anything specifically focusing on natural resources and civil wars. Yet he touches on a noteworthy phenomenon that contraband is seemingly associated with very long civil wars. Fearon acknowledges that some of the longest running civil wars involve drugs and diamonds, but admits that he lacks a rough and ready way to accurately classify wars along these parameters (Fearon 2002). Nonetheless, Fearon's paper lays down an important foundation for this subject matter because it connects civil war duration with the financing capability that comes with various natural resources.

The idea that natural resources can fundamentally determine the type of civil war in a nation, touched upon by James Fearon, is extended in Philippe Le Billon's *The Political Ecology of War: Natural Resources and Armed Conflicts*. While other authors dealt with natural resources in an aggregated manner, measuring natural resources by primary export commodities as a percentage of gross domestic product, Le Billon disaggregates natural resources according to their geographical location and concentration (Le Billon 2001).

Depending on where the natural resources are located relative to the state's center of power, Le Billon determines that natural resource location can have a significant effect on civil wars. In short, the greater the distance of the natural resources from the center of the state's control, the greater the cost of controlling the resource, and thus a higher risk of losing the resource to the adversary (Le Billon 2001). The location of natural resources can subsequently affect civil wars because rebels can more easily exploit natural resources to conduct their military operations if the resources' location is such that it is difficult for the state to maintain its control over.

Aside from classifying the resources as proximate or distant, Le Billon also categorizes natural resources according to their concentration, diffuse or point. Diffuse resources are widely spread across the region and mostly include resources exploited by productive industries over large areas (i.e. agriculture, forestry, and fisheries). Point resources are concentrated predominately in a single area and mostly include resources exploited by extractive industries (i.e. mining).

With these two classifications in hand, Le Billon then categorizes armed conflicts into four broad categories: (1) State control/coup d'état, involving point resources that are proximate to the state's region of control; examples of which include conflicts in Algeria, Angola, and

Chad. (2) Next is rebellion/rioting, which involves proximate resources that are diffuse, like in El Salvador and Guatemala. (3) Point resources located far away from the state's control characterize secession conflicts like in the Democratic Republic of the Congo (DRC), Indonesia, or Sudan. (4) Finally, natural resources that are distant and diffuse seem to involve warlordism, as demonstrated by conflicts in Afghanistan, Burma, Colombia, and Sierra Leone. So while previous studies on natural resources and civil wars seemed to treat natural resources in the aggregate, Le Billon takes his work a step further by disaggregating resources according to their location and concentration, thus offering a new perspective on which to examine the relationship between the two variables (Le Billon 2001). Furthermore, Le Billon offers a novel way of examining civil wars because he posits a direct link between the type of resources existent in a country and what type of conflict it experiences. Le Billon's work thus moves further along the theoretical continuum that natural resources can play a vital role in determining what type of war we see.

Despite Le Billon's extensive work on this new method of categorizing civil wars primarily by the type of resources in the country, it is not without flaws. For instance, countries with many natural resources that display dissimilar characteristics in their location and concentration are classified in more than one of the four listed categories. Liberia, which contains iron ore and rubber, point and proximate resources, is deemed a state control/coup d'état conflict. Yet Liberia also has diamonds, timber, and drugs, distant and diffuse resources which fall under warlordism. According to Le Billon himself, he defines warlords as "strongmen controlling an area through their ability to wage war and who do not obey higher (central) authorities." (Le Billon 2001). Though Philippe Le Billon does not state that his classifications are mutually exclusive, warlordism does not seem compatible with a conflict that is marked by

state control or a coup. Fortunately there are alternative views on how to best relate natural resources and civil wars.

Michael Ross' papers on natural resources and civil wars have built on Le Billon's disaggregated approach toward natural resources. However, instead of using location and concentration of resources as parameters, Ross primarily sorts resources based on their *lootability*. Ross defines a resource as lootable if it can be easily appropriated by individuals or small groups of unskilled workers. He cites diamonds and drugs as lootable resources. He also hypothesizes that lootable resources should tend to lengthen civil wars because the resources can more easily provide funding to the rebels, typically the weaker side in the conflict (Ross 2003).

Ross tests his hypothesis on lootable versus nonlootable natural resources in his paper, *How do Natural Resources Influence Civil War?: Evidence from 13 Cases*. Using a small-N analysis, Ross tests hypotheses relating natural resources to civil war duration based on a "most likely" research design, where the researcher examines a single case in depth to determine the "most likely" casual relationship between the input and output variables. Ross selected thirteen case studies of civil wars that occurred in the 1990s including, Afghanistan, Angola, Burma, Cambodia, Colombia, Congo, DRC (1996), DRC (1997-99), Indonesia, Liberia, Peru, Sierra Leone, and Sudan (Ross 2003).

Ross found that lootable resources lengthened eight of the thirteen conflicts examined because the looting allowed the weaker party to raise money and hence continue fighting. There was less evidence to support the theory that timber, classified by Ross as lootable, lengthened civil war duration. Ross cites the role that timber played in Cambodia as evidence that lootable natural resources provide funding to rebel forces. Yet he acknowledges that the dearth of data on timber makes it difficult to know if Cambodia is an isolated case or part of a larger pattern of

timber potentially financing civil wars. With regard to oil, a natural resource often associated with civil wars, Ross found no evidence that oil either lengthened or shortened civil wars (Ross 2003).

Though Ross' work contributes a great deal in that he classifies resources into lootable and nonlootable categories, offering still a finer methodology, it suffers from several shortcomings. First, Ross uses a small-N analysis of only thirteen cases from the 1990s. His findings therefore lose some greater explanatory power that is typically gained whenever the dataset is expanded to include more cases. Second, Ross' definition/categorization of the resources needs further clarification. Though Ross states that lootable resources are such that can be easily appropriated, he does not go about classifying the resources in any stringent/rigorous manner. Rather, he designates diamonds, drugs, and timber as lootable resources based on a more intuitive, and less objective, evaluation of the resources' physical properties. Though it would seem odd to consider oil anything other than nonlootable, Ross does not sufficiently explain why he categorizes it as nonlootable as opposed to lootable. Furthermore, Ross' disaggregation of resources into a dichotomous category of lootable and nonlootable does not illustrate if there is any variance within the categories as they relate to civil war duration. It is still uncertain which resources seem to lead to the longest wars or which resources lead to the shortest wars.

Fortunately, Macartan Humphreys has extended the works of Le Billon, Ross, and Fearon to elicit more accurate findings on at least two natural resources, oil and diamonds, and their effects on civil war duration. Humphreys employs a much more quantitative approach toward the data and measures oil based on both production levels and reserves to achieve a more accurate figure for the independent variable. Diamonds are also measured quantitatively

according to production instead of a dichotomous production measurement used in many other studies like Ross'. Also, Humphreys tests these new values for oil and diamonds against large-N datasets of civil wars occurring from World War II to the present (Humphreys 2003). These measurements for oil and diamonds as well as the expanded dataset mark significant improvements over the previous tests done on the topic.

Humphreys finds that the natural resources tend to lead to *shorter* conflicts. Though Humphreys does not explicitly say that diamonds are lootable and oil is not, and we should therefore see diamond production associated with longer civil wars and vice versa with oil, his findings seem contrary to what we would expect, at least with regards to a lootable commodity like diamonds. However, theoretically his findings are at heart consistent with the works of Fearon and Ross in that he concludes that resources shorten civil wars because they make military victory more decisive because natural resources can be such a valuable source of income, which in turn affects the military balance. He suggests that negotiated settlements are less likely with certain natural resources like diamonds because rebels feel more capable of achieving victory militarily. So while Humphreys does not dispute the financing capability that natural resources can have to various sides in a civil war, his findings suggest that the relationship between natural resources and civil war duration is non-monotonic when examining the strengths of the two sides (Humphreys 2003).

