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Civil War Onset, Natural Resource Rents and Social Cohesion

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CIVIL WAR ONSET, NATURAL RESOURCE RENTS AND SOCIAL COHESION[1]

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Abstract

This paper examines the nexus between civil war onset, natural resource rents, and social cohesion. Indeed, the main hypothesis is centered on the role of the hydrocarbon resource in promoting conflicts, especially in societies characterized by discrimination. Hence, using a comprehensive dataset, this paper's contribution is twofold. First, we test the non-linear effect of institutions and rents on the likelihood of civil war onset. Second, we introduce several measures of social cohesion and institutions. Our main findings show that both political institutions and rents have a non-linear effect on the outbreak of civil wars. Moreover, social cohesion variables measured by the share of discriminated population increases the probability of a civil war onset. These results remain robust in different econometric specifications, various estimation techniques and diverse measures.

1 Introduction

Natural resources are an important source of income in different countries. Yet, when they are poorly managed or inequitably shared, they can contribute to conflicts eruption. Thus, extending the political economy model of conflict by Elbadawi and Soto (2015), we pose that resource rents, interactively with social cohesion and political institutions, have a non-monotonic effect on the likelihood of civil wars. Indeed, conflict theories from Rodrik (1999) and Caselli and Coleman (2013), link societies with ethnic cleavages and inert democracies to higher probabilities of civil conflict. In the same line, Caselli and Coleman, while ignoring the role of political institutions, find that an upsurge in natural resources promotes exploitive competition amongst ethnic groups. Additionally, Hodler (2006) and Fearon (2005) associate natural resources with civil conflict, through diminished growth in fractionalized societies and an ineffectual political administration, respectively.

Building on Elbadawi and Soto, among others, this paper attempts to explain the curious phenomenon associated with the threshold or the non-monotonic nature of the impact of resource rents on the risk of civil wars. The evidence suggests that societies endowed with small rents or very large rents (as a share of GDP) are likely to be less risky, while those endowed with intermediate levels seem to be ripe for falling into the conflict trap. There are theoretical underpinnings that could be marshalled for explaining this phenomenon. However, the lack of systematic empirical research on this particular channel of the role of rents as a cause of conflicts constitute a lacuna in the received literature, which this paper attempts to address.

Moreover, resource rents are "lootable" and hence can be a cause of large-scale violence by allowing the would-be rebel movements overcome a "revenue constraint" to be able to mount an effective military challenge to an incumbent regime. Hence resource rents could be linked to risk of conflicts from a "loot" perspective. However, the lack of political inclusion in socially fractionalized or polarized societies will likely lead to inequitable allocation of the resource rents in such societies. In his context, resource endowments will be a cause of conflicts from a "grievance" perspective.

Subscribing to the above considerations, this paper models both the threshold/non-monotonic impact of resource rents on the hazard of civil wars as well as their interactions with social characteristics and the degree of political inclusion. Indeed, the main hypothesis is centered on the role of the hydrocarbon resource in promoting conflicts, especially in societies characterized by discrimination. Hence, using a comprehensive dataset, this paper's contribution is twofold. First, we test the non-linear effect of institutions and rents on the likelihood of civil war onset. Second, we introduce several measures of social cohesion and institutions. Our main findings show that both political institutions and rents have a non-linear effect on the outbreak of civil wars. Moreover, social cohesion variables measured by the share of discriminated population increases

the probability of a civil war onset. These results remain robust in different econometric specifications, various estimation techniques and diverse measures.

The remainder of the paper is organized as follows. Section 2 presents the conceptual framework and reviews the literature. Section 3 is dedicated to some stylized facts on natural resources, institutions, social characteristics and civil wars. Section 4 displays the methodology and data used. Section 5 analyzes our empirical findings and Section 6 presents some robustness checks. Section 7 concludes.

