Gold and Civil Conflict:

Is there a Resource Curse?

by

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A Thesis Submitted in Partial Fulfillment

of the Requirements for the Degree of

BACHELOR OF SCIENCE, HONOURS

in the Department of Economics

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Abstract

Using a standard civil war logit model to estimate the relationship between gold and conflict, I find that the production of primary gold increases the likelihood that a country experiences conflict. Primary gold may be considered a resource curse. This result proves to be counterintuitive to economic theory. Understanding the mechanism through which gold influences conflict remains a puzzle.

Acknowledgements

I would like to express my appreciation to my supervisor Dr. Merwan Engineer for devoting a generous amount of his time to my project throughout the year. My project would not be where it is today without his advice and support. I also thank Dr. Nilanjana Roy for assisting me with the technical aspects of my paper. It has been an honour to work with you both.

I also want to acknowledge the support of my fellow colleagues in the Honours program. It has been a challenging 8 months, but the opportunity to learn from each other has been remarkable to say the least.

I want to recognize the Artisanal Gold Council, specifically, Daniel Stapper for providing me with a portion of the dataset.

Finally, I would like to thank both Dr. Daniel Rondeau and Dr. Herbert Schuetze for dedicating their time to the Honours program. The experience was truly rewarding and I could not think of a better way to finish my undergraduate career.

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1. Introduction

In recent decades, the notion that a high endowment of natural resources is favourable to economic growth has been challenged. The dispute gained prominence in the 1990s as influential literature started to shift the general consensus that natural resources are a blessing (e.g., Auty, 1993; Sachs & Warner, 1995). It is now recognized that natural resources may be a curse. The "natural resource curse" is associated with three possible outcomes: slower economic growth, undemocratic governance, and violent civil conflict. In this paper, I study the conditions under which the production of gold[1] increases the risk of armed conflict.

The World Gold Council (WGC) has suggested an initiative that would stop gold production used to finance armed conflict. This initiative proposes to track gold from the time it is mined to the end of the refining process. A tracking system would ensure that production or transportation does not fuel armed conflicts[2]. The initiative is aimed at large scale gold producers and will act as a certification scheme to stop gold's role in fuelling conflict, as witnessed in the Democratic Republic of Congo (WGC, 2011). For instance, gold has resulted in "rebel militias and government forces [fighting] over local power, ethnic hatred, and the control of minerals" (CBS News, 2009).

Based on current events witnessed in the Democratic Republic of Congo, I hope to identify whether gold can be considered a resource curse: does the production of gold fuel civil conflicts?

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[1] Throughout this paper large scale gold and primary gold are used interchangeably. Similarly, artisanal gold and secondary gold are used interchangeably.

[2] Rebel groups are more likely to extort gold during the production or transportation process; thus, fuelling conflict.

The existing literature focuses on diamonds and oil as the main determinants of conflict. Academics thus far have ignored a possible link between gold and conflict, which is the focus of this paper. The production of gold occurs in over 100 countries, while diamond production occurs in 30 countries (United States Geological Survey, 2011). If the production of gold *can* be used to finance conflict, it is worrisome that the relationship has failed to gain political attention. Therefore, concentrating on gold allows for a richer analysis of the link between natural resources and conflict. I am unaware of others who have attempted a systematic study of the role gold has in determining conflict; furthermore, there is a shortage of studies that disaggregate natural resources in order to identify if the type of resource (primary or secondary) matters.

The contribution of this paper is twofold. First, this paper offers a novel attempt to show whether a link between conflict and the production of gold exists. Second, using new estimates on artisanal gold production, I am able to distinguish the influence of primary and secondary gold production on conflict.

By using a variety of sources, I am able to construct a unique dataset to test the relationship between the production of gold and conflict. The data is restricted to 190 countries and includes measures of income, population, land composition, governance, social composition, and primary diamond production. Data for the main variables of interest - primary and secondary gold - are limited due to the costs associated with gathering reliable estimates. However, data on primary gold production exists for the years 1998-2009, whereas data on secondary gold production has been estimated for 2009. The raw data suggests that producers

of both primary and secondary gold may be more prone to conflict. On average, countries that produce gold have lower GDP, larger populations, more mountainous terrain, higher ethnic fractionalization, and higher perceived corruption.

The estimation technique used in this paper follows a standard civil war logit model used by Lujala, Gledistch, and Gilmore (2005). The benefit of using a variant of their model allows for straightforward comparison of the main results. I test two main claims pertaining to the literature: (i) the effect of gold production on conflict, and (ii) whether resource type matters.

Consistent with previous literature, I find that the production of primary diamonds is significant and negatively related to conflict. Primary diamonds can be considered a resource blessing. The intuition behind this result is straightforward. Due to the production process, diamonds produced through large scale processes is relatively unlootable. On the other hand, the principle result found in this paper is that countries well endowed with primary gold are more likely to be prone to violent conflict than countries without primary gold. Yet, the economic impact is small -- production of primary gold increases the risk of conflict by 0.6%. This proves to be counterintuitive based on economic theory; thus, understanding the mechanism under which the production of gold increases the likelihood of conflict remains a puzzle. A subsequent finding suggests that secondary gold production is a blessing (albeit statistically insignificant); suggesting that a relationship may only exist over time. Given that estimates of secondary gold only preview the relationship in 2009 provides insufficient evidence to conclude that resource type does not matter.

The results of this paper are comparable to those in the literature providing mixed evidence for a resource curse. The importance of distinguishing between the types of natural resources in order to come to a unified conclusion must be stressed. Before moving forward, it is necessary to devote future work to documenting production in both the primary and secondary gold sectors. A strategy such as the one outlined will allow policy makers to make better informed decisions; one not based solely on case study evidence of the resource curse.

The remainder of this paper is organized as follows: Section 2 provides an analysis of the relevant contributions made to the literature; section 3 explains the process of creating the dataset; section 4 provides the empirical methodology; section 5 reveals the main findings; and section 6 conducts sensitivity analysis. The closing section discusses implications and suggestions for future work.

2. Literature Review

Several scholars suggest countries with an abundance of gold are plagued by the resource curse. Case studies of Indonesia, Liberia, and Papua New Guinea suggest gold has been used to finance civil conflict (Ross, 2003). Guaqueta (2003) reports gold has been illegally extorted by rebel groups in Columbia; implying that gold is a lootable resource. Similarly, in Myanmar (Burma) there have been accounts of rebel leaders conducting dubious deals with businesses to exercise control over the mining of gold (Sherman, 2003).

However, gold has also been considered a resource blessing and a determinant of economic development. For instance, Maconachie and Hilson (2011) argue that for countries previously plagued by conflict diamonds, small scale gold mining may act as relief in the form of

intermediate employment for young men. Others claim artisanal gold mining provides better economic opportunities and livelihoods for individuals in developing countries (e.g., Chupezi, Ingram, & Schure, 2011; Telmer & Veiga, 2009).

While individual country analysis has some value, it only provides us with special cases of the impact of gold on conflict. An investigation of whether the likelihood of conflict is higher among countries that produce gold has yet to be studied. A review of the relevant literature on the natural resource curse provides the framework for determining the relationship between the production of gold and conflict.

2.1. The natural resource curse

In "On the Economic Causes of Civil War," Collier and Hoeffler (1998) find that resource abundance - as measured as the ratio of primary commodity exports to GDP - is a strong and significant determinant of the onset of civil war. The authors also find that the relationship is non-monotonic. Natural resources increase a countries risk of experiencing armed conflict but as the resource base expands the risk of conflict falls. In this case, the authors interpret natural resources as the taxable base of the economy which creates an incentive for rebels to capture the state. At higher levels of resource wealth the government has greater financial mobility to increase military expenditure; decreasing the risk of conflict as the incentives for rebels weakens due to increased resistance by the state.