Humphreys' paper provides a powerful model relating oil and diamonds to civil war duration in a precise, quantitative model. However, he acknowledges that his tests would have benefited from more data on the military capabilities between the warring factions to better determine if natural resources shorten wars by making military victory more likely (Humphreys 2003). Also, Humphreys focuses solely on two commodities, oil and diamonds. His research

does not include any other natural resources like agricultural products, nonfuel minerals, timber and drugs; resources that have also been considered to have an effect on conflict duration. So while there is considerable improvement in the way of quantitatively measuring two natural resources, oil and diamonds, Humphreys offers very little on other natural resources and their influences on civil war characteristics.

Each of these pieces acknowledges the influence that natural resources have on civil wars. Fearon's work demonstrates how resource civil wars seem particularly long. Michael Ross confirmed these findings with a small-N study. Le Billon broke down conflicts based on the type of natural resources existing in the country, and Macartan Humphreys bridged the gap between Fearon and Ross by comparing a lootable and nonlootable resource in a large-N dataset. However, there is still room for further analysis and theory about how precisely this relationship between natural resources and civil wars works. The causal mechanisms are not quite evident in some of these studies, and we therefore require a more comprehensive study of the topic.

Theoretical Arguments

If we are to truly understand and test the relationship between natural resources and civil war duration, then we first require a solid theoretical foundation. Without proper theories and explanations, the observations will not serve much purpose, and will contribute very little to our knowledge and subsequent policy recommendations on civil wars. Thus, theory goes part and parcel with our understanding and formulation of tests on the subject.

The connection between civil wars and natural resources rests primarily on economic reasoning as was theorized in Collier and Hoeffler's *On Greed and Grievance in Civil War*. Their finding was that economic factors of greed were essential to initiate a civil war because grievance is a factor in most nations and that the only barrier to internal wars is having the

capability or financing to take up arms (Collier & Hoeffler 2001).¹ Extending this logic beyond just initiation of a civil war, it is not unreasonable to assume that funds are needed for warring factions to sustain a civil war. Indeed, in order to engage in conflict, rebels often require at a minimum: weapons, soldiers, bases of operation, etc. A functioning government normally has these at its disposal. All of these necessities require money or payment in some form or another. It is this funding requirement that ties natural resources to civil wars.

The link between natural resources and civil wars is one contingent upon funding. Natural resources can provide a method of funding for a side to engage in a civil war. And if a certain natural resource is in relative abundance, and highly profitable, then it can financially sustain a rebel group for a longer period of time, thus leading to a longer civil war. The logic behind natural resource abundance and civil war is fairly simple when seen from this level. Yet the argument becomes much richer when one examines natural resources and civil war duration at a more disaggregated level, where natural resources are not simply treated as a dichotomy.

Though the link between natural resources and civil war length rests on the economic reasoning, it is not logical that all natural resources should have the same effect on war duration. This is indeed what Le Billon was suggesting in his paper when he sought to classify civil wars into four categories based upon what type of resource is in the country. But while Le Billon focused his efforts on natural resource location and concentration as a way of shaping armed conflict, an alternative way is to measure natural resources based on their lootability.

Lootability simply means how easy is it for a group to extract resources. Looting of natural resources can take the form of illegally extracting diamonds out of a mine, cutting down timber in the forest, or stealing poppy plants from a crop. The relative ease or difficulty of

¹ Collier and Hoeffler also consider economic factors to have the largest impact on civil wars.

looting a natural resource is something determined by the resources' physical, technological, and geological properties.

The concept of a resource's lootability is crucial in the determination of civil war length because natural resources do not all have equal properties that make them an equally available source of funding for all sides. In many civil wars, the rebels or anti-government forces are typically the weaker side and consequently lack manpower, equipment, legitimacy, and technology, at least at the beginning of the conflict. Because of this, rebels benefit most from resources that are highly lootable because the costs and requirements of extracting such commodities are relatively low. This can hold true for the government as well. But the government, being more capable than the rebels in the areas of personnel, equipment, knowledge, etc at least initially, can also benefit from nonlootable natural resources in the country as well. So while rebels benefit from the existence of lootable natural resources, the government benefits more from nonlootable natural resources. Therefore, if we assume that the rebels are typically the weaker side in the conflict, the presence of lootable natural resources should *prolong* wars since they can empower the weaker side and move the factions closer toward parity.² Likewise, the presence of nonlootable natural resources should *shorten* wars since they aid the already stronger government and better enable it to suppress the rebel forces.

However, there is still the question as to what makes certain natural resources more available to guerilla forces rather than to the government, namely what determine lootability? Lootability, as described by Michael Ross, is not defined very precisely. Which resources are lootable and which are not? An examination of each of the resource industries reveals that

² If in fact the rebels are the stronger party, then lootable natural resources should shorten the conflict. Unfortunately, there is not enough data on the relative strengths of participants in civil wars to do any empirical testing.

certain natural resources require very different production methods than others. For instance, in petroleum rich nations, the oil sector is highly capitalized with regards to pumping, refining, and transportation equipment. The industry contains many high-skilled workers. Furthermore, the oil industry itself is dominated by large multinationals that often work through the government to acquire oil concessions (Department of Energy 2002). Agriculture, on the other hand, is not a very capitalized industry in many parts of the world. Low-skilled workers dominate farming in many areas of the world. The less capable and less equipped rebels can therefore exploit labor-intensive industries like agriculture, drugs, and diamond mining. These characteristics in the production process are key determinates in what makes resources lootable, and hence available to rebels, and what makes resources nonlootable, and hence benefit the government.

The amount of capital required determines whether resources are lootable or not. Industries like oil and nonfuel mineral mining are inherently capital-intensive. In order to be processed, these commodities require millions of dollars in heavy machinery for pumping, digging, extracting, refining, and transporting. Rebels often lack such resources as equipment and industry knowledge. This is something that is usually done by large corporations or the state and not something done by rag tag rebel forces. Even if rebels were to take over the region of a country with the oil, they would find it difficult to operate the machinery and still more difficult to sell oil to a multinational corporation. However, diamonds, drugs, and timber do not require large amounts of capital or high-skilled workers. These commodities come at relatively low extraction and transportation costs and thus allow rebels, with their inherently limited capabilities, to exploit these resources. Therefore, capital equipment and knowledge in the production process are sufficient determinants of whether or not natural resources are deemed lootable.

Yet even though some resources are lootable and some are not, this does not mean that all lootable natural resources are equally valuable to the rebel forces, and vice versa for the government with nonlootable natural resources. The length of civil war also depends on the value of the natural resources available to each side. Highly valuable, lootable resources benefiting the weaker rebels should result in a longer civil war. Highly valuable, nonlootable natural resources benefiting the stronger, government side should lead to shorter civil wars.

The value of a natural resource to a party in a civil war depends upon the resource's price over its costs in addition to the abundance of the resource. The higher the price relative to the cost makes the commodity more valuable. And greater quantity also makes for greater total value. Diamonds and drugs have very high profit margins, and certain countries are very abundant in diamonds and/or drugs. We should therefore expect to see longer civil wars in nations with copious amounts of diamonds and/or drugs. Oil also has very high profit margins. Therefore a nation rich in oil is likely to see a shorter civil war because the government can use the large source of revenue from the oil to successfully fight the civil war. Thus the profitability and the relative abundance of the natural resources act as a magnifying effect on the duration of a civil war, much shorter or much longer, while lootability and nonlootability determines the direction of civil war duration, shorter or longer.

Lastly, legality of the natural resource affects duration. Ross claims that whether or not a resource is legal on the international market can affect how beneficial the resource is to the warring parties (Ross 2003). Legal resources may benefit both sides without any extra costs. Yet illegal resources typically involve extra costs due to the higher risks involved. Therefore illegal commodities carry an extra cost, which subsequently lowers the resources' value to whichever side exploits it.

Having laid down the theoretical arguments why more lootable natural resources should result in longer civil wars, it now becomes possible to develop a model by which to test the validity of these theoretical arguments.