2. The Conceptual Framework

The literature on conflict and natural resources is rich. First of all, the mainstream political science literature explains conflict in connection with political and social grievances. The economic sentiment to civil conflict, theoretically embodied by Grossman (1991) and (1999), model rebellions as businesses profiting from 'lootable' resources. Grossman provided the bases for what is later referred to as the greed argument of conflict, pioneered by Paul Collier and other conflict economists. Natural resources, considered 'lootable' assets, constitute an easy source of rebel start-up finance providing an opportunity for insurgencies (Collier and Hoeffler 2004). Critiquing the well cited paper by Collier and Hoeffler (2004), Fearon (2005) adds that oil exports in particular, rather than primary commodity exports, provide stronger explanatory analysis of civil conflict risk. The political conflict literature, however, lacks consensus on the mechanism of how natural resources affect conflict onset.

While surveying 14 cross-national econometric studies of conflict and natural resources, Ross (2004) maintains that the influence of natural resource dependence on the risk of conflict is channeled through: institutions (authoritarian governance and corruption), social characteristics (ethnic grievance and human capital) and economic conditions (stagnant economic growth).

First, institutions have a direct effect on conflicts onset. This is why they are crucial in determining the effect of natural resources on conflicts. Indeed, generally speaking, weak political institutions, in spite of strong economic performance, can have a great influence on the probability of conflict onset. Elbadawi and Soto (2015) show that the solution to natural resource misallocation lies in political participation and political accountability. The authors argue that societies blessed (or in some cases cursed) by natural resources, are more prone to civil conflict when ruled by authoritarian regimes and in the absence of political constraints. Furthermore, Hegre, et al. (2001) find that stable democracies and autocratic regimes have a smaller chance of experiencing internal conflict compared to countries ruled by anocracies. The magnitude of civil conflict greatly declines in economies ruled by regimes with considerably high and low capacity to repress political discontent.

In the same vein, Muller and Weede (1990) argue that potent political repression in authoritarian regimes induces displacement and eventually leadership failure. Effectively democratic regimes on the other hand, are able to peacefully channel political unrest and hence drastically reduce the likelihood of civil conflict. Furthermore, partial (weak) democracies seem to varyingly lack the appriorite peaceful avenues to resolve political or ethnic disctontent and therefore experience more conflict. This relationship is referred to as the "inverted u-shape", where countries on the extremes of the polity score are less prone to domestic armed conflicts than partial democracies (Goldstone, et al. 2010). Conventional wisdom in the political conflict literature affirms that the relationship between conflict and polity is a non-linear one. The inverted U-shape association was proposed earlier by Luttwak (1968), T. R. Gurr (1974), and Jackman (1978) stating that the most autocratic and democratic regimes are known to be the least likely to experience internal conflict. Concurrently, Fearon and Laitin (2003) and Gates, et al. (2006), find that a highly stable democracy and a well-established anocracy are statistically correlated with less conflict. The hypothesis of an inverted-U relationship is based on the following: effective political participation in a politically competitive system, as well as total authoritarianism, reduce the chances of insurgencies. While on the other hand weaker states (economically and politically) are more prone to social grievances that may lead to political violence.

In addition to institutions, social characteristics can be an important determinant of the effect of natural resources on conflicts. Indeed, conflict theories from Rodrik (1999) and Caselli and Coleman (2013), link societies with ethnic cleavages and inert democracies to higher probabilities of civil conflict. Caselli and Coleman, while ignoring the role of political institutions, find that an upsurge in natural resources promotes exploitive competition amongst ethnic groups. Additionally, Hodler (2006) and Fearon (2005) associate natural resources with civil conflict, through diminished growth in fractionalized societies and an ineffectual political administration, respectively. It worthy to note also that the dynamics of ethnic power relations in a society bring about the features of its ruling regime, and can alter the political course of its institutions and potentially breed instability. Contention amongst ethnic groups, in turn, are mediated by the type of ruling regimes in a society. Lipset and Rokkan (1967) demonstrate that harmony amongst controverting social groups can directly affect the types of leading institutions in a society, and thus the extent of ethnic dissention at the executive level. Furthermore, political instability, in the presence of a locally separatist population, increase the likelihood of civil war onset, and promotes anarchy.