In an ensuing paper, Collier and Hoeffler (2000) use a new dataset to predict the risk of civil war outbreak in five year episodes from 1960-1990. The main finding suggests that greed rather than grievances explain why rebels are motivated to initiate conflict. Conflicts occur not

because individuals feel that they have been wronged by the state; instead, potential control over resource rent leads rebels to engage in conflict.

Collier and Hoeffler's work suggest that natural resources are a curse: countries that are endowed with resource wealth face a higher probability of experiencing civil conflict. This result proved to be controversial. The current literature has provided both support and criticism towards Collier and Hoeffler's main finding; do natural resources exhibit a resource curse or a resource blessing? As the literature indicates, a consensus has yet to be reached. The remainder of this review will attempt to discuss the areas of dispute, what the existing results suggest, and how future research should continue.

2.2. Measuring natural resource abundance

The main dispute within the literature focuses on the methodology behind measuring a countries relative abundance of natural resources. Recent evidence suggests that the conventional measure of resource abundance is not robust. It has been argued that measuring natural resource abundance by the ratio of primary commodity exports to GDP creates a measure of resource dependence rather than resource abundance. Countries that are more dependent on their primary industries have a higher ratio of primary commodity exports to GDP. For instance, a country may depend on the primary industry if there are capital and labour restrictions to economic growth towards a manufacturing sector. Thus, primary commodity exports do not imply a countries relative abundance of resources.

The ratio of primary commodity exports to GDP can also be considered endogenous. As a country experiences more conflict, it is expected that the amount of primary commodities

exported falls. When the state is involved in conflict, more financial resources are devoted to military defence rather than primary sector productivity.

The initial evidence presented by Collier and Hoeffler therefore gives reason to believe that an argument for a resource curse must be interpreted with caution. Following a critique of Collier and Hoeffler's main finding, De Soysa (2002) analyzes the relationship between natural resources and conflict by measuring natural resource abundance in terms of resource stock per capita. De Soysa argues that his measure of resource abundance captures the relative inventory of natural resources per capita available within a country. The core result follows that there is no evidence to suggest that the overall level of natural resources is associated with conflict.

Instead of focusing on the magnitude of resource endowment, Lujala, Gledistch, and Gilmore (2005) distinguish between producers and non-producers of natural resources. By focusing on diamond resources, the authors attempt to determine whether countries that produce diamonds increase their chance of experiencing conflict. The authors use a dummy variable to differentiate between countries that produce diamonds and those that do not. This method has two advantages. First, their measure of abundance eliminates the need to account for a non-monotonic relationship between resources and conflict. Second, the dummy variable for the production of diamonds is exogenous. It is realistic to believe that countries involved in conflict will not shift from producers of diamonds to non-producers immediately. The evidence found by Lujala et al. suggests that in general, diamonds have no affect on conflict[3].

[3] Arguably, aggregation of resources tends to bias the results. When focusing on methods of production, Lujala et al. find that primary diamonds are a blessing whereas secondary diamonds are a curse.

Responding to criticism, Collier and Hoeffler (2005) examine the relationship between resources and conflict using a rent-based measure. Measuring resource abundance through resource rents satisfies the mechanism by which rebels initiate conflict through the motivation of greed. The conclusion from their analysis is less significant than their previous result that finds resource abundance leads to more civil conflict.

In a recent paper, Brunnschweiler and Bulte (2009) argue for an improved measure of resource abundance. The main findings turn received wisdom upside down. To proxy for resource abundance, the authors use a stock variable that captures the discounted value of the future flow of resource rents. This measure of resource abundance captures the relative inventory of resources in a country and the degree to which rebels are motivated by greed to finance conflict. The key result found is that there exists a significant negative relationship between resource abundance and the onset of civil conflict. Resource rich countries have a lower probability of entering into civil war -- natural resources are a blessing. However, the authors present a caveat to their results in that their measure of resource abundance fails to include some of the most contested natural resources.

No single measure of resource abundance has yet to provide conclusive support for either a resource curse or resource blessing. Nevertheless, we must still focus on what are considered to be the most contestable resources with regards to fuelling civil conflicts.

2.3. Which natural resources do you consider?

The conventional measure of resource abundance fails to capture the most sought after resources fuelling conflict (diamonds and other minerals), as natural resources are extorted and

illicitly transferred through borders to aid rebels. De Soysa (2002) finds evidence to suggest that the incidence of conflict is not related to total resource wealth, but strongly related to mineral wealth. It is not natural resource abundance per se, but an abundance of particular resources that influences conflict.

There is evidence to suggest that countries rich in opium, diamonds, or oil tend to experience longer civil wars (Fearon, 2004). Based on economic value, natural resources are all subject to rent seeking by rebels. However, it has been argued that resources only vulnerable to rent seeking do not pose a threat to conflict. Ross (2004) suggests that the degree to which natural resources can be captured explains why some resources exhibit the resource curse and others do not. According to Ross, the natural resources most likely to be captured are: coca, timber, opium, and alluvial gems. The production of these resources is associated with very low investment costs and requires minimal technology and skill, making it viable for rebels to capture. For example, if rebels must go through the process of extracting oil from large multinational companies, in most cases, rebels will be unsuccessful in their attempts.

Motivated by Ross' theoretical framework Lujala, Gledistch, and Gilmore (2005) study the link between diamonds and conflict. The authors distinguish between primary diamonds and secondary diamonds. As the production of primary diamonds involves high capital investment and skilled labour, primary diamonds are only vulnerable to rent seeking. In contrast, the production of secondary diamonds can be done using artisanal techniques and does not require the massive infrastructure necessary to produce primary diamonds. Using diamond production as a measure of resource abundance captures the extent to which a

country has diamonds that are truly vulnerable to capture by rebels. The central result of Lujala, Gledistch, and Gilmore's work suggests that the production of diamonds has no effect on the likelihood a country is involved in civil conflict. However, once distinguishing between primary and secondary diamonds, the authors find evidence to suggest Ross' theory is applicable to diamonds. Primary diamonds can be considered a blessing in the sense that countries that produce primary diamonds lower their probability of experiencing conflict. Countries that produce secondary diamonds are considered to be in a resource curse. The reason is simple. Rebels motivated by greed are able to capture secondary diamonds and use them to their advantage; the resource rents can are used to both finance and prolonged conflict.

2.4 Measuring conflict

The controversy that surrounds the initial results of a natural resource curse is not restricted to which resources influence conflict, but also the type of civil conflict resources are able to influence.

Using Collier and Hoeffler's work as a starting point, Reynal-Querol (2002) examined whether natural resources prompted countries divided along ethnic lines to engage in conflict. Using the same proxy for resource abundance as Collier and Hoeffler, natural resources explain the incidence of non-ethnic civil wars but not ethnic civil wars. This finding suggests that the availability of natural resources did not cause countries to be mired in ethnic conflict. However, natural resources are still a curse in countries where conflict is between the state and an opposition group. The importance of Reynal-Querol's work stresses the bias that may arise by generalizing the type of civil war a country experiences.