Research Design

After working through the theoretical arguments linking natural resources to civil war duration, it now becomes possible to test this relationship. This will require a model that captures the unique physical, geological, and technological qualities that differentiates natural resources from one another. There will be two types of tests done to study the impact that natural resources have on civil war duration. One will be an analysis of variation of civil war length according to the most abundant natural resource in the country. The other will be a regression measuring natural resource *lootability* (defined here as a catchall variable) against the civil war duration. The two models will test the following hypothesis:

Since funding is necessary to engage in a civil conflict, and natural resources can provide funding to rebels through plundering, and rebels can more easily obtain lootable natural resources than nonlootable natural resources, civil wars involving lootable natural resources should have longer durations than civil wars not involving lootable natural resources.

The data on civil wars is taken primarily from Sambanis' *Partition as a Solution to Ethnic War*.

The dataset includes 125 civil wars that started since 1944 and terminated before 1997.

Sambanis defines a civil war by the following criteria:

- a) the war has caused more than one thousand battle deaths;
- b) the war represented a challenge to the sovereignty of an internationally recognized state;
- c) the war occurred within the recognized boundary of that state;
- d) the war involved the state as one of the principal combatants;

- e) the rebels were able to mount an organized military opposition to the state and to inflict significant casualties on the state.

This definition is similar to the one used by Singer and Small in the Correlates of War project, except that Sambanis only requires one thousand battle deaths for the entire duration of the war, and not one thousand battle deaths during each year of the war. This was done out of the arbitrariness of the one thousand battle deaths per annum as a threshold for a war even though Sambanis notes that nearly all of the civil wars coded in the dataset meet the Singer and Small requirement (Sambanis 2000).

Additional data pertaining to natural resources was taken from the World Bank's *World Development Indicators 2003*, the U.S. Energy Information Administration, the *BP Statistical Review of World Energy*, the *World Almanac Factbook*, the *CIA World Factbook*, the United Nations Office of Drugs and Crime (UNODC), the Food and Agricultural Organization of the United Nations (FAOSTAT), and the *Mining Annual Review*. These sources provided information and statistics on natural resource production, trade flows, and revenues.

To test the above hypothesis, an analysis of variation will be conducted to determine if any significant variation exists in the length of civil wars with different natural resources. To do this, the civil wars must first be classified according to the natural resource that most appropriately characterizes the type of funding used by the adversaries. This is not an easy task since many of the civil wars under examination suffer from a lack of reliable data. Certain nations lack even accurate reporting of GDP, let alone the insurgents' financing operations and statistics. Because of this dearth of data, compounded by the large size of the sample, it is not feasible to research and code all 125 cases according to the natural resources, if any, exploited to fight the civil war. Therefore, an alternative way of coding civil wars is to classify nations

according to their natural resource abundance, assuming that abundance is closely correlated with the type of resource rebels (government) forces actually use to finance (suppress) a civil war. This appears to represent the most efficient way to classify civil wars for this study since incomplete and inaccurate data unfortunately prevents a more robust method of categorizing civil wars according to the actually type of natural resource exploited by the warring factions.

Since we cannot code civil wars according to the natural resources actually exploited, the best alternative is to classify them according the nation's natural resource abundance at the time of the civil war. In a related paper on natural resources and civil wars, Fearon and Laitin code nations to be oil abundant if oil accounts for at least one-third of the nation's total exports (Fearon & Laitin 2003). Other researchers have adopted this criterion for resource abundance and this same standard is employed here. This standard was then used to classify civil wars into seven categories of natural resources: (1) diamonds, (2) drugs,³ (3) oil, (4) nonfuel minerals, (5) timber, (6) agriculture, and (7) other.⁴ For example, Iraq is oil abundant, Rwanda is an agriculture abundant nation, and Afghanistan is a drug (opium) abundant nation. Civil wars classified as other did not have any natural resource account for at least one-third of its total exports. One important caveat is since agriculture is an essential commodity for the welfare of the domestic population, certain countries are highly agriculture abundant, but export very little. In cases like this, nations had to have at least 50 percent of their total GDP made up in the agriculture sector to be classified as such. Additionally, countries with more than one resource that accounts for at least one-third of exports were classified according the resource that made up the highest percentage of exports; though cases like these were very rare.

³ Estimates for drugs and illegal diamonds were used to code certain civil wars.

⁴ The World Bank uses these same categories to group natural resources with the exception of drugs, which has clearly played a role in several long running civil wars. Figures on drugs were taken from the UNDOC.

Once the civil wars are sorted into the seven resource categories, an analysis of variation will be run to determine if significant variation exists among the mean length of the civil wars (measured in months). Using the definition of lootable as something that is easily extracted, if the theory holds correctly, we should see generally longer civil wars in countries with more lootable natural resources and shorter wars in countries with less lootable natural resources. Yet to distinguish between which resources are lootable, and which resources are not, it is necessary to examine the production and transportation processes of each natural resource to establish which processes require high amounts of capital and which do not, since capital intensity primarily determines lootability.

Oil and nonfuel mineral production are highly capitalized industries. Oil, from the exploration, extraction, refining, and transportation requires heavy machinery and expertise. Highly trained engineers use advanced technological equipment to locate oil reserves. Large corporations use massive pumps to bring oil to the surface, and transportation of petroleum is either done through large pipes traveling hundreds of miles or with colossal oil tankers. The startup costs of petroleum industries are very high and profits come only after achieving large economies of scale (British Petroleum 2003). Oil production is almost entirely a capital-intensive industry.

Similarly, nonfuel minerals, gold, copper, and iron ore, are processed mainly with machinery on very large scales as well. Drilling and extracting equipment for nonfuel minerals is done with heavy machinery. Furthermore, these commodities' relatively low value to weight ratios make transportation a costly process that can really only be done with large trucks (Mining Journal, Limited 2000). It is simply not feasible for low-skilled workers to mine, ship, or even steal these minerals in any sort of efficient or profitable manner.

Timber and agriculture fall into a second category where there is a mixture of capital and labor employed in the production process. While oil and nonfuel mineral production used almost all capital and no labor in their production processes, logging and cultivation use a mixture of the two types of production methods. Timber production, logging, uses heavy cutting equipment. Yet logging can also be done with very little machinery and primarily low-skilled workers so long as manpower is sufficient to make the volume of timber adequate to ensure profit. Transportation is a capital-intensive process, yet the costs of timber transportation are nowhere near that of oil (Global Witness). So it is quite possible for timber to be a source of revenue for rebels since its production process is not fully capitalized.

Agriculture shares similar production characteristics to that of timber. In the United States, corporations conduct most of the cultivation using highly capitalized methods that produce enormous quantities of food. The process is so massive, that other third world countries fail to effectively compete because they lack such capitalization in their production methods. Many of the civil wars classified as being abundant in agriculture are poverty-stricken nations plagued by overpopulation. The farming and transporting methods for agriculture in many of these countries are veritably labor-intensive as capital equipment is scarce, and labor comes so cheaply due to the abundance of low-skilled workers. Agriculture is therefore a commodity that rebels could quite easily use to finance their fighting because it requires neither hardly any capital nor a specialized work force.

The last category of lootability belongs to diamonds and drugs. These two commodities are infamous for their inherently lootable qualities. Diamonds, especially alluvial diamonds, are very easy to extract in that any low-skilled worker can mine diamonds with nothing more than a sieve and shovel (Smillie 2002). There is hardly any capital equipment required in this process

and anecdotal evidence illustrates how anti-government forces have looted diamonds mines to finance their operations (Smillie 2002). Furthermore, diamond's portability makes them very cheap to transport relative to the revenues they can easily fetch on the market. Diamond's low extraction cost and portability make them arguably the most lootable natural resource (Smillie 2002).

Drugs are quite similar to diamonds in the way of processing and transportation, which makes them a highly lootable commodity as well. Drugs like opium, cocaine, and cannabis can be cultivated with very negligible amounts of equipment and technology. Poorly skilled workers can easily cultivate these drugs at very minimal costs. Additionally, transportation of drugs is relatively inexpensive and noncomplex when compared to oil or nonfuel mineral transportation. Low production and shipping costs make drugs second only to diamonds in their lootability.