Thus, social fractionalization and polarization are considered significant determinants of internal conflict. Prominent scholars of conflict maintain that ethnically diverse societies in the presence of social fractionalization are more prone to domestic armed conflicts[4]. Sambanis (2001) shows that social fractionalization is in fact a more accurate determinant of conflict, while controlling for different regime types. In the same line, Elbadawi and Sambanis (2002), not controlling for ethnic

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[4] See Sambanis (2001), Reynal-Querol (2002), and Collier, Hoeffler and Rohner (2009)

polarization, find that ethnic fractionalization robustly increases the prevalence of civil wars in societies ruled by autocratic regimes. Social heterogeneity referred to as ethno-linguistic fractionalization is measured as the probability of two citizens belonging to two different ethnic groups. Collier and Hoeffler (1998) hypothesize that ethnolinguistic fractionalization raises the cost of effective political symbiosis and dawdle collective political action. In the case of ethnic polarization however, such costs are minimized when one ethnic group is affiliated with the government, while the other identifies with the rebels. Collier and Hoeffler add that such coordination costs also apply to rebels. They maintain that the likelihood of civil wars is quite higher in polarized societies due to the reduced cost of rebel organization amid different ethnic groups. Additionally, more recent work by Cederman, Wimmer and Min (2010) and Wimmer, Cederman and Min (2009) suggest that exclusion from government based on ethnic backgrounds greatly increases the chances of civil wars.

However, the literature on resource rents and civil conflict fail to address the implications of social and ethnic cohesion under different political regimes. It is therefore imperative to study the interactive influence of both political institutions and social cohesion on civil conflict. Hence, we extend the political economy model of conflict by Elbadawi and Soto (2015) and pose that resource rents, interactively with social cohesion and political institutions, have a non-monotonic effect on the likelihood of civil wars.

3. Data and Stylized Facts
3.1. Data Sources
To conduct our empirical analysis, we rely on several sources. This section will present different variables and datasets we use.

The conflict data used in our analysis is downloaded from the GROW[up] project in the ETH Zurich Institute and compiled from the Uppsala Conflict Program (UCDP) and the Peace Research Institute in Oslo (PRIO) (Gleditsch et al. 2002; Girardin et al. 2015). Macroeconomic indicators including natural resource rents, per capita GDP growth and population density is from the World Bank's World Development Indicators (World Bank 2019). Data on the percentage of discriminated population is from the Ethnic Power Relations (EPR) dataset and the index for equal distribution of resources is from the Varieties of Democracy dataset (VDEM) (Coppedge et al. 2016; Cederman, Wimmer, and Min 2010).

The civil war incidence, being dependent variable used in this paper, is constructed from the PRIO database on civil conflict (Gleditsch et al. 2002). We recognize the lack of unanimously agreed upon operationalization of civil conflict data as this is largely attributable to the different definitions of what constitutes a civil war, the different operationalization methodologies of ongoing and new civil wars, as well as the reliability of data for newly formed or dissolved states (Sambanis 2004). For the purpose, of this paper we only study the determinants of new civil war

incidences regardless of the duration, severity and continuity of the conflict. In our analysis civil war incidence is defined as 1 for the onset of any new PRIO-defined civil conflict (recoding at least 25 casualties), and 0 otherwise including continuing conflicts. New civil conflict is considered new, if it takes place two years after the previous conflict within the same country in a given year.

Macroeconomic indicators used in this paper include per capita natural resources rents, three-year moving average per capita GDP growth and the population density of the country at a given year. All 3 indicators are from the World Bank's World Development Indicators (World Bank 2019). The three-year moving average is the average change in annual per capita GDP growth calculated using constant 2010 USD GDP data divided by the mid-year population for each country at a given year. The country's population density is calculated as the mid-year number of people living in a country divided by the land area in square km. This includes all residents, refugees, migrants and asylum seekers, except for refugees who are not permanently settled in the country (World Bank 2019).