The strong relationship witnessed between resource abundance and the onset of civil war also depends on the particular civil war database used. The Correlates of War (COW) dataset is used in Collier and Hoeffler's (1998) influential contribution, when it was found that resources are a curse. The COW dataset codes civil wars once a threshold level of 1000 battle-deaths is exceeded (Singer, 2002). In contrast, the Uppsala Conflict Data Program (UCDP) codes civil wars at a threshold level of 25 battle-deaths (UCDP, 2009). The UCDP is the most recently updated dataset of civil wars and was initially developed by Gledistch et al. (2002). By using a lower threshold of battle-deaths, the UCDP dataset is able to report more instances of conflict compared to the COW dataset. Thus, the magnitude or number of conflicts in a sample may wash out the effect of natural resources on conflict as shown by Lujala, Gledistch, and Gilmore (2005).

2.5 Gold and Civil Conflict

Since no paper explicitly studies the relationship between gold and conflict, using what is already known about natural resources and conflict provides a framework for evaluating whether gold exhibits a resource curse. The contribution of my paper is twofold. First, concentrating on gold allows for a richer analysis of the link between natural resources and conflict. Second, this paper offers a novel attempt to show whether a link between conflict and the production of gold exists. I proceed by conducting an empirical study that takes into account various disputes in the literature as mentioned above. The data and methodology is outlined in the next section.

3. Data

Instead of focusing on the relationship between all natural resources and conflict, I consider a resource which has the potential to influence conflict -- gold.

To correctly measure a countries relative abundance of gold, I adopt the strategy presented by Lujala, Gledistch, and Gilmore (2005). Data on primary gold production is available from the United States Geological Survey (2011) and is collected for the years 1998 to 2009. During that 12 year time span, 100 countries were reported to produce primary gold. Data for secondary gold production is available for 2009 and provided as rough estimates[4] from the Artisanal Gold Council's Mercury Watch (2009) database. Based on the Mercury Watch database 70 countries are reported to produce artisanal gold.

The empirical strategy was to create a dummy variable that distinguishes between countries that produce gold and those that do not. Using the World Bank (2012) list of countries, and eliminating countries due to missing observations, the analysis contains 190 countries. Elimination of countries due to missing data does not affect the results. Most of the countries eliminated from the dataset do not report experiencing conflict during the time period of interest.

Interpretation of the gold dummy variable is straightforward. The variable captures the extent to which a country is endowed with gold. It is assumed that a country that produces gold has an abundance of gold; thus, subject to a resource curse. One limitation of the gold variable

[4] Due to the informality of the artisanal gold sector, production is estimated using a 3 to 1 ratio of mercury use to gold production. As this is a large assumption, the data and results with regards to secondary gold production should be interpreted with caution.

is that it is unable to differentiate between countries that have a greater abundance of gold. However, using this measure determines whether countries that produce gold increase their likelihood of experiencing conflict.

In order to explain conflict, I use the UCDP Armed Conflict dataset which has been recently updated in 2009. Armed conflict is defined as "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths" (UCDP, 2009, p. 1). The definition of armed conflict used may limit certain conflicts that have historically occurred. Presumably, conflict may occur between two parties without government involvement. The UCDP dataset differentiates between the types of conflict that occur[5]. Since armed conflict is a rare event, I aggregate all types of reported conflict from 1998 to 2009 to analyze the general relationship between the production of gold and conflict. This modification results in 55 countries being involved in armed conflict at any point in time between 1998 and 2009.

As noted in the literature, conclusions drawn from empirical analysis may be subject to the database of conflict used; no remedy is available to address this critique. The dataset compiled by the Correlates of War Project (COW) reports conflict until the year 2007, reducing the time period my analysis can explain. For comparison purposes, using the COW armed conflict dataset is left for future work.

[5] UCDP reports 4 types of conflict: extrasystemic armed conflict, interstate armed conflict, internal armed conflict, and internationalized internal armed conflict.

Naturally, it may be tempting to control for all factors that may influence conflict. To simplify the analysis, I focus on the key determinants of conflict that have been proposed in the literature. The main determinants include socioeconomic, economic, and governance features.

The existing literature provides evidence to suggest that countries with higher population heterogeneity are more prone to conflict (e.g. De Soysa, 2002; Lujala et al. 2005). Data on socioeconomic features is taken from Alesina et al. (2003). The variables I use are ethnic fractionalization and religious fractionalization. Both of these variables measure the degree of a given populations heterogeneity[6]. One caveat is that the data from Alesina et al. is time invariant. Country measures of ethnic and religious fractionalization are reported within the past 15 years at worst[7]. The data is not ideal, but it provides an approximation of fractionalization within a country. A higher estimate of both ethnic and religious fractionalization is associated with greater population heterogeneity.

Using governance indicators, Fearon (2010) finds that countries perceived to have poor quality governance have a greater risk of experiencing conflict. Data on institutional quality is taken from the World Governance Indicators (The World Bank Group, 2011). Data is collected for the survey years 1998 to 2009. The institutional quality indicators include six dimensions related to perceived quality of governance. In this paper, I focus on the importance of perceived corruption. The control of corruption variable "measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well

[6] Variables reflect the probability that two randomly selected individuals from a population belong to different ethnicities/religious beliefs. Measured as 1 minus the Herfindahl index of ethnic group/religious group share.
[7] I assume that measures of ethnic and religious fractionalization on average have not drastically changed since these figures were reported.

as capture of the state by elites and private interests" (The World Bank Group, 2011). The literature argues that government corruption is one key to understanding the natural resource curse. A government that is highly corrupt is more able to exercise power over mining companies, thus taking control of the resource rent coming from the industry. Rebel uprising and armed conflict could arise due to government self interest. Thus, it is expected that countries that are perceived to be corrupt are more likely to experience conflict.

Information on more conventional measures for a country is also gathered. Reported figures of both GDP and population are taken from the World Bank Development Indicators (2011). I measure a countries income using the log of per capita GDP. Using this functional form reduces the effect of outliers in the data that may influence the results. The size of a countries population is measured in millions of people.

Finally, I use an indicator for the percentage of mountainous terrain in a country which is available from Lujala et al. (2005). It is suggested that countries with a larger proportion of mountainous terrain allow rebels to lengthen conflict by resisting capture and finding refuge in those areas. Accordingly, it is anticipated that countries with higher mountainous terrain have an increased risk of experiencing conflict.

The complete dataset contains 2280 observations for 190 countries during the period 1998 to 2009. The dataset offers a number of advantages over previous datasets used to analyze the natural resource curse. First, the natural resource variables that I have created measure resource abundance rather than resource dependence. Distinguishing between countries that produce gold and those that do not help identify whether gold can be considered

a curse. Recall, using the ratio of primary commodity exports to GDP measures a countries dependence on the primary sector; my data does not fall into this trap. Second, the data for gold is reported as the magnitude of production. The magnitude of gold production allows me to create a measure of resource rents similar to Collier and Hoeffler (2005); this measure is considered as a robustness check. In addition, the presence of the key determinants of conflict allows a direct comparison to previous literature. Lastly, the dataset contains information for 190 countries (all with different characteristics) which reduces the bias of focusing on countries that only produce gold or experience conflict.

Unfortunately, there are limitations to the dataset. Using 12 year panel data allows me to interpret the relationship of gold and conflict between 1998 and 2009. Arguably, the extent to which the production of gold has influenced conflict may include implications from the 19th century. Limited by the data, I am unable to take into account historical events that may influence how gold is produced today. As noted by Acemoglu, Johnson, and Robinson (2001), differences in colonial experiences could be one source of variation in how institutions function today. In an effort to account for historic events I include dummy variables to distinguish between previous British and French colonies. Arguably, colonial dummies for other countries (Belgium, Netherlands, and Spain) are equally as important if they are considered to be more exploitative. However, I leave those considerations for future work.