Test Results and Interpretations

Now knowing which natural resources are lootable and which are not, after examining the production processes of each, an analysis of variation test was run. Table 1 gives the results of the analysis of variation testing resource lootability and war duration. The average civil war duration for the entire sample is 80.6 months, or 6.7 years.⁵ The test shows that diamonds and drugs are associated with longer civil wars, while agriculture, timber, nonfuel minerals, and oil are associated with shorter civil wars. The findings are statistically significant at the 0.01 level allowing us to reject the null hypothesis. Yet this test only examines if the average lengths of the civil wars differ from each other. It does not test to see if more lootable natural resources cause longer civil wars compared to less lootable natural resources.

⁵ For coding on ongoing civil wars see Fearon (2002).

To examine if lootable resources result in generally longer civil wars, *ceteris paribus*, two sample t-test were run by grouping natural resources into three binary categories labeled natural resource type: (1) highly lootable resources (diamonds and drugs), (2) lootable resources (timber and agriculture), and (3) nonlootable resources (oil and nonfuel minerals).⁶ The results of the t-tests are given in tables 2 through 4.

Table 2 shows that diamond and drug wars are significantly longer than all other types of civil wars, by approximately 6.8 years. Table 3 shows that nations abundant in timber or agriculture experience typically shorter civil wars, by about 2.2 years. And civil wars in oil or nonfuel minerals abundant nations have wars that are about 3 years shorter compared to other types of civil wars. These results are what we expected to see with regard to drugs and diamonds, and also with regard to oil and nonfuel minerals. Recall that the presence of drugs and diamonds, being highly lootable and thus empowering the rebel forces, should result in longer civil wars. This is what table 2 confirms. The opposite is true with oil and nonfuel minerals because they only benefit the government and thus should shorten civil wars. Table 4 confirms this as well. The one discrepancy between the theory and the findings was with timber and agricultural products. Both of these products are lootable and thus potentially subject to rebel exploitation. However timber and agricultural civil wars were actually shorter than other civil wars, if only at a marginally significant, 0.1 level.

The next tests were regressions of civil war duration as predicted by the three natural resource categories specified above. The regressions controlled for the following seven variables: (1) the type of war, a dummy variable coded 1 if the war was an

⁶ The resources were grouped into these categories based on their similar production processes outlined earlier in the paper.

ethnic/religious/identity conflict and 0 if the war was an ideological/revolutionary conflict, (2) the level of democracy in the country ranging from 0 to 20,⁷ (3) the real GDP per capita, (4) the ethnic heterogeneity of the country ranging from 0 (minimum heterogeneity) to 144 (maximum heterogeneity)⁸, (5) major power intervention, coded 1 if a major power intervened militarily and coded 0 if otherwise⁹, (6) third party intervention, coded 1 if a foreign power intervened and 0 otherwise, and (7) the terrain of the country, an index measuring the percentage of the country covered by forests or mountains.¹⁰ These variables include both political and economic factors and were selected based on their likely impact on civil wars according to Collier and Hoeffler's studies on civil wars (Collier & Hoeffler 2001).¹¹

Table 5 shows the coefficients and standard errors of all the variables in the three regressions. Column 2 is the regression for drugs and diamonds. Column 3 is the regression equation for timber and agriculture resources, and column 4 is the regression for oil and nonfuel mineral resources. Coefficients of each variable are the top number in each box and standard errors are in parentheses. All three equations have statistically significant F statistics and we can therefore reject the null.

After controlling for all seven variables, it is possible to determine the strength that various natural resources can have on civil war duration. The presence of drugs or diamonds in a country lengthens civil war by approximately 93 months. Only real GDP per capita and third party intervention variables have any statistically significant impact on war duration. Civil war

⁷ This was based on the Polity98 dataset.

⁸ The ethnic heterogeneity index is based on coding of racial, religious, and linguistic divisions within the country according to Vanhanen (1999).

⁹ Major powers are the five permanent members of the UN Security Council.

¹⁰ Forest data was taken from the World Bank *World Development Indicators*. Data on mountain coverage was derived from Buhaug and Gates (2002).

¹¹ Though the rebels' versus the governments' strength is a key variable according to Humphreys, not enough data exists on the military strengths between warring factions in civil wars for it to be controlled for here.

duration is actually an *increasing* function real GDP per capita, but only very slightly; a 0.016 month increase in duration for every one unit increase in real GDP per head. Intervention in the conflict also lengthens civil wars by about 27 months, yet this coefficient is only marginally significant, 0.10.

The timber and agriculture variable in the next regression has a negative coefficient but is not statistically significant. In fact, the only statistically significant variables in the regression are real GDP per capita and ethnic heterogeneity. Both variables increase war duration by 0.016 and 0.467 months, respectively.

Last, oil and nonfuel minerals decrease the length of a civil war by 53 months. The only other variables affecting duration in this last regression are real GDP per capita, ethnic heterogeneity, and third party intervention. Real GDP slightly increases duration, 0.02 months; ethnic heterogeneity increases duration by about a half a month, and third party intervention lengthens wars by almost 30 months, *ceteris paribus*.

In sum, after controlling for other variables, there are a few claims that can be made about natural resources and civil war length according to the above tests. One is that there is evidence to suggest that drugs and diamonds in a country tend to lengthen civil wars, while oil and nonfuel minerals tend to shorten civil wars. There is no evidence that agriculture and timber have significant effects on civil war length, and finally, real GDP, ethnic heterogeneity, and third party intervention have mild impacts on civil war duration.

Regression Model

While the first model illustrated that civil war lengths can vary significantly depending on the abundant natural resource found in the country, the qualitative grouping of the independent variable fails to capture some critical features and dynamics of the actual

interactions between natural resources and their effect on war duration. The most obvious case is when a country has more than one abundant natural resource, especially when one resource is lootable and the other is not. Additionally, the first model does not fully capture the magnitude of economic rents gained from the commodity. Therefore, another model is needed that captures more of the features of natural resources that cause them to affect the duration of civil wars.

In order to fully appreciate how natural resources can influence the length of a civil war, a model has to be devised which simultaneously encapsulates all of the elements of natural resources that can shape a war's length. In the theory section above, there were four factors of natural resources that could influence a civil war's length: the capital requirement, the abundance, the profitability, and the legality of the resource. Recall that capital requirement, K , best determines which side, the government or the rebels, exploits the natural resource. The abundance, A , and profitability, P , measure how valuable the resource is to each side because ultimately the resource's value lies in the amount of revenue it generates to sustain/suppress the conflict. Lastly, the legality, L , also impacts how much is gained from the resource as illegal commodities inherently have higher selling risks than legal commodities. With these variables, we can devise a function to create a lootability variable. Defined here, lootability is a catchall variable that captures the value of natural resources, Y , to warring parties based to the four factors of natural resources outlined above.

Y is a function of the four characteristics of natural resources, K , A , P , and, L . Y_R is a unit less variable that is scaled according to how valuable a lootable resource is to a *rebel group* to finance its war operations. Y_R is defined by how exploitable the resource is, how much revenue does it provide, how abundant it is, and does it have a higher cost due to its legality? The function of Y_R is as follows:

$$(1) \quad Y_R = F(K, A, P, L)$$

- + + -

Equation 1 says the value of a natural resource for a rebel group, Y_R , should decrease with greater capital requirements in the production process. Y_R should increase with the resource's abundance and with its profitability, and Y_R should decrease as the resource becomes more illegal as it should hurt the rebels' ability to actively sell the primary commodity on the market.

If we were to fashion a function of Y that would benefit the *government*, Y_G , it would look like the following:

$$(2) \quad Y_G = F(K, A, P, L)$$

+ + + -

Equation 2 is nearly identical to the Y_R function of the rebels with the exception that increases in capital requirement make it more likely for the government, and not insurgents, to exploit the natural resource. While equations 1 and 2 provide a very general relationship between natural resource characteristics and their derived value to rebels or the government, further dissections of the equations are necessary to actually test this relationship.