The total natural resources rents in our analysis is estimated as the difference between the price of a natural resources and its associated average cost of production, multiplied by the units or physical quantity of the resources produced or harvested. This includes fossil fuels and minerals (World Bank 2011). Per capita natural resource rents are constructed by multiplying the total natural resources rents as a share of GDP, by the constant 2010 USD GDP data for each country. This is to obtain an estimate of total natural resources rents in constant USD terms and then divided by the mid-year population value for each country each year. Therefore, the variable used for total natural resource rents per capita is in constant 2010 USD natural resource rents per person.

To measure the quality of institutions in the country we utilize the *Polity2* data set covering the period between 1947 and 2017, we further construct three measures of political regimes: autocracy (polity score -10 to -7, inclusive), partial autocracy (polity score -6 to -1, inclusive), partial democracy (polity score 0 to 6, inclusive) and full democracy (7 to 10, inclusive) (Marshall, Gurr, and Jaggers 2018). Using the *Polity2* data set however, has been criticized in the political science literature for measurement errors. Cheibub, Gandhi, and Vreeland (2010) find that different measures of democracy are not interchangeable when replicating studies published in leading journals. Furthermore, Treier and Jackman (2008) find considerable measurement errors in modelling democracy as a latent variable using the Polity2 data set. Hence concluding that democracy measures using the Polity2 data set could potentially produce misleading results when used as a covariate in cross-country analysis. To check for the robustness of the results in the paper an alternative measurement of polity is included using the Varieties of Democracy (V-Dem) data set developed by Coppedge et al. (2016).

In order to control for grievances stemming from social inequalities, corruption and a weak rule of law, the model specification includes a measure for equality before the law and individual liberties

from the VDEM data set. Moreover, the percentage of discriminated population is measured as the ratio of the number of group members who are subject to active (informal and formal), intentional and targeted discrimination by the state to exclude such members from political power, to the total population (Cederman, Wimmer, and Min 2010). The index for equal distribution of resources measures the extent to which resources, both tangible and intangible, are equally distributed in the society (0 is low and 1 is high equality). As a component of egalitarian democracy, this index estimated by the VDEM project members from a Bayesian factor analysis model that measures equality of different resources' distribution amongst different society members (Coppedge et al. 2016). Table 1 below shows a summary of the data and data sources.

Table 1. Data summary and sources

	Mean	Std. Dev.	Min	Max
UCDP – PRIO				
Civil war incidence (0/1)	0.209	0.406	0	1
World Development Indicators (WDI)				
Per capita rents (constant 2010 USD)	615.2	2,352.8	0	51,586.2
3-year GDP (per capita) growth (%)	6.3	14.6	-71.3	359.2
Population density (people/km^2)	3,675.1	13,880.7	27	215,146
Polity2				
Polity (-10/10)	2.2	7.152	-10	10
Ethnic Power Relations (EPR)				
Discriminated population (%)	0.038	0.121	0	0.98
Varieties of Democracy (VDEM)				
Equal distribution of resources (%)	0.584	0.272	0.042	0.986
Number of years	1971-2017 (47 years)			
Number of countries	155			
Number of observations	5,865			

Source: Constructed by the authors.

3.2. Preliminary assessment

Historians and conflict theorists have linked persistent economic hardships, natural resource rents, and ethnic dissention with political violence[5]. In terms on conflicts, it is important to note that, during the period between 1946 and 2017 the world has witnessed a total of 1,955 internal civil conflicts. The height of civil conflict onset took place in the period between 1988 and 1995, during the collapse of the Soviet Union (Gleditsch et al. 2002). Before embarking into the empirical work, it is important to have an overview of institutions, conflicts, social characteristics and their relations to natural resources.