Also, I am limited to a cross-section analysis that separates the effect of primary and secondary gold production on conflict[8]. A cross section analysis may not prove to be useful, as the relationship between gold and conflict may only exist over time. However, the analysis

[8] The analysis of resource type is limited because data on artisanal gold production is only available for 2009

allows for a direct comparison with previous research and mitigates the bias that may arise by aggregating the type of resource production.

Even though the dataset provides a focused analysis of the link between gold and conflict, the data itself may not be precise. Both the USGS and AGC attempt to best report country by country gold production. Some of the figures are best estimates, especially for smaller countries who fail to report this data. To increase the reliability of production estimates I focused on whether a country produced or did not produce gold. The presence of gold production in a country is easier to infer than the actual magnitude of production. Nevertheless, the results reported here should be interpreted with caution.

Table 1 reports the descriptive statistics of the key variables in the dataset. Columns (1) and (2) report the mean and standard deviation of the main determinants of conflict using the full sample of countries. Columns (3) and (4) restrict the sample to countries that produce primary gold and countries that do not produce primary gold, respectively. Column (5) calculates the mean difference between the two samples. A summary of the raw data documents the relationship I am attempting to explain -- countries that produce primary gold between 1998 and 2009 experience armed conflict 11.2% more compared to countries that do not produce primary gold. Producers of primary gold exhibit many of the characteristics claimed to promote conflict. On average, countries that produce primary gold have lower GDP, larger populations, more mountainous terrain, higher ethnic fractionalization, and higher

perceived corruption[9]. The raw data is consistent with the idea that the production of gold may be linked to conflict.

Table 2 reports the summary statistics restricting the analysis to 2009 and artisanal gold production. The standout result can be seen in column (5) which reports the mean difference between producers and non-producers of artisanal gold. On average, countries that produce artisanal gold experience conflict 12.3% more than countries that do not produce.

Table 3, column (5) reports the mean difference between producers and non-producers of primary gold in 2009. Consistent with the data from 1998 to 2009, countries producing primary gold exclusively in 2009 experience conflict 9.2% more on average than those that do not produce.

4. Empirical Methodology

The empirical specification used to estimate the relationship between the production of gold and conflict takes the following form:

$$conflict_{c,t}{}^{*} = \alpha + \beta * natural\_resources_{c,t} + \gamma * control\_variables_{c,t} + \varepsilon_{c,t} \qquad (1)$$

where *c* and *t* correspond respectively to country and year. The key variable of interest *natural_resources* includes the dummy variables of gold production. The set of *control_variables* includes the determinants of conflict covered in the previous section. A full set of all available controls in the dataset can be found in the appendix.

[9] A higher value for corruption is associated with less perceived corruption. The negative value implies countries that produce gold are perceived as more corrupt

4.1. Primary model

The above specification is estimated using a random effects[10] logistic regression[11]. Once the model is estimated, the dependent variable of interest is unobservable; it is only known whether conflict occurred (y=1) or not (y=0). The dependent variable is interpreted as the threshold level for experiencing conflict. If the determinants of conflict in the model cause the dependent variable to exceed the threshold, the country experiences armed conflict. Alternatively, an estimate that is below the threshold level corresponds to no conflict. Therefore, the outcome of the model can be defined as:

$$conflict = 1, if\ conflict^* > 0 \quad (2)$$

$$conflict = 0, if\ conflict^* < 0 \quad (3)$$

The theoretical relationship between natural resources and conflict presented by Ross (2004) suggests that the production of primary resources reduces the likelihood a country experiences conflict. Production of primary gold requires countries to invest heavily into infrastructure and labour costs. Much of the investment needed to produce primary gold is borne through large multinational corporations. Because the production of primary resources relies on highly technical procedures, Ross argues that primary resources are safeguarded from rebels. Primary gold is considered subject only to rent seeking; hence, not advantageous for rebels motivated by greed.

[10] Using a random effects model is a strong assumption. A fixed effects specification is preferable but not used because several of the explanatory variables do not display variation over time. Estimating a fixed effects model renders some of the results of the baseline model insignificant, although the signs of the variables remain consistent. Therefore, results stemming from the random effects logit should be interpreted with caution. I include an estimation of the baseline model using fixed effects logit as a comparison.

[11] The coefficient estimates resulting from a logistic regression only provide the expected sign of impact. In this paper I report only the marginal effects of the baseline results.

To test Ross' claim that primary resource production reduces the likelihood of conflict, I use the dummy variable for primary gold to uncover the relationship between the production of gold and conflict from 1998 to 2009. The preliminary findings are compared to existing literature. In order to readily compare my results with Lujala et al., I include a dummy variable for primary diamond production as an extension to the model[12].

The baseline specification (1) only includes a selection of control variables from the dataset. The reason for this simplification is to reduce the probability that high correlation between explanatory variables may affect the results. For example, corruption and government effectiveness are both proxies for perceived institutional quality; thus, government effectiveness is dropped from the baseline model[13]. Using a restricted and simplified model creates a situation where it is more difficult that the model exceeds the threshold level of experiencing conflict. Simply put, countries are more likely to experience conflict if they exhibit several of the characteristics associated with conflict (for example, low GDP and high population).

4.2. Secondary model

To consider whether secondary resources are linked to the resource curse, I use a dummy variable for artisanal gold production to test whether artisanal gold is subject to rent capture by rebels. In this case, I estimate equation (1) using logit regression where the outcome of the model is identical.

[12] Data for primary diamond production is available from the United States Geological Survey
[13] As a sensitivity check, I employ different model specifications that include all explanatory variables in the dataset.

As Ross argues, rebels have greater accessibility to secondary resources because of how secondary resources are produced. Artisanal gold production requires minimal investment and skilled labour; the only tools necessary are a shovel and pan. Since rebels have fewer barriers to go through, secondary gold can be captured by rebels to finance conflict. Unfortunately, the availability of data for secondary gold only allow for a cross section analysis that distinguishes between the production of primary and secondary gold. The advantage of extending the analysis results in a straightforward comparison to work presented by Ross and Lujala et al.

5. Results & Discussion

To see how suitable my empirical specification is, I decide to test how well my dataset is able to replicate the results found by Lujala, Gledistch, and Gilmore (2005, Table 3, p. 17). The dependent variable used in my reproduction is conflict during the period 1998 to 2009. Following Lujala, Gledistch, and Gilmore, I include estimates of GDP per capita, population, mountainous terrain, institutional quality, fractionalization, and primary diamond production. The estimation results are presented in table 4. They confirm my prior expectations: higher population, mountainous terrain, corruption, and ethnic fractionalization all increase the probability of experiencing conflict. However, the statistical significance is mixed. The key result here is the sign of impact on primary diamond production – it is negative and insignificant, which is consistent with Lujala et al.'s result. Lujala, Gledistch, and Gilmore's results are presented in table 5 for comparison. Note that the sign of impact of the determinants of conflict appear to be consistent with the exception of religious fractionalization[14]. Lujala et al.'s

[14] It is possible that the relationship among religious beliefs and conflict has diminished in recent decades.

general conclusion is that the production of primary diamonds can be considered a resource blessing.

5.1. Primary gold and armed conflict

I now investigate the relationship between the production of primary gold and conflict using a simplified specification. Table 6 reports the estimates and marginal effects for the baseline specification. The first row of column (1) summarizes the main finding: primary gold production is positive and statistically significant at the 5% level; countries that produce primary gold are subject to more civil conflict. However, the economic significance is quite weak -- production of primary gold increases the risk of conflict by 0.6%.