To quantify the relationship between natural resources and their value to rebels or the government, we first require a threshold for capital requirement that separates which resources rebels can loot, and which resources they cannot loot. Examining the production processes of the six resources reveals that if capital accounts for at least 20 percent of the average total production costs, then the resource is considered capital-intensive and therefore not available to rebel forces.

Next, the abundance of the resource has to be measured. This is measured as a fraction of total world production of the commodity during the years of measurement. This fraction then serves as a weighted average against the profitability of the commodity. Profit margins are

defined by marginal revenue minus the marginal cost divided by the marginal cost. Finally, the legality of the commodity means that Y is lowered if the commodity is deemed illegal.

Ostensibly, this term would only apply to drugs. Yet often times during civil wars, international sanctions and embargoes are placed against the country, making the export of certain goods illegal. Diamonds are not an inherently illegal commodity, yet diamonds originating from Sierra Leone during its civil war were considered illegal under United Nations Resolutions. Oil, normally not an illegal commodity, can be deemed illegal as in the case of Iraqi oil during its period of sanctioning. Therefore, when a natural resource is illegal, a portion of the revenue is lost due to the higher risks involved in dealing with the illegal good.¹²

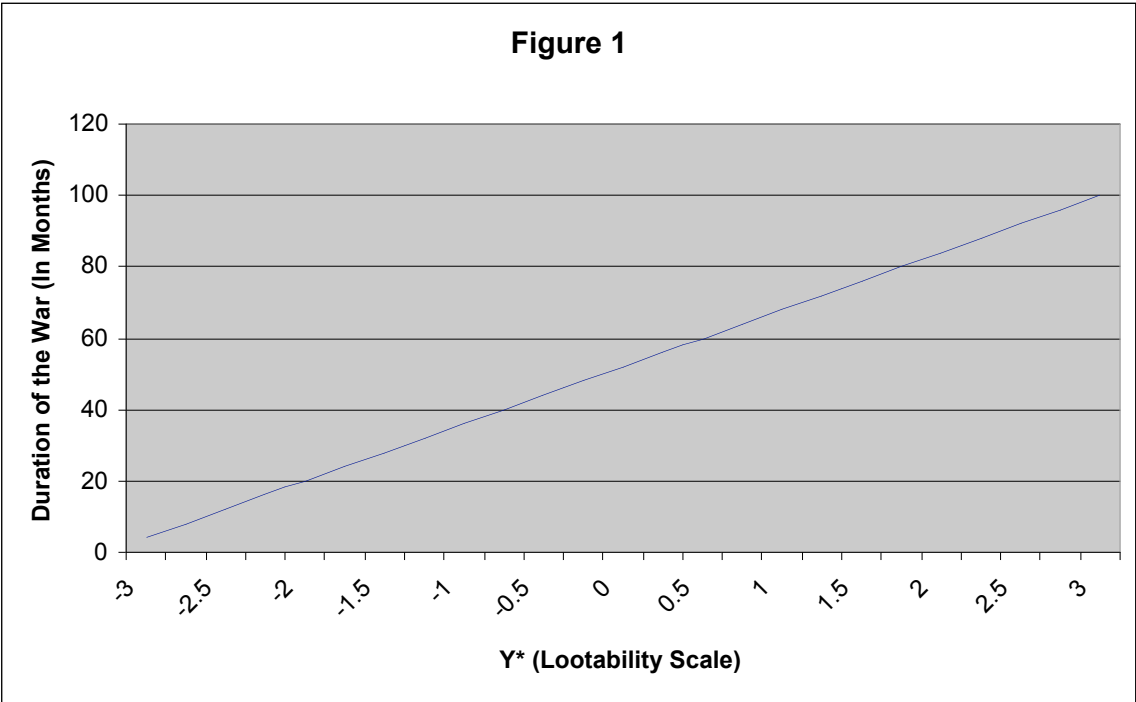
The equation still requires two more amendments. Recall that one of the shortcomings in the first model was that it could not capture the effect of more than one natural resource in a country. The new model corrects this by taking the sum value of all the natural resources in the country, regardless if they meet the previous 33 percent of exports standard. However, because of this summation, Y will no longer be differentiable between benefiting rebels and benefiting the government. To correct for this problem and have just a single Y value serve as the independent variable for each civil war, a natural resource will have a coefficient of negative 1 when the resource requires at least 20 percent of capital in its production process. Likewise, all other non-capital-intensive resources will have a coefficient of positive 1. Thus, the equation is as follows:

$$(3) \quad Y = \frac{P \cdot Q}{C} + \sum_{i=1}^n \alpha_i R_i - \sum_{j=1}^m \beta_j R_j$$

¹² Unfortunately, no rough and ready standard is available to precisely measure the impact that legality has on the value of a natural resource.

Where K takes a negative 1 value if the capital requirement is greater than or equal to 20 percent, where WA represents world production, MR is marginal revenue, MC is marginal cost, i represents the individual natural resources in the country, and n is the total number of natural resources in the country. This will now give us a single value, Y^* , for how much value is there for financing a civil war from the natural resources. Negative values of Y^* imply that the country has many nonlootable natural resources, like oil, and that the government should have an advantage in terms of acquiring finances from natural resources. Positive values of Y^* imply that a country is abundant with lootable resources and hence rebels have an advantage in the way of finances from natural resources. Furthermore, higher or lower values for Y^* , in either direction, measure the magnitude of financing for each side.

Relating this back to the theory of natural resources and civil war duration, a regression equation with Y^* as the independent variable and war duration as the dependent variable should look something like Figure 1.



Where large positive values of Y^* result in longer civil wars and large negative values of Y^* result in shorter civil wars. The positive slope of Figure 1 demonstrates the theoretical relationship we should see.

This regression model now solves some of the problems of the first model in the way of multiple natural resources in a country, and also with the varying degrees of wealth that natural resources can provide to certain sides in the conflict; timber and agriculture perhaps had no substantially impact on civil war duration because of their relatively small profit margins. Unfortunately, this regression is almost impossible to test because of unavailable data in determining the independent variable, Y^* .

Data on diamond mining, timber logging, and drug production is highly unreliable and incomplete for many nations. The diamond industry is very protective of its operations. DeBeers, the world's largest diamond company, maintains its near monopoly on the diamond industry through its close guarding of production methods, costs, and prices (Smillie 2002). Many nations that have large timber operations also suffer from poor record keeping. Cambodia is a nation that used its timber for its civil war financing, yet the Khmer Rouge regime did not keep any accurate records on even national accounting, let alone timber production (Global Witness). Furthermore, data on drug production are only estimates as major drug producers are obviously not transparent with their records. And though the estimates are sufficient in the sense that we can roughly determine which nations are the world's major drug-producers, the data is not reliable enough compared to figures on oil for example (UNDOC 1999).