Political Institutions

In terms of institutions, in 1950 the world's ruling regimes were almost equally split between autocracies (36%), partial democracies (34%), and fully functional democracies (30%). Subsequent to numerous political transitions in the 1970s in the Latin Southern Cone and South-East Asia, autocratic regimes dominated both regions (55% in 1980), while partial democracies

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[5] See Moller (1968), Kaplan (1994), Collier & Hoeffler (1998), Rodrik (1999), Cederman, Wimmer, & Min (2010), and Elbadawi and Soto (2015).

fell from 34% in 1950 to 16% in 1980. The evolution of ruling regimes globally over time is highlighted in Figure 1.
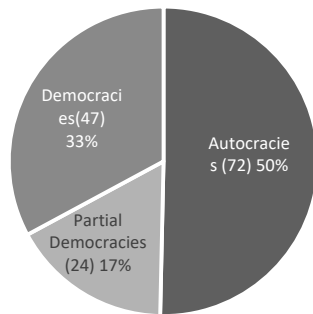
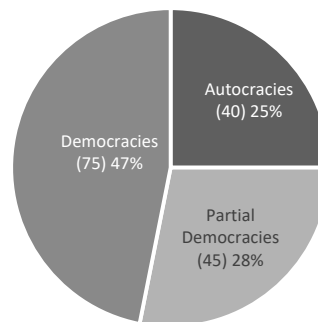**Figure 1. Evolution of Political Regimes 1800-2014**
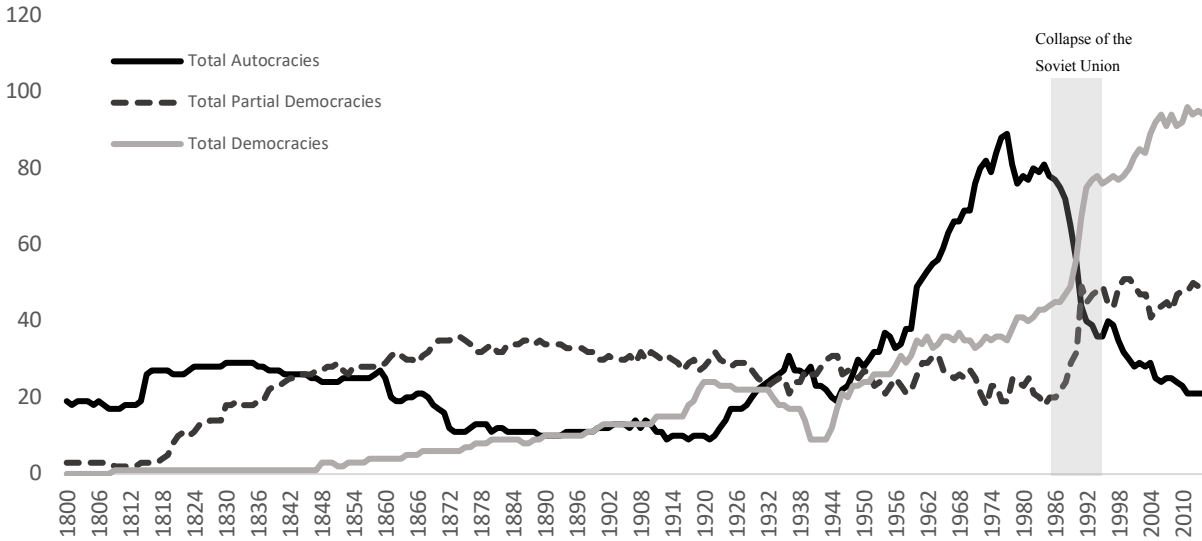
Notes: Polity2 data is from Marshall, Gurr, & Jaggers (2010). Autocratic regimes are regimes with a normalized Polity2 score from 0-4, partially democratic regimes are regimes with a normalized Polity2 score from 5-15, and democratic regimes are regimes with a normalized Polity2 score from 16-20.

The dissolution of the Soviet Union resulted in 15 partial and fully democratic states[6], purported as 'Democracy's Third Wave' (Huntington 1991). As a result, the number of autocratic regimes declined giving rise to more partial and full democracies. Figures 2 and 3 below show a snapshot of world ruling regimes before and after the collapse of the Soviet Union.