The finding that primary gold production leads to a higher probability of experiencing conflict is counterintuitive to economic theory. The expectation that primary resources are subject only to rent seeking is not consistent with primary gold. The inconsistency could be attributed to the availability of primary gold versus primary diamonds, as the availability of primary gold in over 100 countries worldwide may explain the resource curse. The occurrence of primary gold production compared to primary diamond production may mean that rebels have greater opportunities to extort and exercise their power over multinational corporations.

The mechanism through which primary gold influences conflict is unclear. It is difficult to reconcile that primary gold production is associated with conflict when economic theory suggests otherwise. Possible mechanisms to consider could be the differences between the production processes of gold and diamonds. The production of primary gold may require, to some degree, less investment and infrastructure than the production of diamonds. Since

diamonds are arguably rarer and a more desired mineral, there is greater security in the production of primary diamonds; ultimately leading to rebels targeting gold instead. Another reason as to why gold may exhibit a curse is because gold is a fungible mineral. It is substitutable and can easily be remoulded, making it very difficult to track. The same can not be said of diamonds; mineral transformation of diamonds is rather unlikely.

Ultimately, the mechanism under which gold can influence civil conflict may be due to institutions and the degree to which governments are able to harness political stability. According to Hall and Jones (1999) "a country's long-run economic performance is determined primarily by the institutions and government policies that make up the economic environment" (p.114). Consider a weak states mechanism by which the government has minimal control over its population. As the government works together with multinational corporations to set up large scale gold mining, conflicts may arise. This has been seen in Papua New Guinea where the Porgera Gold Mine has led to rebel grievances (Moore, 2010).

The possibility that gold exhibits a resource curse in my model is quite striking given the political circumstance surrounding gold today. Recall, the World Gold Council recently proposed an initiative to track the production of large scale gold mining to limit the consequences of a resource curse. As of March 2012, the World Gold Council has unveiled their second draft initiative and is committed to implementing the final conflict-free gold standard soon (World Gold Council, 2012). The main result found in this paper suggests that an initiative to stop gold production that fuels conflict should not be implemented, given that the overall impact that the WGC hopes to mitigate is small.

To ensure that the baseline results are not driven by other determinants of conflict, the model is estimated under different specifications. To allow for straightforward comparison to Lujala et al., I include primary diamond production in all specifications. Table 7 reports the results of the subset of specifications[15]. Column (1) includes dummy variables that account for regional and colonial effects. Column (2) incorporates the 6 perceived institutional quality variables. Column (3) includes religious fractionalization; and column (4) includes oil production. There are no significant changes to the baseline results. The key variable of interest - primary gold production - remains positive and statistically significant in 3 out of the 4 specifications. The presence of all 6 perceived institutional quality measures removes the statistical significance of primary gold production; high correlation between the institutional quality measures may affect this result. The dummy variable for primary diamond production is consistently negative and statistically significant at the 10% level. Primary diamond production is a blessing. Estimating the model to account for former British and French colonies does not affect the main results; conflict prone African countries and developing countries also do not shift the results.

5.2. Resource type and armed conflict

The model used in the following analysis follows the baseline specification used to estimate the panel component of primary gold production. Previous literature has cited the negative relationship between secondary resources and conflict (e.g. Ross, 2004). Since secondary gold is considered vulnerable to resource capture, secondary gold is more likely to

[15] Table 7 only reports the coefficients of the baseline model including primary diamond production. The various explanatory variables included in each specification are left out of the table for clean presentation.

promote conflict. The previous finding of my research - primary gold may be a curse - necessitates an analysis of secondary gold to see if the effect is consistent with economic theory.

The results are reported in table 8. Column (1) reports the expected sign and significance of the coefficient estimates. Primary gold production remains positive (0.101) but is now insignificant. Interestingly, artisanal gold production is negative albeit insignificant. This appears to be another confounding result. However, the impact of primary and secondary gold production on conflict is quite small. Column (2) reports the estimated impact of the explanatory variables. There is an increase of 1.2% and decrease of 3.4% in the probability of experiencing conflict from producing primary and secondary gold respectively.

Consistent with prior literature, primary diamond production is negative and significant at the 10% level – primary diamond production reduces conflict by 13.1%. Also, the effect of ethnic fractionalization is significant and positive. Countries that have high ethnic heterogeneity increase their probability of experiencing conflict by 31.4%[16] which is significant at the 5% level.

The finding that secondary gold is a blessing is consistent with arguments made by Telmer and Veiga (2009) that artisanal gold can benefit small community development. Recent estimates made by Telmer and Veiga suggest that the artisanal gold sector is made up of over 10 million miners and accounts for at least 15% of total gold production (this number is consistent with my dataset). They argue that artisanal gold mining is an improvement for

[16] One caveat to these results: the estimation only accounts for the year 2009. The estimates and marginal effects should change once a larger time horizon is considered. One would expect that over time countries are able to build social cohesion to reduce the impact of ethnic fractionalization on conflict.

development, in that miners on average earn 5$ a day; in comparison to earning below the poverty line of 1$ or 2$ a day.

Arguably, one may posit that artisanal gold production is a proxy for large scale gold production. In areas where artisanal gold exists, multinational corporations may find it viable to invest into those regions. Through a weak states mechanism, gold may exhibit a resource curse and lead to an increase in conflicts.

Table 9 reports the coefficient estimates of different specifications to check if the baseline model leads to spurious results. Columns (1) to (4) represent inclusion of several variables to the baseline model. Those considerations are regional and colonial effects, institutional effects, religious fractionalization, and oil production. The estimated signs on both primary and secondary gold production are inconsistent with previous findings; the sign of the coefficient depends on the empirical specification. The mixed results may suggest that the relationship between gold and conflict may only exist over time. This is reasonable given the fact that the dependent variable (conflict) exhibits greater variation over time. Therefore, attempting to estimate a relationship between the determinants of conflict and conflict in a given year may be irrelevant[17]. I leave it for future work to collect enough data on secondary gold production to distinguish between resource types in a panel setting.

However, throughout all 4 specifications primary diamond production remains consistently negative and can be considered a resource blessing. The inconsistent results for my

[17] The contradictory and insignificant results may partially be due to the limited number of observations used.

gold production variables may suggest that gold is a weak predictor of conflict in general. Possibly one reason as to why "conflict gold" has failed to gain significant political attention.

6. Sensitivity Analysis

6.1. Random-effects versus Fixed-effects

A random-effects logistic estimator is used to estimate the primary model of interest. A random effects estimator assumes that unobserved country specific variation is uncorrelated with the error term. In reality, such an assumption is hard to justify. One would expect that participation in the labour force (unobserved in my model) may affect the size of the rebel opposition, in turn influencing the likelihood a country experiences conflict. It is preferable to employ a fixed-effects estimator to account for the unobserved country specific characteristics; however, many of the explanatory variables in my dataset are time-invariant and result in a reduction in the number of observations. Estimates from using a random-effects estimator should thus be interpreted with caution.

To defend the use of a random-effects logistic estimator, I estimate the baseline primary model using a fixed-effects estimator. The baseline model does account for country specific differences but other unobserved facets may remain. Thus, Table 10 provides a way to examine whether there exists unspecified country specific heterogeneity. The first row of table 10 reports the expected sign and significance of primary gold production. Under both estimators, primary gold production is consistently positive and significant at the 5% level.

