Environmental Depletion, Governance and Conflict

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Abstract

The link between natural resource dependence and internal conflict has been approached from a variety of angles in a large and growing interdisciplinary literature. While there is an expanding consensus as to what matters the most for such intra-state violence episodes, the feasibility - discontent dichotomy still appears to characterize a disciplinary divide between economists and political scientists. This paper attempts to help bridge the gap by allowing for both intrinsic and extrinsic motivations of potential rebels. Simple non-cooperative bargaining yields a nonlinear impact of regulatory quality on the likelihood of conflict and shows that corruption and resource depletion jointly affect the outcome. The empirical analysis that follows looks at the effect of environmental depletion and government corruption on the emergence of civil conflicts using a large panel dataset. Resource depletion, the quality of governance and their interaction are found to be significant determinants of civil conflict incidence. Results are robust to several steps taken to address potential endogeneity concerns.

JEL: Q27, Q56, D74, H56

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1. Introduction

Resource-related violence is an important worldwide phenomenon. The stakes are significant, and there are both renewable and non-renewable resources involved, as Table 1 illustrates. According to some estimates, more than one in five wars around the world are resource-based,[2] and civil conflicts dwarf inter-state conflicts in terms of casualties, duration and number of participants. This comparison is illustrated in Table 2 below.[3] Substantial case-study evidence exists of resource conflicts triggered by an insensitivity to local concerns of an opportunistic government.[4] Significant effort across disciplines has been expended in trying to understand the root causes of and to find solutions for resource-based conflicts. The study of civil conflict is also becoming an increasingly prominent topic in development economics, adding to a large and growing political science literature.

Combatant	*Resource*	*Period*	*Estimated revenues*
UNITA (Angola)	diamonds	1992-2001	4-4.2 bil.
RUF (Sierra Leone)	diamonds	1990s	25-125 mil./yr
Taylor (Liberia)	timber	late 1990s	100-187mil./yr
Sudan government	oil	since 1999	400 mil./yr
Rwanda government	coltan (from Congo)	1999-2000	250mil. total
Taliban Afghanistan	opium, heroin etc.	mid 1990s-2001	30-40 mil./yr
Northern Alliance Afghanistan	opium, heroin, emeralds	mid 1990s-2001	60 mil./yr
Khmer Rouge Cambodia	timber	mid 1990s	120-240 mil./yr
Cambodia government	timber	mid 1990s	100-150 mil./yr
Burma government	timber	mid 1990s	112 mil./yr
FARC (Colombia)	cocaine	late 1990s	140 mil./yr

Table 1: Estimated revenues from conflict resources: selected cases
Source: The Worldwatch Institute (2002)

The papers widely credited with spurring this empirical literature in economics have been generated by the World Bank project on the Economics of Civil War, Crime and Violence. Analyzing 52 civil wars over a 40-year period (1960-1999), Collier and Hoeffler find an inverse U-shaped dependence of the likelihood of civil war on primary exports' share in GDP.[5] Some subsequent studies have confirmed the main thrust of the argument, while others have disputed

[2] See Renner (2002), p. 6.

[3] See Fearon and Laitin (2003), p. 75.

[4] See Regan in Ballentine and Sherman (eds) (2003), p. 133-166 and Renner (2002), p. 40-47.

[5] See Collier and Hoeffler (2004), p. 23.

the robustness of the findings, focusing mainly on the imprecision of the resource-dependence measure and of some other controls, or on the definition of conflict. Others seek to be more precise in the type of resources under analysis, e.g. oil versus non-oil resources, renewable versus non-renewable, point versus diffuse, more versus less 'lootable',[6] and in describing the conditions that favour insurgency. Fearon and Laitin for instance argue that civil conflicts are best explained by the presence of overpopulation, poverty, instability, which lower the outside-options of recruits, and the existence of rough terrain, which decreases fighting costs for rebels. The majority of existing economic studies on the narrower topic of resource-based conflicts are empirical, and the only robust determinants of civil conflict over which there is consensus in the literature are income and population.[7] However, due to the widely-recognized under-theoretization of resource-conflicts, the choice of variables and specifications in many models has very much been ad-hoc. As emphasized by Blattman and Miguel in an excellent recent review, '...too little of the empirical literature is motivated by and clearly derived from formal theoretical models.'[8]

Conflicts	*No. conflicts*	*No.countries*	*Casualties*	*Duration (median)*
Inter-state	25	25	3.33 mil.	3 months
Civil	127	73	16.2 mil.	6 years

Table 2: Inter-state versus Civil Conflicts
Source: Fearon and Laitin (2003), p.75.

The present paper contributes to addressing this lack by employing an empirical specification informed by a theoretical model of corruption-induced resource depletion and conflict. Simple bargaining between a corrupt government and peasants living off the resource is introduced first, providing justification for the investigation of an empirical relationship between the likelihood for a particular country to be engaged in internal resource-based conflict and the nature of its governance and natural resource policies. This model is thus employed to inform the empirical specification in an attempt to uncover a potential resource-based expla-

[6] E.g. Le Billon (2001). A classification of natural resources can be found in Lujala (2003).

[7] See Hegre and Sambanis (2006), p. 509.

[8] See Blattman and Miguel (JEL) 2009, p. 5.

nation for civil conflict incidence: the impact of resource policies and quality of governance on the prevalence of domestic conflict. The second part of the paper explores the relationship between the incidence of resource-centered civil conflicts, the quality of governance and the management of natural resources, using a large panel dataset including 120 countries over a 20-year period. While in the previous studies broad inequality and ethnic fragmentation variables were used to proxy for grievances, this channel is adapted and more closely explored here by employing data specific to resource depletion. It is shown that income, population level, the quality of governance, depletion and their interaction are significant determinants of civil conflicts and have the hypothesized signs.

Economic theory has largely regarded conflicts as competitions for resources between symmetrical parties maximizing 'contest-success' functions by allocating resources to productive and military purposes. A comprehensive review of this literature is beyond the scope of this paper and the reader is referred to the thorough and informative very recent Journal of Economic Literature piece by Blattman and Miguel (2010). The existing theoretical contributions on the narrower topic of resource-based conflicts come primarily from political science, where the emergence of civil conflicts is at a micro level primarily grounded in political grievances, and at the macro level it is a consequence of the failure of the political system, whereby dependence on resources weakens the state which becomes vulnerable to rebel challenges.[9] In sum, as Collier and Hoeffler (2004) put it, a *large* political science literature on civil conflict focuses on motives, 'preferences' for rebellion, while a *small* economics literature on conflict is mostly concerned with opportunities or 'constraints. (p. 564) In the spirit of Skaperdas (2003), one can argue that both sides are important for understanding the issue and for arriving at correct policy prescriptions. A general distinction of 'greed' vs. 'grievance' motivation for civil war is transparent in many of the earlier papers on the topic and a significant part

[9] See Ron (2005) and the special issue on *Natural Resources and Violent Conflict* of the Journal of Conflict Resolution 49(4) for a balanced selection of recent political science papers.

of the literature regards the rebel as a 'national predator' who 'plunders the resource'.[10]

Focusing on incentives should not, however, preclude an analysis of policy-generated discontent.[11] The real motivations of insurgents are diverse, likely change with time and are in general difficult to describe with certainty. The paper also offers an economic view that can accommodate both predatory greed and legitimate grievances as a possible motive for social unrest. Following a recent trend, we move beyond the artificially strict greed-grievance dichotomy posited in some of the earlier literature. It becomes obvious, after even a brief familiarization with the existing body of case studies, that what characterizes most of the conflicts related to natural resources is likely a combination of the two motives.[12]

The way these motivations play out in our setting is the following: the peasants have preferences over both resource consumption and the rate of resource exploitation. While they prefer a high current rate of consumption, a myopic resource policy by a corrupt government which results in overexploitation may threaten their way of life in the long run. Depending on parameters, the insurgents can be mainly greed or grievance-motivated. The setup allows to show that natural resources can be a factor in episodes of civil violence via the inclusiveness of their extraction regime - and not only appropriation - issues, and this may be especially relevant to instances where conflicts arise in resource-scarce environments.[13]

[10] See Ron (2005), p. 445. In introducing their case-study volume, Ballentine and Sherman emphasize that '...most of the influential studies of the economics of conflict have focused exclusively on the predatory behaviour of rebel or insurgent groups'. See Ballentine and Sherman (2003), p. 7.

[11] Rus (2009) combines a political economy framework with a renewable resource exploitation model to present a situation in which the overexploitation of a renewable resource by a corrupt government can generate group-level discontent and conflict.

[12] Weinstein (2005) argues that the rebel recruitment process can have important implications for solving an adverse selection of insurgents problem, and that 'grievance' rebellion can be confiscated by 'opportunistic' rebellion when valuable resources are involved. While this may be true in some of the four cases cited, it is unlikely that it characterizes all instances of civil war. Moreover, we are primarily interested in the conditions for such conflicts to emerge, and not in their eventual metamorphoses.

[13] E.g. Uganda, Rwanda, Nepal, Ethiopia, Eritrea etc.

Collier and Hoeffler's assumption in their 'Greed or Grievance' suite of papers was that in every society and at all points in time there are marginalized groups that have an incentive to overthrow the existing regime and that what distinguishes the peaceful and the violent cases is merely the existence of economic opportunity that favours insurgency. While this statement does have an intuitive appeal, it is unsatisfactory if one's interest lies in explaining precisely the circumstances that might lead to the disenfranchisement of certain groups in the society. When the focus is on uncovering the conditions sufficient for civil violence to become the preferred course of action by a certain party, a legitimate guiding question is: what caused it and what can be done to prevent it? In the case of poor countries, the attractiveness of looting is always a potential motivator, and the low outside options of recruits always a facilitator in the slide toward violence. However, the way the resource is exploited and the proceeds distributed in the wider society are bound to have an impact on the general level of contentment with the government, while at the same time representing channels that have the potential to 'buy' social peace.

The rest of the paper proceeds as follows.The second section motivates and presents a simple bargaining model between an opportunistic government and potential rebels. The third section introduces the data sources and discusses some important measurement issues. The fourth section includes the empirical method, the model, identification strategy and results, while the last section summarizes and concludes.

2. A simple model of conflict over resources

This section proposes a very simple model of bargaining between a potentially corrupt regulator in charge with administering the exploitation of a natural resource, and resource-dependent and policy-sensitive peasants and potential rebels. The model captures both 'greed' and 'grievance' as possible motivations for reaching a non-cooperative violent outcome. Due to its simplicity, the model does not claim to be a general characterization of circumstances leading to resource-based conflicts. It's goals are much more modest, namely to suggest a link between the resource exploitation rate and the share of the resource revenues being allocated to

potential insurgents and a rather loosely defined 'likelihood of conflict'. The conflict imagined here is not a binary variable, but rather a continuous one which can be better understood as peasants' 'unhappiness' with the policy, which amounts to a certain degree of 'violence'. While civil conflicts can differ significantly in their intensity, they are classified as such in the existing databases *after* having exceeded a certain threshold for violence.[14] Thus, factors contributing to the increase in the disutility of potential rebels are implicitly factors increasing the likelihood of conflict.[15]

Standard economic analysis has traditionally found it difficult to provide a justification for intra and inter-state violence. Since conflicts are so costly and outcomes unpredictable, they should never occur when participants are rational agents, there are no uninternalized externalities and there is perfect information and perfect contracting.[16] This severely constrains the ability of classical theories to justify conflict. 'Luckily', all of these conditions are likely violated in reality. Information asymmetries about each other's capabilities may translate not only in miscalculations of contest success, but also in conflict for signalling purposes. With weak institutions, imperfect contracting means that commitment problems may preclude a stable agreement between the parties. Before describing the strategic interaction, one further point should be made clear here. The simple model presented does not purport to offer a general framework for bargaining failures leading to war, à la Fearon (1995) or Powell (2006). We join most of the literature in taking such asymmetric information and imperfect contracting models as rather convincing as we pursue a much more focused goal: that of clarifying the nature of the interaction between resource depletion and governance quality for resource-based conflicts. As it turns out, the effect of regulatory corruption on the peasants equilibrium payoff can be positive or negative, depending on the level of resource depletion.