Figure 2. Regime Types in 1988   **Figure 3. Regime Types in 1995**

Notes: Polity2 data is from Marshall, Gurr, & Jaggers (2010). Autocratic regimes are regimes with a normalized Polity2 score from 0-4, partially democratic regimes are regimes with a normalized Polity2 score from 5-15, and democratic regimes are regimes with a normalized Polity2 score from 16-20.

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[6] Namely: Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.

Global trends in regime change and leadership survival has been of great interest to a number of scholars[7]. In fact, Goldstone, et al. (2010) maintain that regime types are more accurate predictors of internal conflict; than economic, social, demographic, or geographic aspects of an economy. Unstable regimes and perpetual political transitions can drive political unrest and lead to devastating civil wars. In the period between 1970-2011, authoritarian regimes encountered 88 civil conflicts, while full democracies only saw 75, compared to anocracies that witnessed a total of 99 civil wars. Figure 4 below shows the median polity score for economies experiencing conflict; countries ruled by unstable regimes distinctly experience more conflicts than others.

Figure 4. Median Polity and Civil Conflict 1946-2011
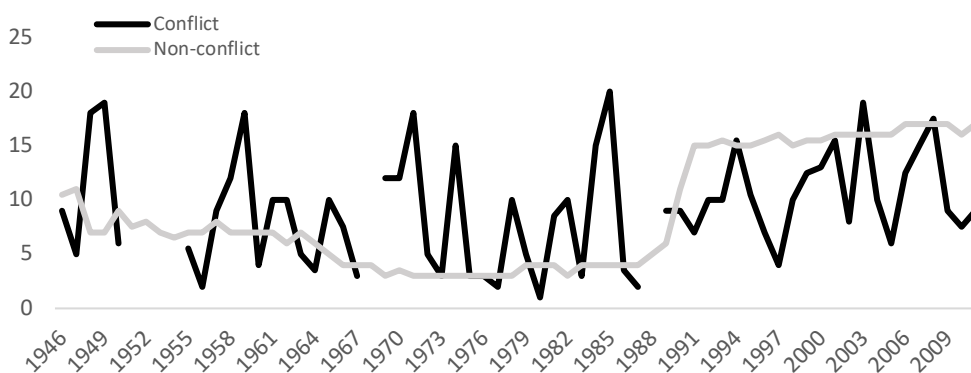
Notes: Civil conflict data is obtained from the Peace Research Institute as part of the Uppsala Conflict Data Program, and authors' own elaboration. Polity2 data is from Marshall, Gurr, & Jaggers (2010).

Natural Resource Rents

Studying the negative implications of natural resource wealth started in the late 1990s[8]. The '*natural resource curse*' notion became prominent during that period, as the literature unanimously associated natural resources with slow economic growth, civil conflict, and the prevalence of authoritarian regimes (Brunnschweiler and Bulte 2009).

In terms of the correlation between conflicts and natural resources, Figure 5 shows the median annual resource rents (% of GDP) in countries that experienced civil conflict during the period between 1970 and 2011. Compared to countries that did not encounter civil conflict, conflict-prone economies are clearly resource-richer.

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[7] See Gurr (1974), Bueno de Mesquita, et al. (2003), Gates, et al. (2006), and Goldstone, et al. (2010).
[8] See Ross (2004).

Figure 5. Median Natural Resource Rents (% of GDP) and Civil conflict

Natural resources are also proven to exhibit a non-linear effect on civil wars. Elbadawi (2016) demonstrates a quadratic relationship between natural resource rents and further estimates thresholds at which the likelihood of conflict onset is maximized. Figure 6 shows the median natural resource rents and total civil wars during the period 1970-2011, suggesting the presence of the aforementioned relationship.