Table 11 reports the outcome of a Hausman Test (1978) to identify whether a random-effects or fixed-effects estimator is supported. Under the null hypothesis, both the random-

effects and fixed-effects estimator is efficient and consistent. Under the alternative hypothesis, only the fixed-effects estimator is supported. The results in table 11 provide a p-value of 0.07. Therefore, I cannot reject the null hypothesis at 5% significance and conclude that using a random-effects estimator is appropriate. Since there is weak evidence for supporting a random-effects estimator, subsequent work will attempt to account for unobserved country specific variation.

6.2. Potential endogeneity of GDP per capita

Arguably, several of the variables in my model used to explain conflict may be endogenous. For instance, if a country experiences conflict, we would expect GDP to increase as a result of increased military support. As a first step, I examine whether GDP is in fact endogenous in my model.

To simplify the analysis, I restrict my attention to the secondary model for 2009. Table 12 reports the coefficient estimates of both the linear probability model (LPM) and logistic regression[18]. As the estimated sign and significance of the variables are consistent across both models, I proceed by using a LPM. To rectify the potential endogeneity of GDP I compare the LPM results to that of a standard instrumental variables (IV) approach.

Following Pritchett and Summers (1996), I use a ratio of investment to GDP[19] as an instrument for GDP per capita. To be a valid instrument I assume that the level of investment is correlated with GDP but uncorrelated with unobserved factors that may influence the

[18] Because panel IV or IV logit make econometric specification and implementation difficult, I check to see whether I can use a LPM (which is an application of OLS).
[19] There are 166 country observations for the ratio of investment to GDP (Economy Watch, n.d.)

likelihood a country experiences conflict. Table 13 reports the Hausman Test for exogeneity of GDP. Columns (1) and (2) report the coefficient estimates of the LPM and IV respectively. The suggestion that GDP may be endogenous does not hold as the estimates remain consistent from the LPM to IV. The outcome of the Hausman Test suggests not rejecting the null hypothesis (p-value=0.860); it implies that GDP is exogenous in the model. The conclusion that GDP is exogenous is not satisfying. The result could be due to using the ratio of investment to GDP as an instrument for GDP.

It would be interesting to see if GDP remains exogenous with the use of other instrumental variables suggested by Pritchett and Summers, such as the change in the terms of trade, deviation from the exchange rate, and a black market premium for the foreign exchange rate. I leave this task for future work.

6.3. Specification of resource abundance

As suggested by previous literature, the resource curse is sensitive to the specification of resource abundance. Table 14 reports the relationship between the production of primary gold and conflict using a measure of resource rents[20]. The estimated impact of primary gold production is positive (0.068) suggesting that gold exhibits a resource curse. However, measuring primary gold production by using resource rents proves to be insignificant. The result highlights the importance of specifying resource abundance -- gold exhibiting a resource curse fails to be robust.

[20] I created a measure of resource rents based on the magnitude of gold production. For example, the country that produced the most gold in a given year had the highest value of resource rent.

7. Conclusion

Using a standard civil war logit model to estimate the relationship between gold and conflict, I find that the production of primary gold increases the likelihood that a country experiences conflict. Primary gold exhibits a resource curse. However, the economic impact is quite small – producing primary gold increases the risk of conflict by 0.6%. The main result provides evidence that contradicts the theory presented by Ross (2004): primary resources reduce the likelihood of conflict.

Since the impact of gold is small, it is possible that the value of gold is not enough of a motivator for rebels. Thus, gold is unsuccessful in helping rebels finance conflict. The evidence presented in this paper suggests that the impact of gold is negligible in influencing conflict.

Contrary to work by Collier and Hoeffler (1998), the results here imply that a systematic natural resource curse fails to be robust to different specifications. Even though producing primary gold is associated with a higher probability of conflict, the effect is so small that we cannot consider gold as a resource curse. There is a growing consensus in the literature that stresses the importance of finding the correct measure of resource abundance. Until that measure is found, it is likely that researchers will continue to provide mixed evidence on the resource curse.

Unfortunately, a lack of long-term data prevents a direct analysis of artisanal gold's effect on conflict. As argued by Telmer and Veiga (2009), secondary gold production can provide economic benefits for rural communities. A next step would be to determine the

impact of artisanal gold production on economic growth and if we can consider artisanal gold as a resource blessing.

From a policy perspective, future work devoted to inferring a causal relationship between gold and conflict is crucial. In fact, the causal relationship may be attributed to the mineralization of gold. The mechanism through which the presence of gold has led to colonization and presumably to the type of institution may be the reason why gold exhibits a resource curse.

Currently, there already exists a certification scheme (The Kimberly Process) for the production of primary diamonds; a similar initiative appears to be on the horizon for primary gold. Before policy makers implement an initiative that helps stop gold that fuels conflict, they should understand that the cost of doing so may far exceed the benefit. The relationship between natural resources and civil conflict is complex. Is gold a resource curse or a resource blessing? Understanding the mechanisms through which gold is able to influence conflict remains a puzzle -- I envy the researcher who is able to find the piece that solves it.

Appendix I.

Table 1. ---Summary Statistics; Primary Gold

	(1)	(2)	(3)	(4)	(5)
	Full Sample		Producers	Non-Producers	Producers vs. Non-Producers
Variable	Mean	S.D	Mean	Mean	Mean Difference
Outcome Variables					
Conflict	0.137	0.344	0.194	0.082	0.112***
Explanatory Variables					
ln GDP	7.964	1.649	7.576	8.335	-0.759***
ln population	8.595	2.089	9.564	7.669	1.895***
ln mountainous	1.893	1.611	2.131	1.579	0.552***
ethnic fractionalization	0.439	0.257	0.500	0.376	0.124***
corruption	-0.040	1.011	-0.241	0.152	-0.393***

Note: Summary Statistics reflect sample of roughly 2280 observations from 190 countries over the period 1998-2009. Columns 1 and 2 report information for raw data covering the whole sample. Columns 3 and 4 summarizes the sample based on whether a country produces large scale gold or not. Column 5 reports the mean difference between the two samples in columns 3 and 4. The explanatory variables listed represent a subset of the control variables used in this analysis. * significant at 10%; **significant at 5%; ***significant at 1%

Table 2. ---Summary Statistics ; Artisanal Gold

	(1)	(2)	(3)	(4)	(5)
	Full Sample		Producers	Non-Producers	Producers vs. Non-Producers
Variable	Mean	S.D	Mean	Mean	Mean Difference
Outcome Variables					
Conflict	0.168	0.375	0.246	0.123	0.123**
Explanatory Variables					
ln GDP	8.383	1.556	7.488	8.925	-1.437***
ln population	8.678	2.092	9.696	8.097	1.599***
ln mountainous	1.893	1.616	2.212	1.633	0.579**
ethnic fractionalization	0.439	0.258	0.574	0.357	0.217***
corruption	-0.037	1.016	-0.481	0.216	-0.697***

Note: Summary Statistics Reflect sample of 190 countries over the period 2009. Columns 1 and 2 report information for raw data covering the whole sample. Columns 3 and 4 summarizes the sample based on whether a country produces artisanal gold or not. Column 5 reports the mean difference between the two samples in columns 3 and 4. The explanatory variables listed represent a subset of the control variables used in this analysis. * significant at 10%; **significant at 5%; ***significant at 1%