Here the threshold for peasants' 'unhappiness' is assumed to be uncertain for both types

[14] E.g. 25 conflict-related deaths in the PRIO/Uppsala data used here and described further below.

[15] i.e. the likelihood that a certain level of violence will escalate enough to 'be promoted' to 'conflict' status.

[16] For a comprehensive discussion see Blattman and Miguel (2010).

of agents.[17] For the government this may mean that it cannot assess with sufficient accuracy the peasant's tolerance and/or outside options, while for the peasants it may mean imperfect knowledge about the outside options of the government and/or that they cannot anticipate the likelihood that a certain utility level may be sufficiently low to be instrumental in solving their own collective action problem.[18] Conflict can erupt due to a variety of deterministic as well as stochastic factors - as documented in the literature. To preserve generality, we only assume that -caeteris paribus- lowering the equilibrium utility of peasants decreases the opportunity cots of a rebellion, and thus increases the likelihood of unrest. Since income is one of the very few robust determinants of civil conflict in the empirical literature, this appears to be a reasonable assumption. It also allows us to focus on the more specific conditions related to resource exploitation and governance quality, while implicitly accounting for this 'stylized fact.'

There is a given level R of a resource and the government is characterized by a certain level of opportunism β. This is referred to in the paper as myopia and/or corruption[19] and it equates the speed of resource extraction. It is a well-documented claim of insurgents in resource-based conflicts that the self-interested government is myopically exploiting the resource at too high a rate, primarily in order to increase the overall amounts it can embezzle.[20] The government keeps a fraction α of the proceeds for itself and shares the rest $(1-\alpha)$ with the peasants, for instance as public goods provision. Although resource extraction problems are inherently dynamic, we aim to capture the essence of the problem in a one-shot game in order to keep the model as simple as possible. Peasants (and potential rebels) have both extrinsic and intrinsic motivations. We represent their utility in a subsistence consumption framework using a simple

[17] E.g. the lowest tolerable value of peasants utility $\underline{G}$ has a stochastic component.

[18] Regardless of motive, the occurrence of conflict hinges on insurgents solving a collective action problem.

[19] The two are of course very different, but indistinguishable in this simple framework.

[20] E.g. Nigerian oil-rebels protesting extraction and agricultural land pollution without local compensation or Cambodian 'forest-people' opposing accelerated deforestation. For other examples see Renner (2002), Homer-Dixon (1999).

Stone-Geary type utility function:

$$G = (R^* - \bar{R})^{\gamma}(\bar{\beta} - \delta\beta)^{1-\gamma}, \tag{1}$$

where R^* is the actual negotiated resource consumption by peasants, $\bar{R}$ is the given subsistence level of resource consumption, $\bar{\beta}$ is a maximum 'tolerable' level of government opportunism, δ is a parameter showing either sensitivity to government corruption or the distance between actual and perceived corruption, γ is the greed parameter and its complement $(1-\gamma)$ is the grievance parameter. The first factor in the product requires a certain minimum level of material consumption in order to obtain a positive level of utility, while the second factor depends negatively on the government's opportunism. This is the sense in which we talk about 'grievance' here: while a faster rate of extraction increases today's pie and the share that can be obtained by the peasants via bargaining, they also derive disutility from knowing the resource is potentially being depleted at a faster rate than optimal. While the government is perhaps more heavily discounting the future because of a limited political horizon, the peasants - resource dependent for generations - may have lower rates of time preference.

Suppose the government sets the extraction rate βR and it bargains with the peasants over rent distribution. Denote the government's payoff by $E = \alpha\beta R$, and the peasants' share $(1-\alpha)\beta R$. The Nash Bargaining solution concept is chosen for its robustness and simplicity (the outcome coincides simultaneously with a utilitarian and a Rawlsian social planner's division). The solution entails choosing the optimal share α to solve the following maximization problem:

$$\underset{\alpha}{Max} \quad \left\{(E - \bar{E})(G - \bar{G})\right\}, \tag{2}$$

where $\bar{E}$ and $\bar{G}$ represent the outside options for government and peasants, respectively.

Given the simple functional forms specified above (2) becomes:

$$\underset{\alpha}{Max} \quad \Big\{(\alpha\beta R - \bar{E})\left\{[(1-\alpha)\beta R - \bar{R}]^{\gamma}(\bar{\beta} - \delta\beta)^{1-\gamma} - \bar{G}\right\}\Big\}. \tag{3}$$

To simplify the algebra, we can normalize one of the threat points to zero. Assume, without loss of generality, that $\bar{G} = 0$. Then, the first order condition yields: $\alpha = \frac{1}{\gamma+1} + \frac{\gamma\bar{E} - \bar{R}}{\beta R(\gamma+1)}$ and

$(1-\alpha) = \frac{\gamma}{\gamma+1} - \frac{\gamma\bar{E}-\bar{R}}{(\gamma+1)\beta R}$ as the equilibrium rent-splitting rule between the government and the peasants. The equilibrium payoff of the peasants is then equal to $G^* = \left[\frac{\gamma(\beta R-\bar{E}-\bar{R})}{\gamma+1}\right]^{\gamma} (\bar{\beta} - \delta\beta)^{1-\gamma}$.

As motivated above, we are interested in how this utility changes with the level of government corruption.[21] It is a priori ambiguous whether more corrupt governments increase or decrease the welfare of locals, given their preferences over both material resources and governance quality. On one hand, a higher β increases the size of the surplus to be divided, on the other hand it creates dissatisfaction. We focus on the non-trivial solutions for which positive utility levels G^* obtain, which is whenever $\bar{\beta} - \delta\beta > 0 \Leftrightarrow \beta < \frac{\bar{\beta}}{\delta}$ and $\frac{\gamma(\beta R-\bar{R})}{\gamma+1} > 0 \Leftrightarrow R > \frac{\bar{R}}{\beta}$. Under these conditions, $\frac{\partial G^*}{\partial \beta} > 0$ whenever

$$R\left[\frac{\gamma(\gamma\bar{\beta} - \delta\beta)}{\delta(1-\gamma)}\right] > -\gamma(\bar{E} + \bar{R}). \tag{4}$$

Since the right-hand side expression in (4) is negative, the inequality is satisfied for any level of the resource R when its coefficient is positive, i.e. if $\gamma > \frac{\delta\beta}{\bar{\beta}}$, or if the peasants are 'greedy enough' that they can be appeased with resource transfers. If however this is not the case and in fact the peasants are less greedy and more concerned about the quality of governance: $\gamma < \frac{\delta\beta}{\bar{\beta}}$, the left-hand-side of expression (4) becomes negative as well. Then $\frac{\partial G^*}{\partial \beta} > 0$ obtains when:

$$R < \frac{\delta(1-\gamma)(\bar{E} + \bar{R})}{\delta\beta - \gamma\bar{\beta}} \equiv \tilde{R}. \tag{5}$$

The intuition for these results is the following. When peasants are relatively greedy, a more opportunistic government sets a higher rate of resource exploitation and implicitly increases their consumption of the resource, while increasing their disutility from bad governance proportionately less. This in turn increases the potential rebels' equilibrium utility and thus it reduces the likelihood a conflict centred around re-distribution should occur. When peasants are relatively less greedy and whenever the resource is sufficiently large so that the inverse

[21] In a dynamic framework the simple game could be extended to include a first stage in which the government 'chooses' its corruption level and implicitly the resource exploitation rate, then bargaining occurs.

of (5) is true, higher government corruption decreases their equilibrium utility and increases their discontent. This can then increase the probability that potential rebels will solve their collective action problem and initiate conflict. Whenever the peasants are less greedy but the resource is sufficiently depleted so that (5) holds, more government corruption has the effect of increasing their equilibrium level of utility and lowering their discontent, thus decreasing the chances of a rebellion.

The main implications of this simple model can be summarized as follows. When potential rebels have both material and governance quality motivations, their equilibrium level of utility - a proxy for their willingness to rebel and for their success in overcoming the collective action hurdle - is an important determinant of the probability of civil conflict. Even though the technology of conflict is left unspecified to preserve generality, looking at comparative statics of this equilibrium utility gives information about the probability of seeing a resource-centered civil conflict in the data. Thus we expect that the quality of governance and resource depletion are jointly influencing the incidence of civil violence. While in general higher government corruption augments the policy disutility component of peasants' objective and thus increases the likelihood of conflict, in very depleted environments, it may actually reduce it.

When taking the implications of such a simple model to data, several qualifications and caveats are in order. By linking the probability of conflict to welfare, we implicitly assumed conflicts are less likely where income level and growth is higher. Thus, even though we have not specifically included a variable for outside opportunities in the model, we do expect income to be a leading correlate of conflict. Also, by considering civil violence to be the only channel for regime change, we assumed away the democratic channel. Generally we expect more democratic countries to have less conflicts. By focusing exclusively on resource extraction and distribution, we also ignored other leading motivations, such as ethnic separatism. To minimize the distance between the simple model and the diversity of motivations and realities, we control for such factors in the following empirical exercises. The rest of the paper presents the data, the empirical model and examines the merits of these findings in the sample.

3. Data

To assemble the panel data set we require information on natural resources, civil conflicts, governance and corruption, democracy and general macro-economic variables such as GDP level and growth or population. Several different sources are used for this purpose. A complete list of variables and their sources is provided in the Appendix, and a brief introduction is provided in the following paragraphs.