Additionally, figures on nonfuel minerals and agriculture are unreliable and difficult to work with because these categories are aggregates for many different commodities, some with varying degrees of profitability. Gold and iron are both nonfuel minerals, yet the two have

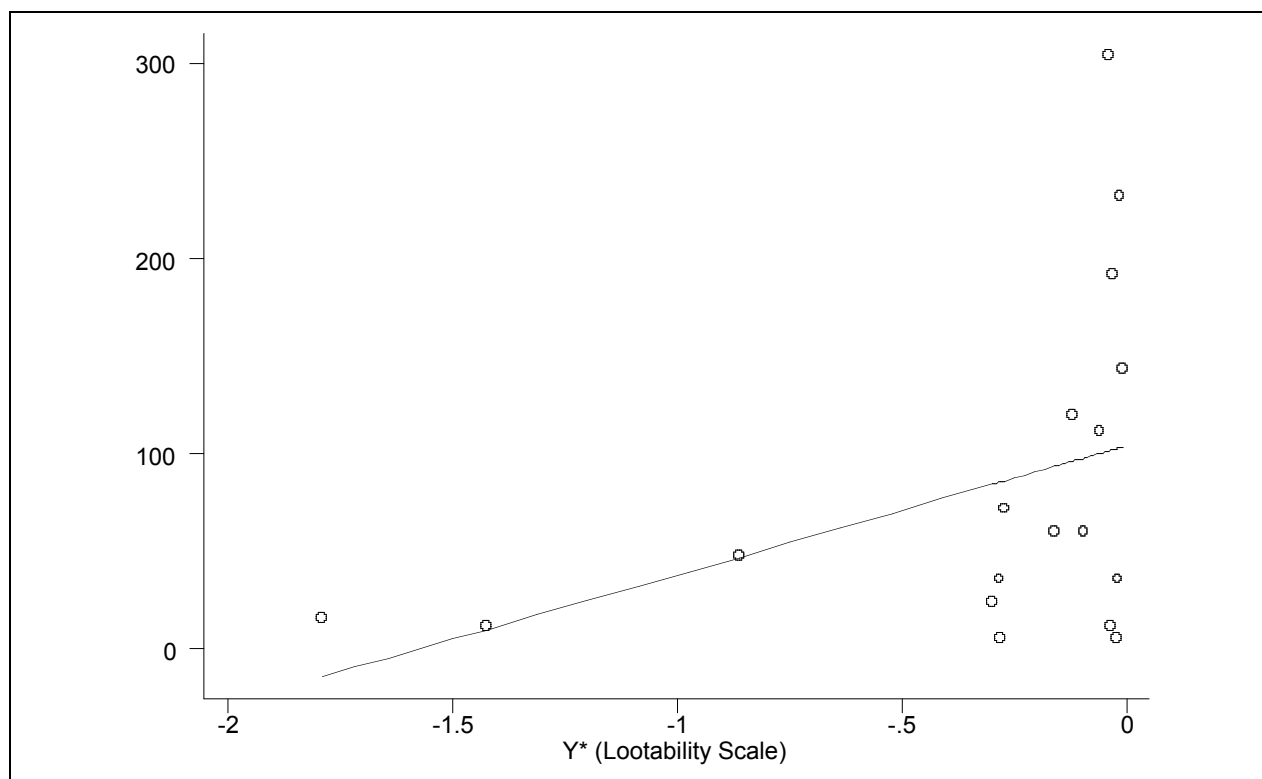
significantly different profit margins. The same applies to various agricultural products that are lumped together but have different profit margins, like wheat and fruits. So though gold and iron, wheat and fruit, can still be group together for the purposes of this paper because they more or less have the same characteristics with regard to their production process, which determines their lootability, the other variables in the equation would be inaccurate unless the natural resources were further disaggregated beyond the six categories; a task not taken in this paper.

However where it is possible to test the equation is with oil. The U.S. Department of Energy (DOE) has data on oil production, prices, and costs going back to the mid-1970s. So although the data is not exhaustive given that the civil wars in the dataset go back to 1944, we can at least attempt to test the model for a certain number of cases where the data is reliable and available.

Oil is a capital-intensive industry and therefore takes on a negative 1 coefficient (EIA 2002). Oil is measured in barrels per day, where one barrel equals 42 gallons. The price of a barrel of oil was taken from the DOE, which takes the average world price of oil for a given year. This is the marginal revenue. The marginal cost of oil was calculated by examining the lifting costs of oil according to region.¹³ This number does not include the initial setup costs for drilling and extracting oil because these two costs are part of the fixed costs in oil production. The lifting cost of oil varies from around \$2 a barrel in the Middle East, to up to \$10 a barrel in certain parts of the ocean (British Petroleum 2003). With this, we can see that oil is much more profitable in certain regions of the world compared to others. Lastly, legality was not an issue with any of the civil wars under examination here. With this information, it is possible to construct a regression of civil war duration as determined by the Y^* of oil in the country.

¹³ The lifting cost is the cost of actually bringing crude oil up to the surface.

Test Results and Interpretations



The above graph is a regression of war duration as predicted by Y^* for oil only. The equation is statistically significant with the coefficient of Y^* equal to 66.23 with a P-value of 0.10. The positive coefficient implies that increases in Y^* values for oil *lengthens* wars by 66 months or about 5.5 years because Y^* values of oil are negative on the lootability scale. This is all consistent with the theoretical arguments above. However, once the seven other control variables are added to the equation, the relationship between oil and duration is no longer significant.

According to table 6, with the seven other control variables in place, the coefficient for Y^* increases from 66.23 to 81.34, suggesting that oil lootability has an even stronger impact on duration, but the coefficient is no longer statistically significant, P-value equals 0.124. Only the

level of democracy, major power intervention, and third party intervention significantly affect the regression.

This discrepancy could be due to several reasons. This regression only includes one natural resource, oil. Ideally, enough data would exist on all of the other five natural resources so that it would be possible to obtain values of Y^* that encompass the value of all the natural resources to the appropriate sides in the conflict, for every civil war. Unfortunately, due to the lack of data, only figures on oil going back to the mid-1970s were used to test this regression model. A larger sample, with more accurate, and exhaustive data, might offer evidence in support of the theories above, but nevertheless, the best available data says that the model does not hold up to rigorous analysis.

Even though this regression model failed to make definitive conclusions on natural resources and civil war duration, it did contribute to the subject in that it offered an improved model on natural resource lootability. The model was able to incorporate several different elements of natural resources that are likely to affect civil war duration. Even if the model is never testable because of data limitations, it nonetheless furthers to our theoretical understanding of the two variables.

Case Studies

In both of the large-N tests, one critical assumption was made; that the existence of natural resources in a country meant that the government or guerilla forces are actually exploiting the resource. It is wholly possible that rebels may not loot from an existing diamond mine because they have other means of funding, like a foreign state-sponsor. Therefore, a small-N study of a few cases on civil wars in natural resource abundant countries can better determine if the theoretical explanations outlined above indeed hold true.

The small-N approach will be similar to the work of Ross in which he examined thirteen cases of natural resources and civil war. Using reports from NGOs, the United Nations, and other researchers, the small-N case studies will look to see if the actual theoretical mechanisms hold true. As best as can be determined, the case studies will examine if looting of natural resources did indeed take place if there was an opportunity. If so, how did the rebels or government use this money? Did they purchase arms, recruit soldiers, or spread more propaganda? Essentially, this portion of the paper will be a more in depth approach to the material to more forcefully establish causality. If it turns out to be the case that such mechanisms hold true in a small-N case study, it can buttress the large-N tests by moving the findings away from a rather speculative position toward a more complete and empirical one.

The key assumption made in the large-N study was that the presence of natural resources in a country meant that the government or the rebels were actually exploiting the commodities, and that the subsequent revenue went toward the war effort. Yet there could be numerous reasons as to why this assumption might be false. Also, a case study investigation can uncover whether certain resources are more available to certain groups in the conflict than to others. In other words, does lootability matter? More formally, the case studies will examine the following questions:

Question 1: Were natural resources exploited for the war effort? If so, were the economic rents used to finance the war by purchasing arms, men, equipment, etc?

Question 2: As best as can be determined, how does the presence of more than one resource appear to affect the duration of the war?

Question 3: Do certain natural resources, depending on their physical and geological characteristics, lend themselves more easily to one party of the conflict compared to another?

Question 4: Are there any additional properties of natural resources that can shape the duration of the conflict?

The nine civil wars examined here are: (1) Afghanistan, (2) Angola, (3) Burma, (4) Cambodia, (5) Colombia, (6) the Democratic Republic of the Congo, (7) Liberia, (8) Sierra Leone, and (9) Sudan. These cases were chosen based on several criteria. First, all of the civil wars here involve some abundant natural resource and most are abundant in more than one resource. The multi-abundant countries allow us to potentially examine the interplay in a civil war where one resource benefits the government, and the other resource benefits the opposition. Second, these cases were chosen because of the availability of data on them. Admittedly, this may create bias as these wars with copious amounts of data have garnered much attention and research in part because of their blatant connection to natural resources. So even though these nine countries do not represent a random sample of civil wars, they can still be valuable for analyzing the financing mechanisms of natural resources. The last criterion for selection was that three of the nine countries, Afghanistan, Burma, and Colombia, are drug-producing countries. Of all the primary commodities, drugs have received the least amount of attention and research from scholars. This is quite ironic considering that some of the longest running civil wars involve the drug trade.