Table 3. ---Summary Statistics ; Primary Gold

	(1)	(2)	(3)	(4)	(5)
	Full Sample		Producers	Non-Producers	Producers vs. Non-Producers
Variable	Mean	S.D	Mean	Mean	Mean Difference
Outcome Variables					
Conflict	0.168	0.375	0.212	0.120	0.092*
Explanatory Variables					
ln GDP	8.383	1.556	8.062	8.745	-0.683***
ln population	8.678	2.092	9.659	7.611	2.048***
ln mountainous	1.893	1.616	2.120	1.530	0.590**
ethnic fractionalization	0.439	0.258	0.495	0.372	0.123***
corruption	-0.037	1.010	-0.261	0.206	-0.467***

Note: Summary Statistics Reflect sample of 190 countries over the period 2009. Columns 1 and 2 report information for raw data covering the whole sample. Columns 3 and 4 summarizes the sample based on whether a country produces large scale gold or not. Column 5 reports the mean difference between the two samples in columns 3 and 4. The explanatory variables listed represent a subset of the control variables used in this analysis. * significant at 10%; **significant at 5%; ***significant at 1%

Table 4. --- Logit Estimation using Lujala et al. specification n=190

Dependent Variable: Conflict, 1998-2009	Coefficient	Std. Error
ln GDP per capita	-0.317	0.216
Ln Population	1.119***	0.268
Ln Mountainous Terrain	0.317	0.234
Corruption	-0.557	0.387
Ethnic Fractionalization	4.905***	1.665
Religious Fractionaliztion	-2.684*	1.583
Production Primary Diamonds	-0.821	0.692

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Table 5. --- Results from Lujala, Gledistch, and Gilmore (2005) n=161

Dependent Variable: Conflict, 1945-1999	Coefficient	Std. Error
Per Capita Income	-0.334***	0.075
Population (log)	0.249***	0.061
Mountainous Terrain (log)	0.237***	0.088
Instability	0.593***	0.215
Ethnic Fractionalization	0.158	0.343
Religious Fractionaliztion	0.310	0.530
Production Primary Diamonds	-0.185	0.409

Notes: *significant at 10%; **significant at 5%; ***significant at 1%

Table 6. --- Impact of Large Scale Gold Production on Conflict using RE logit Model

Dependent Variable: Conflict	Coefficient Estimates (1)	Marginal Effects (2)
Large Scale Gold Production	0.983**	0.006
	(0.495)	(0.004)
Log of GDP per capita	-0.261	-0.002
	(0.217)	(0.001)
Population	0.005**	0.000*
	(0.002)	(0.000)
Log Mountainous	0.497**	0.003*
	(0.237)	(0.001)
Ethnic Fractionalization	3.989**	0.027*
	(1.750)	(0.014)
Corruption	-0.613	-0.004
	(0.387)	(0.003)
Constant	-6.615***	-
	(2.28)	-
Log likelihood	-382.28	-
Obvs.	1770	-
Wald	29.37***	-

Notes: Column 1 shows the coefficient estimate and direction of magnitude for the explanatory variables. Column 2 reports the estimated impact of the variable. Standard errors are reported in parenthesis.
*significant at 10%; **significant at 5%; ***significant at 1%

Table 7. --- Different specifications of the primary model, 1998-2009

Dependent Variable: Conflict	Inc. Regional and Colonial (1)	Inc. Institutional Qual (2)	Inc. Rel Frac (3)	Inc. Oil (4)
Large Scale Gold Production	0.954*	0.556	1.047**	1.187**
	(0.501)	(0.535)	(0.498)	(0.517)
Primary Diamond Production	-1.380*	-1.210*	-0.954	-1.264*
	(0.730)	(0.713)	(0.725)	(0.718)
Log of GDP per capita	-0.136	-0.065	-0.234	-0.125
	(0.248)	(0.243)	(0.219)	(0.234)
Population	0.007***	0.003*	0.007***	0.007***
	(0.002)	(0.001)	(0.002)	(0.002)
Log Mountainous	0.544**	0.068	0.394*	0.448*
	(0.259)	(0.197)	(0.238)	(0.245)
Ethnic Fractionalization	3.390*	2.293	5.138***	4.722**
	(1.969)	(1.405)	(1.836)	(1.873)
Corruption	-0.676	0.803	-0.520	-0.658*
	(0.419)	(0.702)	(0.390)	(0.396)
Constant	-7.253**	-6.373***	-5.572**	-7.499***
	(2.981)	(2.287)	(2.375)	(2.394)
Log likelihood	-379.85	-286.86	-379.37	-379.87
Obvs.	1770	1770	1770	1770
Wald	35.41***	142.79***	35.28***	32.47***

Note: Table only reports coefficient estimates of the baseline model including primary diamond production. Standard errors are reported in parenthesis. *significant at 10%; **significant at 5%; ***significant at 1%

Table 8. --- Impact of Resource Type across countries in 2009

Dependent Variable: Conflict	Coefficient Estimates (1)	Marginal Effects (2)
Large Scale Gold Production	0.101	0.012
	(0.621)	(0.072)
Artisanal Gold Production	-0.288	-0.034
	(0.620)	(0.072)
Primary Diamond Production	-1.495*	-0.131**
	(0.788)	(0.051)
Log of GDP per capita	-0.146	-0.017
	(0.233)	(0.027)
Population	0.003**	0.000**
	(0.001)	(0.000)
Log Mountainous	0.291*	0.034*
	(0.161)	(0.019)
Ethnic Fractionalization	2.633**	0.314**
	(1.236)	(0.144)
Corruption	-0.510	-0.06
	(0.425)	(0.048)
Constant	-2.249	-
	(2.275)	
Log likelihood	-60.337	-
Obvs.	147	-
Pseudo R-squared	0.173	-

Notes: Standard errors are reported in parenthesis. *significant at 10%; **significant at 5%; ***significant at 1%

Table 9. --- Different specifications of the secondary model, 2009

Dependent Variable: Conflict	Inc. Regional and Colonial	Inc. Institutional Qual	Inc. Rel Frac	Inc. Oil
	(1)	(2)	(3)	(4)
Large Scale Gold Production	-0.014	-0.191	0.013	-0.108
	(0.638)	(0.825)	(0.651)	(0.682)
Artisanal Gold Production	-0.369	0.470	-0.272	-0.440
	(0.642)	(0.852)	(0.645)	(0.667)
Primary Diamond Production	-1.748**	-1.814*	-1.017	-1.304
	(0.830)	(1.075)	(0.829)	(0.843)
Log of GDP per capita	0.058	0.055	-0.209	-0.524*
	(0.314)	(0.339)	(0.245)	(0.281)
Population	0.003**	0.001	0.003**	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Log Mountainous	0.404**	0.163	0.288*	0.294*
	(0.184)	(0.219)	(0.166)	(0.174)
Ethnic Fractionalization	2.052	2.025	2.911**	3.081**
	(1.312)	(1.506)	(1.265)	(1.303)
Corruption	-0.687	0.059	-0.403	-0.248
	(0.497)	(1.161)	(0.448)	(0.473)
Constant	-4.203	-4.292	-0.863	1.520
	(3.315)	(3.089)	(2.407)	(2.621)
Log likelihood	-59.215	-43.256	-57.586	-53.826
Obvs.	147	147	147	147
Psuedo R-Squared	0.188	0.407	0.211	0.262

Note: Table only reports coefficient estimates of the baseline model including primary diamond production. Standard errors are reported in parenthesis. *significant at 10%; **significant at 5%; ***significant at 1%