The natural resource data comes from the World Bank's Adjusted Net Savings database, which provide general measures of economics sustainability. The ANS project provides information since 1970 for a wide cross-section of countries on several indicators relevant to our main focus, such as: net forest depletion, mineral depletion, energy depletion, CO_2 pollution damage.[22] For example the net forest depletion calculation is based of estimated depletion rents, 'calculated as the rent on that amount of extraction which exceeded the natural increment in wood volume.' One caveat is in order here: the calculation of rents includes several price components, among which a 'regional price'. To be exact, this is not a unique exogenously determined international price, but is calculated using export quantities and values for every country and averaged at a regional level. While individual country data is also available, and its use would even more closely reflect local scarcity rents, it is considered to be too noisy.[23] This data source has an advantage over the traditional measures of resource abundance/dependence used in the resource curse literature, such as the proportion of primary exports in GDP, since it overcomes the endogeneity concerns associated with the measure. Conflict and/or corruption perception may influence the level of economic activity and thus the denominator of the measure. Brunnschweiler and Bulte (2008) take issue with the treatment of resource dependence (share of primary exports in GDP) as resource abun-

[22] Adjusted net savings are calculated as augmented standard national income accounting figures deflated by the Gross National Income (GNI). More information is provided in the World Bank manual at: http://siteresources.worldbank.org/INTEEI/1105643-1115814965717/20486606/Savingsmanual2002.pdf

[23] I am indebted to Edward Barbier for pointing out the (in)appropriateness of some of these indicators.

dance, and the exogenous treatment of what may essentially be an endogenously determined variable. Alexeev and Conrad (2008) also caution against using bias-inducing export-related GDP shares. For this reason, despite the aforementioned caveats, this database is the one preferred by most recent contributions to the field, notably Collier and Hoeffler (2009) and Bhattacharyya and Hodler (2009).

Civil conflict data was obtained from the PRIO/Uppsala Armed Conflict Dataset[24] which - compared to previous efforts - extends the conflicts set by lowering the casualty threshold necessary for an episode of violence to qualify as a conflict from 1000, in the Correlates of War (C.O.W) project,[25] to 25-battle related deaths annually, while also keeping track of the intensity of the war. Thus, these data are much more comprehensive, capturing not only the major civil conflicts worldwide, but also many more smaller scale episodes of violence over the period 1946-2005. Since we are focusing on resource-based conflicts which erupt when disgruntled former peasants turn into rebels, this inclusiveness makes the data source most appropriate for our purposes here. The operational definition of conflict used in the database is '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.'[26] The dataset also includes inter-state conflicts, however, in accordance to the stated interest, only the internal ones are kept.[27] While most of the previous empirical studies use the much more restrictive 1000 casualties per year threshold, the position expressed here is the following: whereas that body of work looks actually to identify the factors important in reaching a *war-level* intensity of hostilities, this data allows to test more directly for determinants of *civil conflict* emergence. Moreover, data comprehensiveness is important for our identification strategy, as explained a little further.

[24] See Gleditsch et al 2002.

[25] Started by Singer and Small in 1972 at the University of Michigan, transferred to Penn State in 2001.

[26] See *UCDP/PRIO Armed Conflict Dataset Codebook*, p. 4.

[27] Categories 3 and 4, for 'internal armed conflict' and 'internationalized internal armed conflict', the latter group including civil wars that witness some form of external interference.

Reliable data about corruption and the general quality of governance are difficult to collect, due to the very nature of the phenomenon, premised on concealing its existence. Therefore all data sources available for a wide array of countries and time periods are not based on factual data, but rather on perceptions.[28] These perception-based corruption indicators are constructed with information from multiple sources, and so there are less chances of any systematic bias or measurement error. Among the most prominent in this category of sources, one can count the Transparency International's Corruption Perception Index started in 1995 with 41 countries gradually expanded to 158 in the present, the International Country Risk Guide which looks specifically at corruption in the political system, and the World Bank's Governance Indicators.

The source for corruption data used here is the International Country Risk Guide (ICRG) score,[29] which refers specifically to corruption in the political system and to ties between business and politics. There are a number of governance indicators available, such as: Government Stability, Socioeconomic Conditions, Investment Profile, Military in Politics, Religion in Politics, Law and Order, Ethnic Tensions, Democratic Accountability, Bureaucracy Quality and Corruption, with the last two being the more relevant to the present focus. In particular, the measure of corruption refers to 'financial corruption in the form of demands for special payments and bribes...and suspiciously close ties between politics and business'.[30] As with all ICRG indicators, higher values of variables `corruption` and `bureaucratic quality` (`bur.quality` for short) signify better quality governance: *less* corruption and higher bu-

[28] Several studies analyze the distance between perception indicators and more factual-based measures of corruption. See Olken (2006) for a recent example, where a local measure of corruption in road-building in Indonesia is compared with corruption perceptions. Though interesting, this is not a significant problem in the present setting, where *perceived* mismanagement and embezzlement of public funds can equally generate revolt.

[29] International Country Risk Guide (Table 3B), C The PRS Group, Inc., 1984-Present. For more details see $http://www.prsgroup.com$.

[30] Quotation from the ICRG codebook *A Business Guide to Political Risk for International Decisions*, p. 31.

Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min.*	*Max.*
GDP growth	4238	3.287308	6.115611	-51.03086	106.2798
GDP per capita (PPP)	3906	8189.072	8563.14	466.1966	66702.59
Food exports	2798	25.23914	25.30327	.000238	99.11278
Fuel exports	2681	15.95988	25.86532	0	101.5603
Metal ore exports	2747	6.291353	11.86478	3.36e-06	88.81229
Gini coefficient	400	41.1678	10.80784	19.4	74.33
Aid	3267	8.251895	13.82001	-3.016838	242.2864
Aid per capita	3521	80.30627	215.12	-203.5889	2337.979
Population	4728	1.45e+08	5.95e+08	19700	6.44e+09
Rural population density	4013	555.3755	1121.809	0	13776.82
Subsidies and transfers	975	36.21356	21.67086	-.7346081	90.65208
Surface area	4536	3374.076	12867.36	.05	134000
Unemployment youth male	1178	16.37603	9.214946	1	69.2
Polity (democracy indicator)	3158	1.548132	7.255555	-10	10
Bureaucratic quality	2889	2.139171	1.20512	0	4
Control of corruption	2889	3.13674	1.382194	0	6.166667
Democratic accountability	2889	3.612924	1.646162	0	6
Conflict intensity	640	1.326563	.4693225	1	2
Peace before conflict	945	4.445503	9.4801	0	50
In conflict	945	.6772487	.4677761	0	1
ANS energy depletion	3582	4.217113	10.22142	0	79.12
ANS mineral depletion	3596	.7258843	3.002218	0	56.95
ANS net forest depletion	3139	.5396974	1.559226	0	15.97

Figure 1: Summary statistics - selected variables

reaucratic quality, respectively.

Additional controls incorporated in the data set come from World Bank's Development Indicators for variables such as: GDP levels and growth rates, population, agricultural products, food and ore exports, measures of inequality, unemployment, foreign aid and others. Additionally, data from the POLITY IV project were used to account for the general level of democracy in a country in the form of a special variable (`polity2`) designed specifically for time-series analyses.[31] While we use it in some robustness checks, the main regressions do not include the democracy variable. Although it has been used in the literature on resource curse

[31] This variable is obtained as a difference between the democracy and the autocracy scores for each country and year. For a thorough explanation of why a modification of the combined polity score is necessary, please refer to the original source: Marshall and Jaggers, *Polity IV Project: Data User's Manual* at www.cidcm.umd.edu/inscr/polity.

and even in some studies of civil conflict, one component in the democracy score compilation is the existence of a civil conflict, which renders it endogenous to our framework.[32]

Variables	gdp	gwth	pop	pol	bqua	cor	mid	nfd	end
Gdp per capita	1.00								
Gdp growth	-0.06	1.00							
Population	-0.06	0.14	1.00						
Polity	0.46	-0.07	-0.07	1.00					
Bureaucatic quality	0.78	-0.03	0.05	0.40	1.00				
Corruption control	0.62	-0.06	-0.09	0.41	0.64	1.00			
Mineral depletion	-0.16	-0.02	-0.02	-0.00	-0.10	-0.06	1.00		
Net forest depletion	-0.25	0.05	0.00	-0.17	-0.28	-0.18	-0.03	1.00	
Energy depletion	-0.07	0.09	-0.00	-0.43	-0.13	-0.23	-0.08	-0.12	1.00

Figure 2: Cross-correlations.

Figure 1 lists some of the variables included in the compiled dataset. Unconditional correlations between important variables are presented in Figure 2. Two relationships are particularly worth pointing out in this cross-correlations table. First, the ICRG indicators of corruption and bureaucratic quality, are positively and quite strongly correlated with the level of income in a country, while bearing little relationship with the income growth rate. Our results are presented mainly using income growth, although regressions including income levels are provided as well for robustness. Secondly, collinearity between independent variables is a concern. Investigating genuine savings, Dietz, Newmayer and de Soysa (2007) present a limited reduced-form dependence between corruption control, resource dependence[33] and genuine savings, although they cannot address the endogeneity of corruption. Moreover, their focus on sustainability and investment in non-natural capital to compensate for a high rate of resource extraction is somewhat complementary to ours.[34] Although we do not focus on

[32] See Blattman and Miguel (2010). p. 28.

[33] Their measure of resource dependence is average share of fuel and minerals in total exports, which can be interpreted as a measure of resource dependence and contains total exports in the denominator of one explanatory variable and income level and growth as separate regressors. See Brunnschweiler and Bulte (2008) for a discussion of why this may be problematic.

[34] The fuel and mineral exports as a percentage in total exports does not yield a reliable measure of the

genuine savings, but only on specific resource-depletion components (without investments in produced and human capital), we ask whether governance quality indicators and resource depletion indicators are correlated in the sample. The correlations between the indicators of depletion and corruption over the sample are low, while bearing the expected signs.[35]

4. Empirical Method and Results

Following the discussion in the first part of this paper, we undertake in this section the investigation of the impact of resource depletion and government corruption on civil conflict incidence. We analyze the relationship between the incidence of internal violence, resource depletion and the quality of governance in a wide cross section of countries over the 1984-2004 period. The only correlates of civil war that are consistently robust in the empirical literature are income level and/or growth - displaying a negative relationship - and population levels - having a positive relationship - with the incidence of domestic violence. Intuitively, the opportunity cost of participating in an armed insurgency is higher in a high average-income country, while a larger population per se may increase the probability that one particular group may rebel against the government, in a territorial dispute or in a coup. Beyond these two factors, however, there is little agreement in the field. Collier and Hoeffler's stark initial claims identifying rebellion with a 'quasi-criminal activity', based on their findings that dependence on primary commodity exports are an important determinant in the emergence of civil wars, still stands in contrast to theoretical work in political science as well as case study evidence, which provide examples of grievance-based uprisings. While many papers concentrate on

extraction rate, however, in the absence of stock data. The measurement problems are composed by the the underestimation of genuine savings in the world Bank database, which may be systematically correlated with corruption, in that a corrupt government may invest less of the resource proceeds in other forms of capital.

[35] We also investigate collinearity by checking the stability of estimates to small perturbations in potentially collinear regressors. We use `Stata` command `perturb` which is particularly appropriate as a collinearity diagnostic for nonlinear specifications, interaction terms and limited dependence variables, and we do not find evidence of strong collinearity between governance and depletion variables in the sample.

attempting to replicate Collier and Hoeffler's results using different definitions, time periods or conflict data sets, few actually move forward and look for other convincing explanations. One chief reason for this may have been that the body of theoretical literature to guide such empirical explorations is relatively slim.