The Findings

Table 7 list the nine civil wars, their lengths, and the prominent natural resources in the country. All of these civil wars are fairly long with Angola being the longest at 27 years.¹⁴ With regard to Question 1, all nine cases involved one, and in some cases both sides, exploiting natural resources to finance the war. The United Nations, and the British NGO Global Witness, and various other reputable sources have documented cases of rebel looting and government exploitation of natural resources with the specific intent of using the revenues to buy weaponry or pay fighters to fight in the war.

However, in certain cases, looting/extraction did not take place to the same degree as it did in other cases. The RUF looted timber to finance its war, but timber represented only a small portion of the RUF's finances. Contrast this with rebel looting in Angola. Angola is the world's fourth largest producer of diamonds. The northeastern part of the country is rich with alluvial diamonds and was under the control of UNITA rebel forces. The northeast, Lundas provinces, where most of the country's diamond production takes place, was rampant with illegal looting and smuggling of diamonds. In 1983, UNITA professionalized its diamond operations and saw a windfall of \$4 million in profits each month by 1986. This surge in profits corresponded to the Government's nearly 600 percent drop in diamond revenues during that same time. UNITA's extended power over the diamond region resulted in greater control of the operations as evidence by more recruiting of diggers and the taxing of garimpeiros, or illegal diamond prospectors (Le Billon 1999). Diamonds became the backbone of UNITA as one general put it, "Diamonds are UNITA's lifeblood. Without them UNITA wouldn't be able to maintain its options...UNITA needed to maintain military reserves so that the Government doesn't destroy us." In Angola, it

¹⁴ This portion of the paper will not attempt to explicitly determine if natural resources made civil wars longer or shorter. Rather it examines some of the theoretical links between natural resources and civil wars left unanswered in the large-N tests. See Michael Ross (2003) on how natural resources have affected the lengths of civil wars in these countries.

would have nearly impossible for UNITA to sustain the civil war without its diamond profits (Le Billon 1999). So while all nine countries experienced exploitation of its natural resource to fight the civil war, varying degrees of dependence on the natural resource do exist.

Particularly interesting to note are the cases of Burma, Afghanistan, and Columbia, the drug-producing nations. The drug trade is inextricably linked to these civil wars, from growing, to cultivating, to shipping, to the purchasing of weapons and men (Lintner 1999). Sanchez, Solimano, and Formisano even illustrate a direct, positive correlation between the number of hectares of cocaine crops in Colombia and the number of men in the FARC (Sanchez, Solimano, & Formisano 2002).

The next question asks how civil war duration is affected when more than one natural resource is present in a country. The case studies provide some evidence to suggest that conflicts in nations abundant in both lootable and nonlootable natural resources last a very long time. The civil wars in Colombia, Angola, and Liberia were/are some of the longest running civil wars in the 20th century. The warring factions in these conflicts exploited their nation's natural resources and the results have been continuing violence. Truces and ceasefires have proved to be very tenuous in these conflicts, possibly because the parties feel that the natural resources will always provide them with funding to continue the conflict.

The next area of discussion is if certain natural resources are more available to certain sides in the conflict compared to others. Question 3 deals directly with the notion that capital-intensive resources are not subject to rebel looting compared to low-skilled, labor-intensive primary commodities. The case studies offer some evidence in support of this theory. Capital-intensive industries like oil and nonfuel mineral mining were for the most part generating

revenue for the government in the way of direct sales, if the industry was state owned, or through multinationals' paying taxes or concession to the government.

In Colombia, Angola, and Sudan, oil exclusively aided the government. In the 1990s, oil became the key resource for the Angolan government, accounting for over 80 percent of revenue. Angolan oil is located almost entirely offshore and out of the reach of UNITA rebels. Philippe Le Billon has determined the military to be the greatest beneficiary of oil as military expenditures have increased with increases in the value of oil production. As a result, the army has become an integral part of the Angolan economy (Le Billon 1999).

Since the discovery and subsequent exportation of oil in Sudan in 1999, one of the longest running civil wars in Africa has taken on a new dimension. The government has unambiguously used its oil revenue to expand its military and continue the fighting. Since construction on the Red Sea pipeline began, the military's budget has doubled to \$327 million, approximately half of the state's budget. Profits from oil fall in the \$400 million range annually. The money has gone toward arms purchases and manufacturing as well as pay increases up to 80 percent for army personnel. Furthermore, the conflict is not only being financed by oil, but the conflict is now revolving around oil as the military is conducting mass deportations of citizens living in and around the oilfield and pipeline areas. The military balance is becoming more and more lopsided in favor of the government, and subsequently making the prospects for peace very marginal (Christian Aid 2001).

The situation in Colombia is not much different. Its civil war has been raging long before the discovery of oil and the construction of its 800km long pipeline. Yet because oil accounts for approximately 25 percent of government revenues, the battle has shifted toward protecting the oil pipeline. The Colombian government has taken massive steps through the military to guard the

pipeline from rebel attacks, whose bombings shut down the pipeline for 243 days in 2001. The military doubled the size of its force protecting the pipeline in an attempt to bring down the number of bombings, which numbered 170 in 2001 (Frontline World 2002). Like Sudan, Colombia's civil war has engulfed oil into it, both as a means of financing the fighting, and as something to fight for.

Finally, in the Democratic Republic of the Congo, the copper, gold, and coltan industries were all for the most part government operated, as we would expect to see in capital-intensive mining industries. Though very much dilapidated and decaying after years of neglect due to fighting, the copper and coltan industries do provide income for the government, though both industries' revenue streams have fallen precipitously over the years (United Nations 2001). The one exception is the gold mining industry located in the northeast and eastern regions of the country. The UN panel assigned to investigate the exploitation of the DRC's natural resources concluded that the Ugandan army has been extracting gold from the Kivus and Maniema and Ituri Provinces since the army took control of that region. The Ugandan People's Defense Force (UPDF) has set up gold mining and trading networks in the Congo and has subsequently exported the gold out through Uganda. So while not under rebel control, the Congo's gold was going to a third party in the conflict and not to the government as expected (United Nations 2001).

Also interesting to note is that the government of the DRC profited very lucratively from diamond mining despite losing a large portion of the country's diamonds to the rebels. The UN panel even learned of an explicit deal between the government and the Israeli-owned International Diamond Industries (IDI). In 1997, the Kabila Government struck a deal with IDI offering the latter a monopoly on Congolese diamonds for \$20 million even though the diamonds

are valued at \$600 million. The panel then learned of an undisclosed clause in the deal where the IDI would supply in addition to the \$20 million, arms as well as training for the government troops (United Nations 2001).

The Congo's troubles with natural resources do not end there however. The DRC has some of the best timber in the world. Though not directly related to rebel exploitation, the presence of hard woods in the country has also led to sustained fighting. The government, in its impoverished state and in dire need of money after years of conflict, has granted very profitable logging concessions to the ZDF and its joint ventures. The exact size of the concession remains disputed as the ZDF subsidiary claims the concession to be 1.1 million hectares while British NGO Global Witness estimates the concession to be 33 million hectares; making it the largest logging operation in the world (United Nations 2001). The panel expressed considerably worry at such a timber concession because a sustained ZDF presence in the Congo, should these ventures become highly profitable, would provide an incredible incentive for Zimbabwe to see a continuation of violence. Thus timber could potentially contribute toward more violence, but not by providing rents to the Congolese rebels.