Table 10. --- Comparison of Various Logit Estimation Techniques

Dependent Variable: Conflict	Random Effects (1)	Fixed Effects (2)
Large Scale Gold Production	0.983**	1.236**
	(0.495)	(0.616)
Log of GDP per capita	-0.261	-0.083
	(0.217)	(0.325)
Population	0.005**	0.050
	(0.002)	(0.033)
Log Mountainous	0.497**	-
	(0.237)	
Ethnic Fractionalization	3.989**	-
	(1.750)	
Corruption	-0.613	0.046
	(0.387)	(0.518)
Constant	-6.615***	-
	(2.28)	
Log likelihood	-382.28	-182.91
Obvs.	1770	488
Wald	29.37***	7.34

Notes: '-' represents variables not included due to being time-invariant. Column (1) displays results from a random effects logit model. Column (2) displays results from a fixed effects logit. Standard errors are reported in parenthesis. *significant at 10%; **significant at 5%; ***significant at 1%

Table 11. --- Comparison of Panel Estimation Methods

Hausman Test: Random-Effects vs. Fixed-Effects Estimator

Ho: Both RE and FE estimators are efficient and consistent
Ha: Only FE estimator is efficient and consistent

Chi-Square Statistic: 8.60
Degrees of freedom: 4
p-value = 0.0718

Conclusion: Cannot reject the null hypothesis. Using a random-effects estimator is appropriate.

Table 12. --- LPM and Logit Estimates of Experiencing Conflict

Dependent Variable: Conflict	LPM (1)	Logit (2)
Large Scale Gold Production	0.013	0.025
	(0.078)	(0.155)
Artisanal Gold Production	-0.028	-0.072
	(0.086)	(0.155)
Primary Diamond Production	-0.184**	-0.747*
	(0.090)	(0.197)
Log of GDP per capita	-0.026	-0.036
	(0.033)	(0.058)
Population	0.000**	0.000**
	(0.000)	(0.000)
Log Mountainous	0.038*	0.072*
	(0.020)	(0.040)
Ethnic Fractionalization	0.332**	0.658**
	(0.157)	(0.309)
Corruption	-0.024	-0.127
	(0.049)	(0.106)
Constant	0.205	-0.562
	(0.319)	(0.568)
Log likelihood	-	-60.337
Obvs.	147	147
Pseudo R-squared	0.378	0.173

Notes: Column 1 shows the coefficient estimate for LPM using robust standard errors. Column 2 shows scaled Logit coefficients (divided by 4). Standard errors are reported in parenthesis, and also scaled. *significant at 10%; **significant at 5%; ***significant at 1%

Table 13. --- Hausman: LPM and IV estimates (Instrument for GDP = Investment to GDP ratio)

Dependent Variable: Conflict	LPM (1)	IV (2)
Large Scale Gold Production	0.013	0.020
	(0.078)	(0.091)
Artisanal Gold Production	-0.028	-0.046
	(0.086)	(0.296)
Primary Diamond Production	-0.184**	-0.175
	(0.090)	(0.110)
Log of GDP per capita	-0.026	-0.067
	(0.033)	(0.447)
Population	0.000**	0.000**
	(0.000)	(0.000)
Log Mountainous	0.038*	0.041*
	(0.020)	(0.021)
Ethnic Fractionalization	0.332**	0.297
	(0.157)	(0.490)
Corruption	-0.024	0.019
	(0.049)	(0.448)
Constant	0.205	0.563
	(0.319)	(4.039)

Hausman Test: Is GDP an endogenous regressor?

Ho: Both LPM and IV estimators are efficient and consistent
Ha: Only IV estimator is efficient and consistent

Chi-Square Statistic: 3.26
Degrees of freedom: 7
p-value = 0.860

Conclusion: Cannot reject the null hypothesis. Using LPM is appropriate.

Table 14. --- Primary Gold and Conflict. Using a measure of Resource Rents

Dependent Variable: Conflict	Coefficient Estimate (1)	Std. Error (2)
Resource Rent	0.068	0.082
Log of GDP per capita	-0.231	0.216
Population	0.006***	0.002
Log Mountainous	0.519**	0.235
Ethnic Fractionalization	4.356**	1.742
Corruption	-0.670*	0.384
Constant	-6.692***	2.274
Log likelihood	-383.86	-
Obvs.	1770	-
Wald	27.09***	-

Note: *significant at 10%; **significant at 5%; ***significant at 1%

Appendix II.

Large Scale Gold Mining Production

- Amount of large scale gold produced by country measured in kilograms from 1998-2009
- Figures have either been reported or estimated, see USGS codebook for more

Dummy Variable for Primary Gold Production

- = 1 if a country produced gold in the given year using large scale mining technology
- Calculated using data from *Large Scale Gold Mining Production Variable*

Artisanal Gold Mining Production

- Amount of artisanal gold produced by country measured in kilograms in 2009
- Inferred using a 3 to 1 ratio of mercury use to gold produced

Dummy Variable for Secondary Gold Production

- = 1 if a country produced gold in the given year using artisanal mining technology
- Calculated using data from *Artisanal Gold Mining Production Variable*

Dummy Variable for Primary Diamond Production

- Dummy variable of 1 indicating whether a country produced diamonds in a given year from 1998-2009
- Figures have either been reported or estimated, see USGS codebook for more

Armed Conflict

- Defined by the UCDP as: "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths."
- Data is compiled using data from Gleditsch et al. (2002). The data set is: the UCDP/PRIO Armed Conflict Dataset (V4-2009)

GDP per Capita

- GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.

Population

- Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates.

Ethnic Fractionalization

- Reflects the probability that two randomly selected individuals from a population belong to different ethnicities
- Measured as 1 minus the Herfindahl index of ethnic group share

Religious Fractionalization

- Reflects the probability that two randomly selected individuals from a population belong to different religious beliefs
- Measured as 1 minus the Herfindahl index of religious group share

Percent of Mountainous Terrain

- Captures the extent to which a country's area is covered by mountainous terrain
- Approximated by measuring the logged share of a country's area covered by mountains

Control of Corruption

- Measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests
- Ranges from about -2.5 to +2.5 (higher values associated with less corruption)

Voice and Accountability

- Measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media
- Ranges from about -2.5 to +2.5 (higher values associated with better voice and accountability)

Political Stability

- Measures the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism
- Ranges from about -2.5 to +2.5 (higher values assoicated with stronger political stability)

Government Effectiveness

- Measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies
- Ranges from -2.5 to +2.5 (higher values associted with better government effectiveness)

Regulatory Quality

- Measures the ability of government to formulate and implement sound policies and regulations that permit and promote private sector development
- Ranges from about -2.5 to +2.5 (higher values asociated with better regulatory quality)

Rule of Law

- Measure the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence
- Ranges from about -2.5 to +2.5 (higher values associated with stronger rule of law)

British

- = 1 if the country was part of the Former British Empire

French

- = 1 if the country was part of the Former French Empire

Africa

- = 1 if the country is located in Sub-Saharan Africa

Developing

- = 1 if the country is considered a developing country

Oil Production

- Total oil production measured in thousand barrels per day
- =1 if a country produces oil in a given year

Table A1: Countries excluded due to missing data

American Samoa	Gibralter
Aruba	Greenland
Burma	Guam
Cayman Islands	Isle of Man
Channel Islands	Monaco
Curacao	Northern Mariana
Kosovo	Palau
Mayotte	Sint Marten
Montenegro	South Sudan
New Caledonia	Saint Martin
San Marino	Timor-Leste
Faeroe Islands	Turks & Caicos
French Guiana	Taiwan
French Polynesia	Virgin Islands

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