Civil wars may have their origin in several different social phenomena. One potential source of resource-based conflicts is investigated here, namely natural resource-related rebellion. The simple model presented above describes a resource-based motive for internal violence in a framework which allowed for extrinsic (i.e. 'greed') as well as intrinsic (i.e. 'grievance') motivations of potential rebels. Previously, the proxies used for grievances were broad and political-based: level of democracy and measures of ethnic and religious fractionalization.[36] Given the relatively large number of what appear to be resource-based conflicts out of the total civil conflicts, an additional way one can think about resource exploitation grievances and the quality of the governance as factors leading a certain group to consider conflict was suggested above. The resource depletion data on net forest depletion and mineral depletion are used to proxy for the level of resource exploitation, and governance indicators on corruption and bureaucracy quality represent the quality of policy-making. Following the insights gained in the theory part, the governance quality terms are also interacted with the depletion indicators.

The basic probit specification (lags are omitted for simplicity) can be written as follows:

$$\Phi^{-1}(Conflict_{it}) = \beta_0 + \beta_1 Income_{it} + \beta_2 Population_{it} + \beta_3 Gov.Quality_{it} + \tag{6}$$
$$+\beta_4 Depletion_{it} + \beta_5 (Gov.Quality * Depletion)_{it} + \beta_6 Z_{it} + \nu_i + \epsilon_{it},$$

where Φ is the standard normal cumulative density function, income_{it} is either the level of GDP per capita level (purchasing power parity) or GDP growth, Z includes other controls and i indexes the panels (countries), t is time measured in years, ν_i is the panel-specific, unobserved heterogeneity effect and ϵ_{it} is the error term.[37]

[36] On the latter, some studies argue that it could be also interpreted as *preventing* conflict, since rebel recruitment is more difficult in more fragmented societies. More on this later in the paper.

[37] $\Phi(z) \equiv \int_{-\infty}^{z} (2\pi)^{-1/2} exp(-x^2/2) dx$. Alternatively, the specification could be expressed as:

Income variables have been widely used as a controls in regressions of civil conflict. A higher income level represents a high level of outside opportunities, with the effect of decreasing both potential government policy-related grievances and the numbers of potential rebels.[38] In an innovative paper that uses rainfall as an instrument for economic growth, Miguel et al. (2004) show that income growth is also a significant determinant of domestic conflict in Africa. Note that, although rainfall data exists for a wider cross-section of countries, this identification strategy is not available here, since rainfall instruments for economic growth only in a particular subset of agriculture-dependent economies where irrigation is lacking, such as Sub-Saharan Africa. If group-level discontent related to the way an opportunistic government manages exploitation and distribution in the economy are among the causes of conflicts on average, we expect the control of corruption and the quality of the bureaucracy to generally decrease the likelihood a domestic conflict ensues, while the depletion indicators should increase it. We also expect that depletion and governance quality jointly influence the incidence of conflicts. For relatively depleted environments, the conflict-inducing effect of depletion decreases with corruption, which implies that the likelihood of conflict should be lower, the lower the ICRG corruption control score for these countries. Therefore, while the marginal effect of corruption control and bureaucratic quality are expected to be negative, the effect of the interaction term between the governance score and the depletion indicator is hypothesized to be positive. The estimation method is panel probit.[39] We explore random effects probit, panel probit, pooled probit, fixed effects panel logit, OLS and IV models. The

$Probability(Conflict_{it} = 1) = \Phi(\beta \cdot Z)$, where β and Z are, respectively, the vectors of coefficients and regressors.

[38] Recall that this aspect is implicitly incorporated in our simple bargaining model.

[39] The first table (in Figure 3) presents a random effects probit model. Our choice in this exercise is somewhat conditioned by the software package capabilities. According to `Stata` Manual, 'There is no command for a conditional fixed effects model, as there does not exists a sufficient statistic allowing the fixed effects to be conditioned out of the likelihood'. Results from a panel fixed effects logit model are also reported in the appendix.

results are summarized in the following tables, starting with Figure 3.

Variables	*Dependent variable: inconflict5 (PanelProbit)*			
	(1)	*(2)*	*(3)*	*(4)*
Gdp growth (lag)	-0.0230***	-0.0247***	-0.0164**	-0.0195***
	(0.00848)	(0.00854)	(0.00732)	(0.00745)
Population (ln, lag)	0.860***	0.888***	0.928***	0.913***
	(0.292)	(0.266)	(0.256)	(0.257)
Bur.Quality (lag)	-0.605***		-0.519***	
	(0.0998)		(0.0917)	
Corruption control (lag)		-0.481***		-0.396***
		(0.0880)		(0.0776)
Forest Depletion (lag)	-0.309**	-0.488**		
	(0.144)	(0.206)		
Mineral Depletion (lag)			-0.0505*	-0.0835***
			(0.0263)	(0.0323)
Bur.Qual*ForestDep (lag)	0.236***			
	(0.0911)			
Corruption*ForestDep (lag)		0.159***		
		(0.0609)		
Bur.Qual*MinDep (lag)			0.0948***	
			(0.0259)	
Corruption*MinDep (lag)				0.0604***
				(0.0175)
Year	-0.120***	-0.128***	-0.120***	-0.124***
	(0.0114)	(0.0112)	(0.0110)	(0.0111)
Constant	233.2***	249.6***	232.5***	240.4***
	(22.02)	(21.93)	(21.46)	(21.69)
Observations	2419	2419	2486	2486
Groups	130	130	133	133

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 3: Civil conflict incidence

As expected, income growth has a discouraging effect on conflicts: when the economy is growing and good alternative options exist, participating in a rebellion is much less appealing.[40] Also, the natural logarithm of population level has a positive and strongly significant effect, confirming the findings in the literature. In addition, both governance variables chosen (bureaucratic quality and corruption control) have negative and strongly significant coeffi-

[40]Appendix Table 7 reports the same regressions, but using income level instead of the growth rate.

cients, seemingly indicating that conflict incidence is inversely related to good quality governance. However, the model includes the interaction term between governance quality and resource depletion indicators, therefore the marginal effects are not equal to the coefficients, and need to be calculated separately.[41] We follow a simple post-estimation calculation procedure in which the marginal effect of a regressor participant in an interaction term is calculated as the derivative of a function of the predicted coefficients as well as the mean-centered regressors.[42] Calculating the marginal effects of the quality of governance and depletion variables confirm that the forest depletion increases the likelihood of conflict in columns 1 and 2, while the bureaucratic quality and corruption control both decrease the likelihood of conflict. The same results obtain in the case of mineral depletion combined in turns with bureaucratic quality and control of corruption in columns 3 and 4, respectively. As the appendix reports, the results for energy depletion are consistently different, confirming the vague consensus in the empirical literature that the dominant energy resource - oil - 'is different'.[43] These results provide some support to our thesis that quality of governance and resource depletion matter for civil conflicts.

Moreover, the interaction term between the quality of governance variable and the depletion indicator is positively significant for both forest and mineral depletion. This statistical significance is interpreted to mean that the effect of resource depletion on the incidence of civil conflicts is dependent on the governance variable (here control of corruption and bureaucratic quality), as hypothesized. Moreover, the relationship between the prevalence of conflict and

[41] See Norton and Ai (2003) for a thorough explanation of this point. Table 15 in the Appendix plots the correct marginal effect of the interaction in a baseline probit model.

[42] Details and code available upon request. Also see `Stata` at *http* : *//www.stata.com/support/faqs/stat/mfx_interact.html*.

[43] Fearon's thesis is that 'oil is different'. He dismisses the greed interpretation of the association between some commodity exports with civil war, and states that '...an empirically more plausible [...] explanation is that oil exporters are more prone to civil war because they tend to have weaker state *institutions* than other countries with the same per capita income'. (italics mine) See Fearon (2005).

the governance variable also appears to exhibit the characteristics proposed in the theoretical section. While the (previous period) control of corruption and bureaucratic quality are negative and strongly significant, the interaction with the indicator of net forest depletion and mineral depletion it is positive and significant. These results provide some additional support for the hypothesis derived in the theoretical section: while a poor governance quality is positively correlated with the incidence of civil conflicts, its effect is lower given a high level of environmental depletion.

Since institutional variables are among the regressors, *reverse causality* running from conflict to governance quality is clearly a potential problem. It could be argued that a high degree of corruption and resource exploitation might be due to the presence of conflict, which shortens the time in office horizon contemplated by opportunistic bureaucrats and incentivizes them to behave in a more corrupt fashion. In an unstable environment, the government bureaucrats may have short appointment horizons and might be attempting to make up for this 'shortcoming' by accepting side-payments in exchange for policy favours, and consequently the quality of governance decreases, exacerbating overexploitation. This problem is common to most of the papers in the literature and is particularly severe for cross-sectional studies. As a first step to account for such reverse causation, the analysis here takes advantage of the time structure of the data set and uses time lags for all right-hand-side variables, while the dependent variable is 'forward-looking' by construction. Secondly, there is another advantage, besides comprehensiveness, to adopting a lower death-threshold when defining conflicts, which is worth pointing out in this context. It could be argued that attempts to rule out reverse causality by using one period-lagged regressors are not fool-proof, since adverse consequences of the civil war on governance quality can occur early, before the typical 1000-battle related deaths threshold is reached. However, the particular conflict database used here allows for a very early detection of violence (25 battle related deaths), so that the likelihood of anticipatory behavior from the regulator is reduced.

Alternatively, the results might be *spurious*: perhaps the relationship captures the fact that both sets of variables are trending, or perhaps there exists a factor that is not included in

the regressions and that influences both the incidence of conflict and the governance quality variable. The latter source of spuriousness is investigated below by instrumenting for the quality of governance. The former is ruled out by including a time trend, and results do not change, except for slight increase in the significance of income growth and population variables.

Variables	*Depletion variables*			
	(1) Forest	(2) Forest	(3) Mineral	(4) Mineral
Inconflict	-0.178**	-0.154**	-0.174	-0.215
	(0.072)	(0.071)	(0.172)	(0.171)
Inconflict5	0.074	0.101	-0.799***	-0.860***
	(0.100)	(0.098)	(0.239)	(0.234)
Controls	yes	yes	yes	yes
Constant	-0.985	-1.597	17.314***	18.150***
	(1.343)	(1.290)	(3.184)	(3.078)
Observations	591	591	598	598
Groups	51	51	51	51

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 4: Depletion and conflict

There is yet another potential source of endogeneity that we are concerned about: perhaps conflicts drive resource exploitation and not the other way around, in order -for example - to provide resources which can be used in the battle. Do conflicts on average intensify resource exploitation? As a first pass in addressing the possibility of reverse causation between depletion and conflict, we show in Figure 4 how the main conflict indicator, `inconflict5`, which is a dummy that turns one when civil conflict occurs within five years from the observation year,[44] is not a significant determinant of forest depletion, and it negatively affects mineral

[44] This time horizon is chosen for compatibility with the previous literature. A non-binary alternative is `intensitymax5`, which measures the maximum intensity of conflicts in a country during a period of 5 years from the observation year. However, the variability of this indicator is also limited, as it is zero for cases where conflict is absent, one for minor conflict and two for large-scale civil war.

depletion. It appears that the anticipation of future conflict does not encourage current-period over-exploitation of forest resources in the sample. On the other hand, the dummy for contemporaneous conflict `inconflict` is a significant determinant of net forest depletion in both regressions, but is associated with *lower* exploitation, and it is not a significant factor for mineral depletion. The controls include the governance quality indicators: bureaucratic quality in columns 1 and 3 and corruption control in 2 and 4. The two conflict dummies are never significant determinants of resource depletion when entered in such regressions alone, without the additional controls.