Question 4 asked if there were any other links between natural resources and duration other than through a direct funding mechanism. While there is much anecdotal evidence that natural resources fund civil wars through their extraction and looting, the case studies reveal that the relationship is much more dynamic and complex than it would first appear. For instance, in Colombia, rebels profited from the oil pipeline owned by the government and the Occidental Petroleum Corporation. The FARC and ELN rebels were able to extort money from private contractors who fix and maintain the pipeline by threatening to blow it up. These rebel groups would also threaten oil officials to work with companies with guerilla ties and charge a 5 percent

tax on every contract (Hodgson 2002). This is a problem that is unique to natural resource industries because unlike manufacturing, these industries cannot easily relocate if the political/security situation deteriorates considerably. The options are often times to pay the extortion money or forgo the returns on the capital investment. Rebels in the DRC also practiced this tactic with the gold mining industries. They would levy taxes on mining companies who operated in rebel-controlled areas (United Nations 2001).

Another interesting aspect of the interaction between natural resources and civil wars is that which occurs with foreign direct investment (FDI). In the Sudan and the DRC, foreign companies brought in FDI to develop the oil industry in Sudan and the gold mining industry in the Congo. This at first may appear to have no significance on the civil wars themselves, yet these developments actually contributed to more violence.

In Sudan, the oil companies had to construct roads in various oil rich regions that had previously been very rural. These roads not only allowed the oil companies to travel more easily to conduct business, but also allowed the Sudanese military freer movement in the area to deport the local inhabitants. The oil companies did not build the roads with the specific intent of the military using them this way, yet the investment nonetheless aided the government in its deportation policy (Christian Aid 2001).

In the Congo, the Ugandan army invested heavily in the mining industry; erecting equipment and establishing trading networks. Consequently, when the Ugandan army pulled out of the country, Congolese rebels used the machinery and trading routes to continue the gold mining operations setup by Uganda (United Nations 2001). Normally the rebels would not have been able to take on such a venture due to their lack of capabilities in working with a capital-intensive industry, but the FDI of the Ugandan army circumvented this obstacle for the rebels.

Thus, foreign direct investment in natural resource industries is yet another aspect that can potentially have a considerable impact on a civil war.

In conclusion, the case studies do appear to confirm some of the initial findings in the large-N study as well as verify some of the theoretical mechanisms as to why natural resources should affect civil war duration. Furthermore, the nine cases revealed other properties of natural resources, aside from direct funding, that can have a considerable effect on civil wars. These case studies helped buttress some of the findings in the large-N tests as well as offer new areas of study with regard to natural resource extortion and foreign direct investment by third parties.

Conclusion

The paper attempted to examine if various natural resources affect the lengths of civil wars. The results were mixed as some tests confirmed the general theory that lootable natural resources make for longer civil wars, while other tests drew somewhat different conclusions. The three angle approach consisting of the analysis of variation, the regression model, and the small-N case studies sought to tackle this question through a multi-pronged examination to make the findings as concrete as possible. Clearly though, the major limitation here was not locating the right data to enable a robust testing of the regression model for multiple natural resources.

Aside from finding more data on natural resources, areas of future research could more closely examine how natural resources affect the military balance in the state to better determine if certain resources shorten wars by making military victory more likely. Also, there has yet to be a study devoted entirely to examining the negotiation process in a civil war in a country abundant with natural resources. Furthermore, the cases studies touched upon the extortion element of natural resources that rebels in Colombia are using to sustain their three-decade long

war against the government. This could perhaps be another crucial aspect of natural resources that has up to this point received relatively little scholarly attention.

In closing, the relationship between natural resources and civil wars is indeed a rich and complex one. This paper offered some evidence that natural resources significantly impact civil war length, but the topic is by no means exhausted. This subject will continue to be an intense field of research for some time to come.

Tables and Results

Table 1

<u>Natural Resource</u> (accounting for at least one-third of total exports)	<u>Average Duration</u> (measured in months)	<u>Standard Deviation</u>	<u>Frequency</u>
Oil	48.31	46.07	16
Nonfuel Minerals	57.57	80.43	7
Timber	46.00	50.94	7
Agriculture	66.59	76.79	37
Diamonds	128.88	112.41	8
Drugs	165.91	91.15	11
Other	83.56	110.29	39
Total	80.62	92.78	125

F Probability = 0.0126*
***Significant at the 0.01 level**

Table 2

Two-Sample t-test (Drugs and Diamonds)			
Natural Resource	Observations	Mean Duration	Standard Deviation
Drugs and Diamonds	19	150.32	99.41
All Other Resources	106	68.12	86.22
Difference		-82.19	
Degrees of Freedom: 123			
t = -3.7374			
P < 0.0001*			
*Significant at the 0.01 level			

Table 3

Two-Sample t-test (Timber and Agriculture)			
Natural Resource	Observations	Mean Duration	Standard Deviation
Timber and Agricul.	44	63.32	73.19
All Other Resources	81	90.01	101.04
Difference		26.69	
Degrees of Freedom: 123			
t = 1.5449			
P > 0.0625***			
***Significant at the 0.10 level			

Table 4

Two-Sample t-test (Oil and Nonfuel Minerals)			
Natural Resource	Observations	Mean Duration	Standard Deviation
Oil and Nonfuel	23	51.13	56.84
All Other Resources	102	87.26	98.10
Difference		36.13	
Degrees of Freedom: 123			
t = 1.700			
P > 0.458**			
**Significant at the 0.05 level			

Table 5

Independent Variables	Diamonds & Drugs Regression Equation Prob > F = 0.000	Timber & Agriculture Regression Equation Prob > F = 0.057	Oil & Nonfuel Regression Equation Prob > F = 0.004
Natural Resource Type	93.37* (19.68)	-2.957 (17.12)	-53.82* (19.95)
War Type	18.39 (15.32)	5.917 (16.70)	7.018 (16.04)
Democratization	1.179 (1.262)	0.880 (1.387)	0.658 (1.342)
Real GDP/Capita	0.016* (0.005)	0.016* (0.006)	0.020* (0.006)
Ethnic Heterogeneity	0.308 (0.220)	0.467** (0.239)	0.502** (0.231)
Major Power Intervention	13.68 (15.46)	10.35 (17.01)	-1.366 (17.01)
Third Party Intervention	27.51*** (16.73)	22.62 (18.49)	29.26*** (17.92)
Terrain Index	-14.73 (30.94)	4.025 (33.75)	-2.602 (32.73)
Constant	-18.84 (25.78)	-4.085 (29.82)	0.300 (27.35)

***Significant at 0.10 level

**Significant at 0.05 level

*Significant at 0.01 level

Table 6

Independent Variables	Oil Lootability Regression Probability > F = 0.112
Oil Lootability (Y*)	81.34 (47.28)
War Type	-73.34 (44.68)
Democratization	8.166*** (3.665)
Real GDP/Capita	-0.013 (0.016)
Ethnic Heterogeneity	0.002 (0.840)
Major Power Intervention	135.82** (59.56)
Third Party Intervention	-165.73** (56.79)
Terrain Index	-39.44 (78.16)
Constant	208.37** (92.90)

***Significant at 0.10 level

**Significant at 0.05 level

*Significant at 0.01 level

Table 7

Civil War	Duration	Natural Resource	Looting of Resource
Afghanistan/Taliban	1992-2001	Opium	Rebels – Opium
Angola	1975-2002	Diamonds & Oil	Gov – Both Rebels – Diamonds
Burma	1983-95	Opium	Rebels – Opium
Cambodia/Khmer Rouge	1978-97	Timber	Khmer Rouge - Timber
Colombia	1984-ongoing	Cocaine & Oil	Rebels – Cocaine Government – Oil
The Democratic Republic of the Congo	1997-99	Diamonds, Gold, Coltan, Copper, Cobalt, & Timber	Rebels – Diamonds Government – All resources
Liberia	1989-96	Diamonds & Timber	Rebels and Government – Both
Sierra Leone	1991-2000	Diamonds	Rebels and Gov – Diamonds
Sudan	1983-ongoing	Oil	Government – Oil

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