Finally, some of the right-hand side variables may be jointly determined: low quality governance, or institutions may be the result of high levels of income per capita. This is the issue to which the analysis turns next.[45] Studying the role of institutions is difficult, given their plausible endogeneity to almost any conceivable model specification. Good instrumental variables are not easily available, and the practice has been to rely on the few ones coming mostly from the cross-country development literature. La Porta et al (1998, 1999) establish that the *legal origin* of the country is a salient determinant of the legal protection of investors and thus of economic development.[46] Acemoglu, Johnson and Robinson (2001) show that *settlers mortality*, available for 64 countries, is a good indicator for the type of institutions created by Europeans in the colonies, especially with regards to property rights protection. Bockstette, Chanda and Putterman (2002) present data on the *antiquity of the state* and argue for its usefulness as an instrument for the quality of institutions, if one is ready to accept a long-run learning-by-doing process in governance. While the strength of property rights is, undeniably, crucial for development, it is less of an issue in view of the theoretical framework, where we assume property rights are reasonably enforced. In the first stage data

[45] The quality of institutions has an overwhelming impact on the process of economic development, taking precedence over classical factors such as geography and trade, as shown in Rodrik, Subramanian, and Trebbi (2002). Presumably, they also are an important ingredient in the prevalence for domestic violence in society.

[46] The categories are British, French, Scandinavian, German and Socialist origin of the legal system. See La Porta et al.(1999).

on state antiquity and legal origin is used, which are the more reasonable instruments for the quality of institutions in the sense used here, while also implying the smallest restriction of the sample of countries. In addition to being correlated with the potentially endogenous variable - here the quality of governance - valid instruments have to also satisfy the exclusion restriction, i.e. they have to not be significant determinants of conflicts on their own. While this is plausible for the antiquity of the state, which likely does not have an impact on civil conflicts directly or through the other regressors than the one it instruments for, legal origin may determine the economic regressors. However, when only state antiquity is used as an instrument, the results do not change, apart from some decreases in the level of significance.[47]

An instrumental variable approach is implemented in an two-stage least squares framework, which is preferable to a panel probit in the presence of endogeneity bias. This approach was previously followed in Miguel et al (2004).[48] Moreover, the OLS results can be given an easier interpretation. In the first stage we regress the quality of governance indicators on the instruments and additional controls. The antiquity of the state (`statehist05`) and the legal origin (`legor`) indeed emerge as preferred instruments and their quality is better for the case of bureaucratic quality. Then we run the IV regression of conflict incidence on the instrumented endogenous and hypothesized exogenous regressors and the results are presented in the table in Figure 5, where we report heteroskedasticity-robust coefficients and clustered standard errors. In alternating columns we first run a panel OLS, followed by the instrumental variable regression. The governance quality variable is bureaucratic quality, which is more correlated with the instruments. The appendix provides the results for when corruption control is chosen as the governance quality variable instead. We repeat this for forest depletion and mineral depletion.

[47] These results are also reported in the Appendix Tables 10 and 11.

[48] See also Wooldridge (2002). Miguel et al (2004) argue that the Rivers and Vuong (1998) two-stage conditional maximum likelihood estimator method designed for cross-sectional analysis 'requires strong specification assumptions' to be translatable to panel data (p. 738). The same idea is expressed in Elbadawi and Sambanis (2002), p. 327.

Notice that most of the results that were previously emphasized survive in the regressions where the quality of governance is instrumented for: income growth is generally negative and significant, population is generally positive and significant, the quality of governance is negative and generally significant and the interaction between bureaucratic quality and net forest depletion is positive and significant.[49] Also, the interaction between bureaucratic quality and mineral depletion loses significance once bureaucratic quality is instrumented for in column 4. The marginal effects of depletion and of quality of governance on the likelihood of civil conflict are mostly significant and have the 'right' signs, thus providing a stronger confirmation of the hypotheses.[50]

In the admittedly simplistic theoretical model which was used to inform the empirical specification, only resource policy can lead to conflict. For this reason the empirical analysis needs to control for other possible explanations. Many empirical investigations of civil conflicts include indicators of societal fractionalization, be it ethnic, religious or linguistic. Our principal results are robust to controlling for the degree of heterogeneity in the population.

Artificially drawn post-colonial borders are thought to favour ethnic and territorial disputes, especially in Africa. To control for this independent source of conflicts, our database was updated with measures of fractionalization taken from Alesina et al.(2003), referring to ethnic, language and religious dimensions. This is the most comprehensive source available and the three indices range from zero (perfect homogeneity) to one (perfect heterogeneity or

[49] Appendix Table 8 substitutes the level for the growth rate of income, while Table 9 reports the same regressions using corruption control instead of bureaucratic quality.

[50] The marginal effect (and standard errors) of net forest depletion (`nfd`) is 0.007978(0.004473) in column 1 and 0.1806501(0.0836433) in column 2 and the marginal effect of bureaucratic quality (`bqua`) is -0.0164645(0.0042947) in column 1 and 0.0209756(0.0330079)in column 2. The marginal effect of mineral depletion is 0.0094178(0.0018715) and of bureaucratic quality -0.0146866(0.0042225) are strongly significant in column 3 but lose significance in the IV regression in column 4. The rest of the marginal effects are available but not reported here.

Variables	*Dependent variable: inconflict5*			
	(1) Panel OLS	*(2)IV*	*(3) Panel OLS*	*(4) IV*
Gdp growth (lag)	-0.0036**	-0.0041**	-0.0035**	-0.0014
	(0.00163)	(0.00190)	(0.00171)	(0.0013)
Population (ln, lag)	0.0578***	0.0230	0.0641***	-0.0032
	(0.0156)	(0.0319)	(0.0151)	(0.0375)
Bur.Quality (lag)	-0.051***	-0.096	-0.050***	-0.0769*
	(0.0117)	(0.0629)	(0.0115)	(0.0917)
Forest Depletion (lag)	-0.0269	-0.286**		
	(0.0164)	(0.134)		
Bur.Qual*ForestDep (lag)	0.0215***	0.352**		
	(0.00748)	(0.170)		
Mineral Depletion (lag)			-0.00789	0.0123
			(0.00496)	(0.0092)
Bur.Qual*MinDep (lag)			0.0146***	-0.0164
			(0.00262)	(0.0136)
Year	-0.011***	-0.011***	-0.010***	-0.009***
	(0.000974)	(0.00162)	(0.000970)	(0.00117)
Constant	21.26***	22.22***	20.16***	19.88***
	(1.934)	(3.144)	(1.927)	(3.175)
Observations	2419	2208	2486	2235
Groups	130	118	133	119

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 5: Instrumental variable approach

fractionalization) are calculated as:

$$frac_j = 1 - \sum_{i=1}^{n} s_{ij}^2$$

where s_{ij} is the share of group i in country j.[51] Fractionalization is interpreted as the probability that two randomly chosen individuals belong to different ethnic, linguistic or religious group. Note that these are time-invariant measures[52] and therefore justify the use of the ran-

[51] i.e. Fractionalization equals 1 minus the respective group Herfindahl concentration index. See Alesina et al. (2003), p. 159.

[52] Although these fractionalization measures are in principle endogenous in the long-run, due to diverse factors such as: differences in fertility rates across groups, migration, mixing, definitional changes and identity/affiliation shifts, they are shown to be very stable in a time frame of up to 30 years. See Alesina et al. (2003), p. 161.

Variables	*Dependent variable: inconflict5 (Panel probit)*			
	(1)	*(2)*	*(3)*	*(4)*
Gdp growth (lag)	-0.0264***	-0.0248***	-0.0222***	-0.0186**
	(0.00923)	(0.00861)	(0.00760)	(0.00746)
Population (ln,lag)	0.986***	0.971***	0.981***	1.013***
	(0.198)	(0.197)	(0.199)	(0.199)
Corruption control (lag)	-0.416***		-0.367***	
	(0.0904)		(0.0805)	
Bureaucratic Quality (lag)		-0.542***		-0.465***
		(0.104)		(0.0950)
Forrest depletion (lag)	-0.464*	-0.323**		
	(0.262)	(0.147)		
Mineral Depletion (lag)			-0.0813**	-0.0510*
			(0.0335)	(0.0268)
Corr*ForestDepl (lag)	0.139**			
	(0.0621)			
BurQual*ForestDepl (lag)		0.213**		
		(0.0878)		
Corr*MineralDepl (lag)			0.0605***	
			(0.0179)	
BurQual*MineralDepl (lag)				0.0960***
				(0.0263)
Ethnic fractionalization	2.591*	2.063	2.695*	2.394
	(1.575)	(1.562)	(1.543)	(1.527)
Linguistic fractionalization	4.811***	4.995***	4.409***	4.589***
	(1.465)	(1.434)	(1.428)	(1.390)
Religious fractionalization	-4.450***	-4.192***	-4.269***	-4.233***
	(1.298)	(1.312)	(1.260)	(1.265)
Year	-0.127***	-0.120***	-0.123***	-0.119***
	(0.0111)	(0.0111)	(0.0113)	(0.0113)
Constant	245.9***	231.7***	237.4***	229.5***
	(21.69)	(21.62)	(22.04)	(22.05)
Observations	2352	2352	2411	2411
Groups	126	126	128	128

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 6: Civil conflict incidence and measures of fractionalization

dom effects probit model. As Elbadawi and Sambanis note, a fixed effects specification would create multicollinearity between the fixed individually-specific error-component and the time invariant regressor.[53] Results are presented in Figure 6, where we run our main regressions using the two governance indicators and the three depletion indicators in turn, and adding the three types of societal fragmentation mentioned above.

The table contains the previous panel probit specification including lagged regressors and

[53] See Elbadawi and Sambanis (2002), p. 313.

a time trend. First, it can be seen that the relationships of interest to us remain significant in all columns and change little in magnitude when the degree of fragmentation in the society is controlled for. Second, the measures of ethnic and linguistic fractionalization in a society have a positive influence on the likelihood of conflict:[54] as hypothesized, some conflicts indeed seem to have roots in ethnic divisions. Third, religious fractionalization indicator has the opposite sign when the other two measures are included, but is not statistically significant when entered alone. This result is consistent with other studies in the literature and is usually explained by the fact that religious affiliation is 'more endogenous' than the other measures, as it is relatively easy to hide or change under an intolerant regime.[55] The results are again robust when using income per capita instead of income growth and the coefficients are provided in Figure 12 in the Appendix. The usefulness of these measures of fractionalization in predicting civil strife has recently been questioned.[56] Some authors consider polarization, i.e. the division of society in comparably-sized clusters exhibiting strong differences, rather than fractionalization to be a more meaningful determinant of conflict.[57] When we add the Raynal-Querol measures of ethnic and religious polarization and repeat the above exercise in Appendix Figure 13, we find that our results survive. In addition, we find that ethnic polarization is positively and significantly related to the incidence of civil conflicts in the sample, while religious polarization is not statistically significant.

[54] This result confirms the findings of Elbadawi and Sambanis (2002), Hodler (2006). The latter paper's result that fractionalization is linked to the *perpetuation* of resource-related violence is driven by the assumption that the number of rival groups in the society is inversely proportional to property rights enforcement, and thus the productivity in legitimate economic activities.

[55] e.g. Alesina et al.(2003), p. 167.

[56] See Blattman and Miguel (2010), p. 27.

[57] See Esteban and Ray (1994), Duclos, Esteban and Ray (2004), Montalvo and Raynal-Querol (2005).

5. Conclusion

The paper presents a simple bargaining theoretical framework and then analyzes empirically the importance of governance quality indicators in conjunction with the level of depletion of natural resources, as factors explaining the incidence of civil conflict. A Nash bargaining process between locals and the government yields an equilibrium payoff for the former that depends on the quality of governance in an interesting way. In general, government corruption has the direct effect of lowering the policy-based component of the peasants' utility, and the indirect effect of accelerating the exploitation of the resource and increasing the current 'pie' available to be shared. Thus, it is not unambiguously clear what is the relationship between corruption and policy-driven discontent. A simple comparative statics on the equilibrium outcome reveals a somewhat intriguing scenario: when the peasants are relatively less 'greedy' and the resource is relatively scarce, a more corrupt government leads to a lower likelihood of conflict based on resource-policy discontent.

A panel data set containing a large cross section of countries during 20 recent years is used to show that governance and depletion and their interaction appear, indeed, to significantly influence the chance for civil violence, lending support to a 'grievance' motive of conflict. In order to increase the robustness of the empirical analysis, two different resource depletion variables have been chosen: net forest depletion and mineral depletion, in conjunction with two different quality of governance variables: corruption control and bureaucratic quality. Even after taking several steps to account for the possible endogeneity of some regressors, results confirm that resource depletion and governance quality jointly influence the likelihood civil conflict outcome. More specifically, a more corrupt government leads to an increased chance of civil conflict, except in more depleted environments, where the opposite is the case. This outcome may mean that in such cases the government is better able to 'appease' the locals by offering them side-payments or perhaps the distance between the capabilities of the government and those of the locals is larger. This suggests that it is not inconceivable, at least in some cases, that economic policy grievances are more than mere justifications used by rebels

to mask their real objectives. In contrast to the appropriation channel which offers little in terms of policy advice, the resource policy mechanism yields the following policy prescription: a more inclusive resource policy in conjunction with better overall economic conditions are likely to decrease civil conflict incidence on average. More generally, establishing a link between resource abundance and/or scarcity and civil conflicts requires an understanding of the exploitation regime and the division of rents prevalent in the society.

Given the explicit modeling choices made in both the theoretical and the empirical sections, the interpretation proposed here does not claim to be a universal explanation of civil conflict. Nor is the empirical exercise solid proof that civil conflict is *determined* by resource depletion grievances when the policy channel is by assumption unavailable or insufficient to achieve a political balance in society. Rather, this is an attempt to, on one hand, suggest that economic analyses of conflict do not have to be premised on a priori dismissing legitimate causes but can accommodate them, and on the other hand, to point at the fragility of what still constitutes 'conventional wisdom' in the empirical studies of civil conflict.

APPENDIX:

Some of the most important variables in the dataset are detailed in the following table, which also lists their respective sources:[58]

Variable	**Explanation**	**Source**
intensity	Intensity of conflict in given year: 1-minor,2-war	UCDP-PRIO
inconflict	Dummy turns 1 when a conflict is ongoing in given year	based on UCDP-PRIO
inconflict5	Dummy turns 1 if conflict in the next 5 years	based on UCDP-PRIO
intensitymax5	Maximum intensity of conflict in the next 5 years	based on UCDP-PRIO
pop	Population (deflated)	W.D.I.
gdp_cap	GDP per capita (deflated)	W.D.I.
gdp_growth	GDP growth (annual %)	W.D.I.
gini	Gini index	W.D.I.
food_exp	Food exports (% of merchandise exp.)	W.D.I.
fuel_exp	Fuel exports (% of merchandise exp.)	W.D.I.
metalore_exp	Ores and metals exports (% of merchandise exp.)	W.D.I.
polity2	Revised combined polity score	POLITY IV project
ans_end	Energy Depletion	A.N.S.
ans_mid	Minerals Depletion	A.N.S.
ans_nfd	Net Forest Depletion	A.N.S.
cor	Corruption	PRS-ICRG
bqua	Bureaucratic Quality	PRS-ICRG

[58] The following abbreviations have been used: UCDP-PRIO= Uppsala Conflict Data Project-International Peace Research Institute Oslo, W.D.I= World Development Indicators (World Bank, 2006), ANS database = Adjusted Net Savings Indicators (World Bank, 2006), PRS-ICRG = International Country Risk Guide from the Political Risk Services.

Variables	*Dependent variable: inconflict5 (PanelProbit)*					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Gdp/cap ppp (lag)	0.009	-0.026	0.001	-0.034	0.028	-0.029
	(0.033)	(0.030)	(0.032)	(0.030)	(0.032)	(0.030)
Population (ln, lag)	0.996***	0.956***	0.952***	0.956***	0.968***	0.923***
	(0.261)	(0.248)	(0.254)	(0.219)	(0.258)	(0.278)
Bur.Quality (lag)	-0.561***		-0.467***		-0.613***	
	(0.108)		(0.100)		(0.103)	
Corruption control (lag)		-0.425***		-0.350***		-0.446***
		(0.088)		(0.080)		(0.080)
Forest Depletion (lag)	-0.109	-0.205				
	(0.164)	(0.188)				
Energy Depletion (lag)			-0.027	-0.024		
			(0.017)	(0.020)		
Mineral Depletion (lag)					-0.422***	-0.327***
					(0.081)	(0.092)
Bur.Qual*ForestDep (lag)	0.212**					
	(0.087)					
Corruption*ForestDep (lag)		0.121**				
		(0.059)				
Bur.Qual*EnergyDep (lag)			0.007			
			(0.008)			
Corruption*EnergyDep (lag)				0.002		
				(0.007)		
Bur.Qual*MinDep (lag)					0.301***	
					(0.059)	
Corruption*MinDep (lag)						0.120***
						(0.031)
Year	-0.123***	-0.126***	-0.120***	-0.121***	-0.127***	-0.124***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Constant	238.074***	244.297***	233.676***	235.719***	246.343***	242.220***
	(23.103)	(21.792)	(21.494)	(21.025)	(22.735)	(22.491)
Observations	2376	2376	2436	2436	2436	2436
Groups	126	126	128	128	128	128

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 7: Robustness checks (Figure 3 in text): GDP /capita level

Variables	*Dependent variable: inconflict5*					
	(1) Panel OLS	*(2)IV*	*(3) Panel OLS*	*(4) IV*	*(5) Panel OLS*	*(6) IV*
Gdp/cap ppp (lag)	0.00690***	0.0271*	0.00544**	0.0282*	0.00761***	0.0131
	(0.00222)	(0.0143)	(0.00214)	(0.0159)	(0.00214)	(0.0178)
Population (ln, lag)	0.0675***	0.0503*	0.0715***	0.0694***	0.0749***	0.0963***
	(0.0172)	(0.0260)	(0.0166)	(0.0114)	(0.0168)	(0.0141)
Bur.Quality (lag)	-0.0533***	-0.292*	-0.0437***	-0.313**	-0.0659***	-0.212
	(0.0105)	(0.163)	(0.0104)	(0.141)	(0.00989)	(0.168)
Forest Depletion (lag)	-0.00854	-0.367**				0.0431***
	(0.0135)	(0.148)				(0.0123)
Bur.Qual*ForestDep (lag)	0.0190***	0.418***				
	(0.00712)	(0.160)				
Energy Depletion (lag)			-0.00248	0.0721***		
			(0.00201)	(0.0184)		
Bur.Qual*EnergyDep (lag)			0.000512	-0.0391***		
			(0.000897)	(0.0103)		
Mineral Depletion (lag)					-0.0376***	
					(0.00622)	
Bur.Qual*MinDep (lag)					0.0254***	0.0168**
					(0.00307)	(0.00714)
Year	-0.0120***	-0.0151***	-0.0114***	-0.0196***	-0.0118***	-0.0123***
	(0.00103)	(0.00209)	(0.00101)	(0.00312)	(0.00101)	(0.00198)
Constant	23.96***	30.40***	22.61***	39.40***	23.55***	24.72***
	(2.020)	(4.296)	(1.977)	(6.346)	(1.977)	(4.052)
Observations	2376	2167	2436	2197	2436	2169
Groups	126	121	128	122	128	121

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 8: Robustness checks (Figure 5 in text): GDP /capita level

Variables	*Dependent variable: inconflict5*					
	(1) Panel OLS	*(2)IV*	*(3) Panel OLS*	*(4) IV*	*(5) Panel OLS*	*(6) IV*
Gdp growth (lag)	-0.00347***	-0.000864	-0.00299***	0.000832	-0.00349***	-0.00207*
	(0.00106)	(0.00136)	(0.00102)	(0.00249)	(0.00102)	(0.00120)
Population (ln, lag)	0.0612***	0.0538***	0.0630***	0.0684***	0.0640***	0.0552***
	(0.0168)	(0.0144)	(0.0167)	(0.0128)	(0.0166)	(0.0172)
Corruption control	-0.0464***	-0.0867***	-0.0426***	-0.100***	-0.0501***	-0.0966**
	(0.00758)	(0.0308)	(0.00746)	(0.0290)	(0.00721)	(0.0385)
Forest Depletion (lag)	-0.0219	0.274***				0.00538
	(0.0226)	(0.104)				(0.0107)
Cor.ctrl*ForestDep (lag)	0.00752	-0.104**				
	(0.00762)	(0.0420)				
Energy Depletion (lag)			-0.00185	-0.0827		
			(0.00211)	(0.0555)		
Cor.ctrl*EnergyDep (lag)			-2.51e-05	0.0361		
			(0.000745)	(0.0240)		
Mineral Depletion (lag)					-0.0155***	
					(0.00433)	
Cor.ctrl*MineralDep (lag)					0.0102***	-0.00282
					(0.00199)	(0.00232)
Year	-0.0128***	-0.0158***	-0.0124***	-0.00796	-0.0124***	-0.0156***
	(0.000954)	(0.00150)	(0.000942)	(0.00528)	(0.000952)	(0.00179)
Constant	25.60***	31.77***	24.94***	16.10	24.79***	31.42***
	(1.890)	(3.065)	(1.864)	(10.58)	(1.886)	(3.685)
Observations	2419	2208	2486	2235	2486	2208
Groups	130	118	133	119	133	118

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 9: Robustness checks (Figure 5 in text): Corruption control

Variables	*Dependent variable: inconflict5*					
	(1) Panel OLS	*(2)IV*	*(3) Panel OLS*	*(4) IV*	*(5) Panel OLS*	*(6) IV*
Gdp/cap ppp (lag)	0.00690***	0.0174	0.00544**	0.00568	0.00761***	0.0221**
	(0.00222)	(0.0470)	(0.00214)	(0.0699)	(0.00214)	(0.00892)
Population (ln, lag)	0.0675***	0.114*	0.0715***	0.0968	0.0749***	-0.0488
	(0.0172)	(0.0603)	(0.0166)	(0.622)	(0.0168)	(0.0997)
Bur.Quality (lag)	-0.0533***	-0.269	-0.0437***	-0.0501	-0.0659***	-0.0414
	(0.0105)	(0.635)	(0.0104)	(0.613)	(0.00989)	(0.376)
Forest Depletion (lag)	-0.00854	0.348				-0.0162
	(0.0135)	(0.296)				(0.0502)
Bur.Qual*ForestDep (lag)	0.0190***	-0.409				
	(0.00712)	(0.369)				
Energy Depletion (lag)			-0.00248	-0.108		
			(0.00201)	(0.586)		
Bur.Qual*EnergyDep (lag)			0.000512	0.0660		
			(0.000897)	(0.367)		
Mineral Depletion (lag)					-0.0376***	
					(0.00622)	
Bur.Qual*MinDep (lag)					0.0254***	-0.00685
					(0.00307)	(0.00902)
Year	-0.0120***	-0.0100***	-0.0114***	-0.00972	-0.0118***	-0.0136***
	(0.00103)	(0.00269)	(0.00101)	(0.0239)	(0.00101)	(0.00472)
Constant	23.96***	20.23***	22.61***	19.22	23.55***	27.55***
	(2.020)	(5.317)	(1.977)	(48.84)	(1.977)	(8.262)
Observations	2376	2182	2436	2202	2436	2182
Groups	126	115	128	115	128	115

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 10: Robustness checks (Figure 5 in text): Only 'state antiquity' as instrument

Variables	*Dependent variable: inconflict5*					
	(1) Panel OLS	*(2)IV*	*(3) Panel OLS*	*(4) IV*	*(5) Panel OLS*	*(6) IV*
Gdp growth (lag)	-0.00356***	-0.00496*	-0.00303***	-0.00143	-0.00349***	-0.00232*
	(0.00106)	(0.00272)	(0.00102)	(0.00178)	(0.00102)	(0.00119)
Population (ln, lag)	0.0578***	0.00534	0.0626***	0.0660***	0.0641***	0.0545***
	(0.0167)	(0.0470)	(0.0163)	(0.0169)	(0.0164)	(0.0204)
Bur.Quality (lag)	-0.0512***	-0.0219	-0.0397***	-0.0868	-0.0497***	-0.0476
	(0.0100)	(0.170)	(0.0101)	(0.110)	(0.00944)	(0.113)
Forest Depletion (lag)	-0.0269**	-0.404*				-0.0109
	(0.0124)	(0.231)				(0.0199)
Bur.Qual*ForestDep (lag)	0.0215***	0.520*				
	(0.00692)	(0.300)				
Energy Depletion (lag)			-0.00231	0.0167		
			(0.00196)	(0.0445)		
Bur.Qual*EnergyDep (lag)			0.000449	-0.0118		
			(0.000893)	(0.0300)		
Mineral Depletion (lag)					-0.00789**	
					(0.00350)	
Bur.Qual*MinDep (lag)					0.0146***	-0.00339
					(0.00246)	(0.00623)
Year	-0.0106***	-0.0122***	-0.0104***	-0.0110***	-0.0101***	-0.0112***
	(0.000929)	(0.00291)	(0.000921)	(0.00157)	(0.000922)	(0.00163)
Constant	21.26***	24.48***	20.80***	22.19***	20.16***	22.50***
	(1.830)	(5.538)	(1.814)	(3.014)	(1.817)	(3.040)
Observations	2419	2208	2486	2235	2486	2208
Groups	130	118	133	119	133	118

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 11: Robustness checks (Figure 5 in text): Only 'state antiquity' as instrument

Variables	*Dependent variable: inconflict5 (Panel probit)*					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Gdp/capita ppp (lag)	0.038	0.074**	0.030	0.063*	0.038	0.097***
	(0.029)	(0.033)	(0.029)	(0.032)	(0.030)	(0.036)
Population (ln,lag)	1.087***	1.148***	1.150***	1.245***	1.131***	1.349***
	(0.208)	(0.227)	(0.217)	(0.234)	(0.216)	(0.244)
Corruption control (lag)	-0.368***		-0.294***		-0.405***	
	(0.0914)		(0.0838)		(0.0841)	
Bureaucratic Quality (lag)		-0.553***		-0.439***		-0.626***
		(0.112)		(0.104)		(0.108)
Forrest depletion (lag)	-0.141	-0.125				
	(0.191)	(0.160)				
Energy Depletion (lag)			-0.013	-0.014		
			(0.0203)	(0.0178)		
Mineral Depletion (lag)					-0.328***	-0.464***
					(0.0939)	(0.0857)
Corr*ForestDepl (lag)	0.105*					
	(0.0600)					
BurQual*ForestDepl (lag)		0.206**				
		(0.0888)				
Corr*EnergyDepl (lag)			0.000179			
			(0.00687)			
BurQual*EnergyDepl (lag)				0.00203		
				(0.00865)		
Corr*MineralDepl (lag)					0.121***	
					(0.0320)	
BurQual*MineralDepl (lag)						0.337***
						(0.0657)
Ethnic fractionalization	2.148	2.306	2.271	2.434	2.262	3.399*
	(1.639)	(1.727)	(1.670)	(1.760)	(1.682)	(1.885)
Linguistic fractionalization	5.189***	5.563***	5.432***	5.822***	5.325***	5.776***
	(1.440)	(1.476)	(1.469)	(1.510)	(1.468)	(1.587)
Religious fractionalization	-4.716***	-4.833***	-4.769***	-4.977***	-4.614***	-5.593***
	(1.268)	(1.360)	(1.288)	(1.370)	(1.272)	(1.430)
Year	-0.131***	-0.130***	-0.128***	-0.131***	-0.133***	-0.141***
	(0.0119)	(0.0124)	(0.0119)	(0.0125)	(0.0124)	(0.0136)
Constant	252.8***	249.9***	247.4***	251.6***	256.2***	269.5***
	(23.11)	(23.92)	(23.05)	(24.07)	(24.09)	(26.11)
Observations	2308	2308	2368	2368	2368	2368
Groups	122	122	124	124	124	124

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 12: Robustness checks (Figure 6 in text): Gdp/capita level

Variables	*Dependent variable: inconflict5 (Panel probit)*					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Gdp growth (lag)	-0.0226**	-0.0207**	-0.0150*	-0.0131	-0.0170**	-0.0144*
	(0.0108)	(0.00902)	(0.00813)	(0.00799)	(0.00785)	(0.00770)
Population (ln,lag)	1.044***	0.945***	0.961***	0.971***	0.944***	0.968***
	(0.252)	(0.338)	(0.238)	(0.258)	(0.270)	(0.269)
Corruption control (lag)	-0.544***		-0.390***		-0.418***	
	(0.0936)		(0.0828)		(0.0797)	
Forrest depletion (lag)	-0.516	-0.304**				
	(0.330)	(0.152)				
Corr*ForestDepl (lag)	0.178***					
	(0.0620)					
Bureaucratic Quality (lag)		-0.654***		-0.516***		-0.531***
		(0.107)		(0.0997)		(0.0947)
BurQual*ForestDepl (lag)		0.255***				
		(0.0927)				
Energy Depletion (lag)			-0.0333	-0.0359**		
			(0.0205)	(0.0174)		
Corr*EnergyDepl (lag)			0.00232			
			(0.00681)			
BurQual*EnergyDepl (lag)				0.00757		
				(0.00844)		
Mineral Depletion (lag)					-0.0792**	-0.0466*
					(0.0318)	(0.0261)
Corr*MineralDepl (lag)					0.0531***	
					(0.0181)	
BurQual*MineralDepl (lag)						0.0849***
						(0.0264)
Ethnic Polarization (Reynal-Querol)	3.654**	3.543**	3.504***	3.613***	3.278***	3.343***
	(1.607)	(1.501)	(1.161)	(1.185)	(1.215)	(1.218)
Religious Polarization (Reynal-Querol)	0.974	0.725	1.019	0.844	0.874	0.871
	(1.016)	(0.938)	(0.817)	(0.839)	(0.820)	(0.855)
Year	-0.126***	-0.115***	-0.120***	-0.117***	-0.119***	-0.116***
	(0.0115)	(0.0124)	(0.0109)	(0.0111)	(0.0114)	(0.0114)
Constant	242.3***	221.8***	230.7***	224.2***	230.4***	222.4***
	(22.16)	(23.56)	(21.15)	(21.54)	(22.08)	(22.00)
Observations	2145	2145	2201	2201	2201	2201
Groups	106	106	109	109	109	109

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 13: Robustness checks (Figure 6 in text): Ethnic and Religious Polarization

Variables	*Dependent variable: inconflict5 (Panel Fixed Effects Logit)*					
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Gdp growth (lag)	-0.047***	-0.047***	-0.024*	-0.026**	-0.028**	-0.030**
	(0.015)	(0.014)	(0.013)	(0.013)	(0.014)	(0.013)
Population (ln, lag)	0.570	3.109	1.944	3.139	1.069	2.432
	(2.157)	(2.166)	(1.970)	(1.949)	(1.920)	(1.900)
Bur.Quality (lag)	-0.949***		-0.676***		-0.753***	
	(0.197)		(0.177)		(0.173)	
Corruption control (lag)		-0.675***		-0.428***		-0.489***
		(0.165)		(0.141)		(0.139)
Forest Depletion (lag)	-0.994***	-1.284***				
	(0.296)	(0.380)				
Energy Depletion (lag)			-0.0776**	-0.0750*		
			(0.0362)	(0.0429)		
Mineral Depletion (lag)					-0.107**	-0.127**
					(0.0531)	(0.0546)
Bur.Qual*ForestDep (lag)	0.291					
	(0.192)					
Corruption*ForestDep (lag)		0.249**				
		(0.105)				
Bur.Qual*EnergyDep (lag)			0.0107			
			(0.0157)			
Corruption*EnergyDep (lag)				0.00386		
				(0.0146)		
Bur.Qual*MinDep (lag)					0.158***	
					(0.0536)	
Corruption*MinDep (lag)						0.0934***
						(0.0327)
Year	-0.185***	-0.245***	-0.220***	-0.245***	-0.196***	-0.225***
	(0.0495)	(0.0505)	(0.0461)	(0.0460)	(0.0449)	(0.0445)
Observations	785	785	793	793	793	793
Groups	39	39	40	40	40	40

Note: Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 14: Robustness checks: fixed effects (panel) logit

As an additional robustness check we ran a pooled probit regression of the baseline specification: inconflict5 on lagged gdp growth, population, bureaucratic quality, net forest depletion, the interaction between governance and depletion and a time trend. All the main results carry over. In particular, the marginal effect of the interaction is as expected. Here are the plots of the interaction effects following the Norton and Ai (2003) procedure implemented in `Stata`'s `inteff` command:

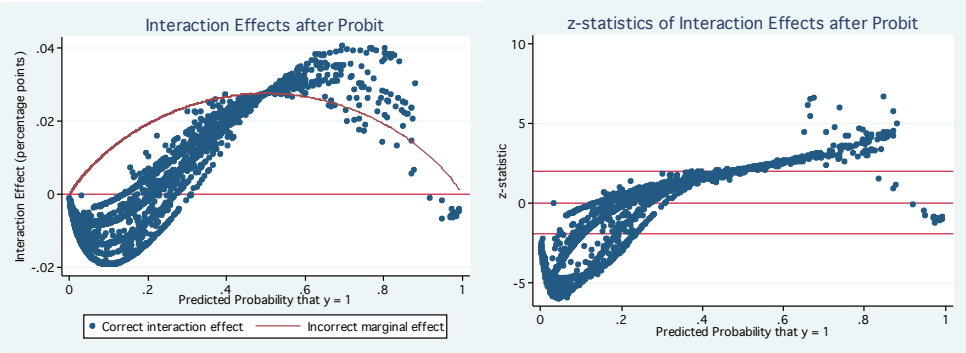

Figure 15: Interaction effect Bureaucratic Quality $*$ Net Forest Depletion (based on a probit regression)

References

[1] A. Alesina, A. Devleeschauwer, W. Easterly, S. Kurlat, R. Wacziarg, Fractionalization, Journal of Economic Growth 8 (2003) 155-194.

[2] M. V. Alexeev, R. F. Conrad, The elusive curse of oil, Review of Economics and Statistics (2008) 155-194.

[3] K. Ballentine, J. Sherman (Eds.), The Political Economy of Armed Conflict: Beyond Greed and Grievance, Lynne Rienner Publishers, London, 2003.

[4] I. Bannon, P. Collier (Eds.), Natural Resources and Violent Conflict: Options and Actions, The World Bank: Washington, D.C., 2003.

[5] E. Barbier, R. Damania, D. Leonard, Corruption, trade and resource conversion, Journal of Environmental Economics and Management 50 (2) (2005) 276-299.

[6] E. B. Barbier, M. Rauscher, Trade, tropical deforestation and policy interventions, Environmental and Resource Economics 4 (1) (1994) 75-90.

[7] E. B. Barbier, C.-E. Schulz, Wildlife, biodiversity and trade, Environment and Development Economics 2 (02) (2001) 145-172.

[8] S. Bhattacharyya, R. Hodler, Natural resources, democracy and corruption, European Economic Review, in press.

[9] C. Blattman, E. Miguel, Civil war, Journal of Economic Literature 48 (1) (2010) 3-57.

[10] V. Bockstette, A. Chanda, L. Putterman, States and markets: The advantage of an early start, Journal of Economic Growth 7 (4) (2002) 347–69.

[11] K. A. Bollen, D. K. Guilkey, T. A. Mroz, Binary outcomes and endogenous explanatory variables: Tests and solutions with an application to the demand for contraceptive use in tunisia, Demography 32 (1) (1995) 111-131.

[12] A. Borrmann, M. Busse, S. Neuhaus, Institutional quality and the gains from trade, Kyklos 59 (3) (2006) 1-26.

[13] C. N. Brunnschweiler, E. H. Bulte, The resource curse revisited and revised: A tale of paradoxes and red herrings, Journal of Environmental Economics and Management 55 (3) (2008) 248-264.

[14] P. Collier, A. Hoeffler, On economic causes of civil war, Oxford Economic Papers 50 (4) (1998) 563-73.

[15] P. Collier, A. Hoeffler, Greed and grievance in civil war, Development and Comp Systems 0409007, Economics Working Paper Archive at WUSTL (Sep. 2004).

[16] P. Collier, A. Hoeffler, Resource Rents, Governance and Conflict, Journal of Conflict Resolution 49 (4) (2005) 625-633. doi:10.1177/0022002705277551.

[17] P. Collier, A. Hoeffler, D. Rohner, Beyond greed and grievance: feasibility and civil war, Oxford Economic Papers 61 (1) (2009) 1–27.

[18] P. Collier, A. Hoeffler, Testing the neocon agenda: Democracy in resource-rich societies, European Economic Review 53 (3) (2009) 293-308.

[19] R. Damania, E. Barbier, Lobbying, trade and renewable resource harvesting, cIES Discussion Paper 0114 (2001).

[20] R. Damania, A. Gupta, The political economy of resources and development in india, adelaide University (http://www.economics.adelaide.edu.au/workshops/doc/_guptaresources6.pdf).

[21] S. Dietz, E. Neumayer, I. De Soysa, Corruption, the resource curse and genuine saving, Environment and Development Economics 12 (01) (2007) 33–53.

[22] J.-Y. Duclos, J. Esteban, D. Ray, Polarization: Concepts, measurement, estimation, Econometrica 72 (6) (2004) 1737–1772.
[23] I. Elbadawi, N. Sambanis, How much war will we see? explaining the prevalence of civil war, Journal of Conflict Resolution (46) (2002) 307-334.
[24] P. Eliste, P. G. Fredriksson, Environmental regulations, transfers, and trade: Theory and evidence, Journal of Environmental Economics and Management 43 (2) (2002) 234-250.
[25] J. D. Fearon, D. D. Laitin, Ethnicity, insurgency, and civil war, American Political Science Review 97 (2003) 75-90.
[26] J. D. Fearon, Primary commodity exports and civil war, Journal of Conflict Resolution 49 (4) (2005) 483-507.
[27] J. D. Fearon, Rationalist explanations for war, International Organization 49 (3) (1995) 379–414.
[28] H. Fjelde, Natural resources, quality of government and civil conflict, department of Peace and Conflict Research, Uppsala University (http://www.pcr.uu.se/publications/other_pub/isapaper_fjelde.pdf).
[29] P. G. Fredriksson, J. Svensson, Political instability, corruption and policy formation: the case of environmental policy, Journal of Public Economics 87 (78) (2003) 1383-1405.
[30] P. F. Diehl, N. P. Gleditsch (Eds.), Environmental Conflict, Westview Press, Boulder, CO, 2001.
[31] M. R. Garfinkel, S. Skaperdas, Economics of conflict: An overview, Working Papers 050623, University of California-Irvine, Department of Economics (April 2006).
[32] I. The PRS Group, International country risk guide (table 3b), c, http://www.prsgroup.com (1984-Present).
[33] N. P. Gleditsch, Armed conflict and the environment: A critique of the literature, Journal of Peace Research (35) (1998) 381-400.
[34] N. P. Gleditsch, P. Wallensteen, M. Eriksson, M. Sollenberg, H. Strand, Armed conflict 1946-2001: A new dataset, Journal of Peace Research 39 (5) (2002) 615-637.
[35] K. Hamilton, M. Clemens, Genuine savings rates in developing countries, World Bank Economic Review 13 (2) (1999) 333-56.
[36] R. Hodler, The curse of natural resources in fractionalized countries, European Economic Review 50 (6) (2006) 1367-1386.
[37] T. F. Homer-Dixon, Environment, Scarcity, and Violence, Princeton University Press, Princeton N.J., 1999.
[38] H. Hegre, Disentangling democracy and development as determinants of armed conflict, The World Bank.
[39] H. Hegre, N. Sambanis, Sensitivity analysis of empirical results on civil war onset, Journal of Conflict Resolution 50 (4) (2006) 508-535.
[40] M. Humphreys, Natural Resources, Conflict, and Conflict Resolution: Uncovering the Mechanisms, Journal of Conflict Resolution 49 (4) (2005) 508-537.
[41] D. Kaufmann, A. Kraay, M. Mastruzzi, Governance matters iv: Governance indicators for 1996-2004 (World Bank Policy Research Working Paper 3630, 2005).
[42] M. T. Klare, Resource Wars: The New Landscape of Global Conflict, Metropolitan Books: New York, 2001.
[43] R. La Porta, F. Lopez-de Silanes, A. Shleifer, R. Vishny, Law and finance, Journal of Political Economy 106 (6) (1998) 1113-1155.
[44] R. La Porta, F. Lopez-de Silanes, A. Shleifer, R. Vishny, The quality of government, Journal of Law, Economics and Organization 15 (1) (1999) 222-79.

[45] P. LeBillon, The political ecology of war: natural resources and armed conflict, Political Geography 20 (5) (2001) 561-584.
[46] P. Mauro, Corruption and growth, The Quarterly Journal of Economics 110 (3) (1995) 681-712.
[47] P. Mauro, Corruption and the composition of government expenditure, Journal of Public Economics 69 (2) (1998/6/1) 263-279.
[48] J. W. Maxwell, R. Reuveny, Resource scarcity and conflict in developing countries, Journal of Peace Research 37 (3) (2000) 301-322.
[49] E. Miguel, S. Shanker, E. Sergenti, Economic shocks and civil conflict: An instrumental variables approach, Journal of Political Economy 112 (4) (2004) 725-753.
[50] C. Ai, E. C. Norton, Interaction terms in logit and probit models, Economics Letters 80 (1) (2003) 123–129.
[51] B. A. Olken, Corruption perceptions vs. corruption reality, NBER Working Papers 12428, National Bureau of Economic Research, Inc (August 2006).
[52] O. Olsson, Conflict diamonds, Journal of Development Economics 82 (2) (2007) 267-286.
[53] R. Powell, War as a commitment problem, International Organization 60 (01) (2006) 169-203.
[54] M. Reynal-Querol, Ethnicity, political systems, and civil wars, Journal of Conflict Resolution 46 (1) (2002) 29-54.
[55] R. Reuveny, J. W. Maxwell, Conflict and Renewable Resources, Journal of Conflict Resolution 45 (6) (2001) 719-742.
[56] M. Renner, The anatomy of resource wars, Worldwatch Institute (162).
[57] M. Renner, Fighting For Survival: Environmental Decline, Social Conflict, and the New Age of Insecurity, Worldwatch Institute, Washington D.C., 1996.
[58] D. Rivers, Q. H. Vuong, Limited information estimators and exogeneity tests for simultaneous probit models, Journal of Econometrics 39 (3) (1988) 347-366.
[59] D. Rodrik, A. Subramanian, F. Trebbi, Institutions rule: The primacy of institutions over geography and integration in economic development, Journal of Economic Growth 9 (2) (2004) 131-165.
[60] J. Ron, Paradigm in distress? primary commodities and civil war, Journal of Conflict Resolution 49 (4) (2005) 443-450.
[61] M. L. Ross, What do we know about natural resources and civil war?, Journal of Peace Research 41 (3) (2004) 337-356.
[62] H. Rus, Corruption, conflict and the management of natural resources, mimeo, Department of Economics, University of British Columbia (2009).
[63] P. Sale, M. Butler IV, A. Hooten, J. Kritzer, K. Lindeman, Y. J. Sadovy de Mitcheson, R. Steneck, H. van Lavieren, Stemming decline of the coastal ocean: Rethinking environmental management, United nations university policy brief, UNU-INWEH, Hamilton, Canada (2008).
[64] S. Skaperdas, Restraining the genuine homo economicus: Why the economy cannot be divorced from its governance, Economics and Politics 15 (2) (2003) 135–162.
[65] S. Skaperdas, An economic approach to analyzing civil wars, Tech. rep., Department of Economics, University of California, Irvine (May 2005).
[66] A. Skonhoft, J. T. Solstad, The political economy of wildlife exploitation, Land Economics 74 (1) (1998) 16-31.
[67] K. Bolt, M. Matete, M. Clemens, Manual for Calculating Adjusted Net Savings, Environment Department, World Bank (September 2002).
[68] xxx, World development indicators, World Bank, Washington, DC.