Figure 6. Median Natural Resource Rents and Civil War Onset (1970-2011)

$y = -0.5253x^2 + 3.294x + 0.2428$
$R^2 = 0.0454$
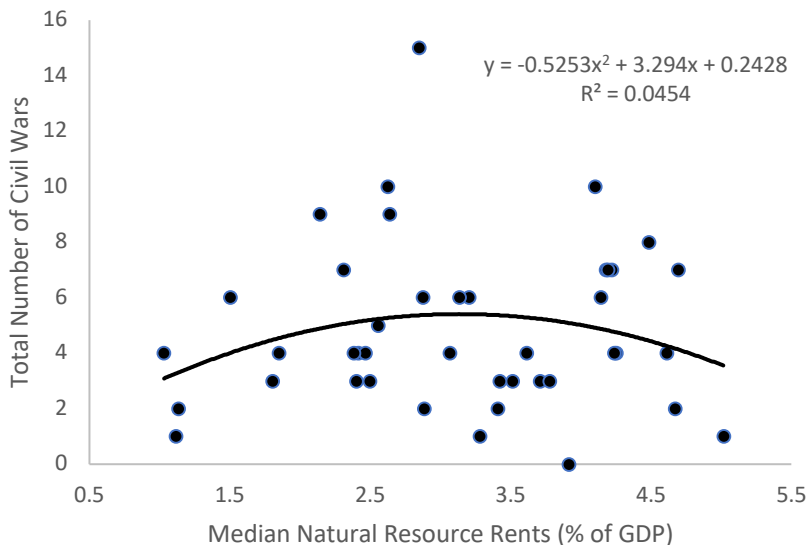
Source: Authors' own elaboration.

This same relationship holds when we use the natural resource rents per capita (Figures 7). Indeed, this measure can be more accurate it shows the impact of resource abundance rather than resource

dependence (Mohtadi, Ross, and Ruediger 2015). The same non-linear relation is confirmed for GDP per capita and conflicts (Figure 8).

Figure 7. Natural Resource Rents per Capita and Civil War Incidence
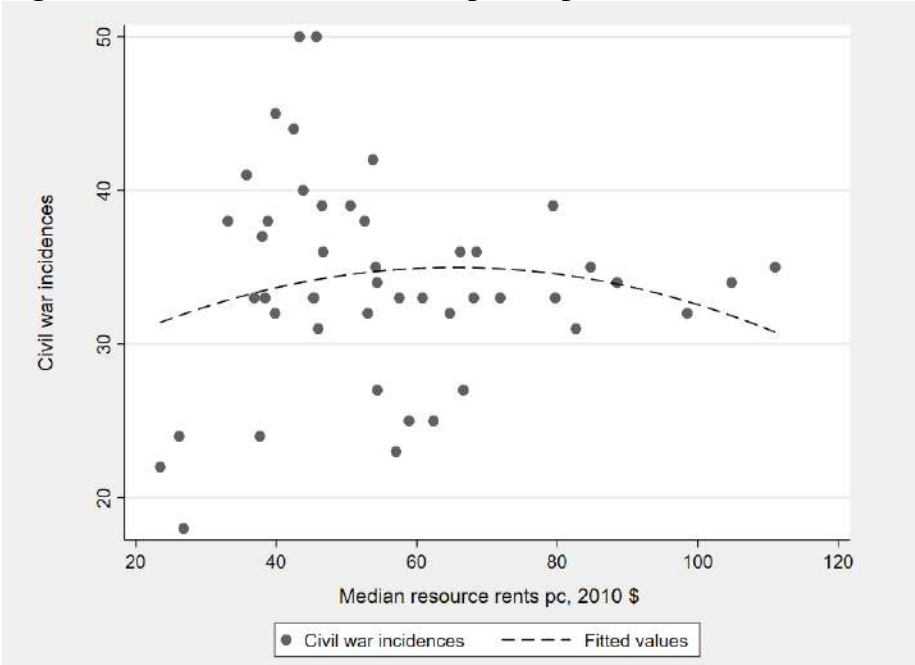
Source: Authors' own elaboration.

Figure 8. GDP per Capita and Civil War Incidence
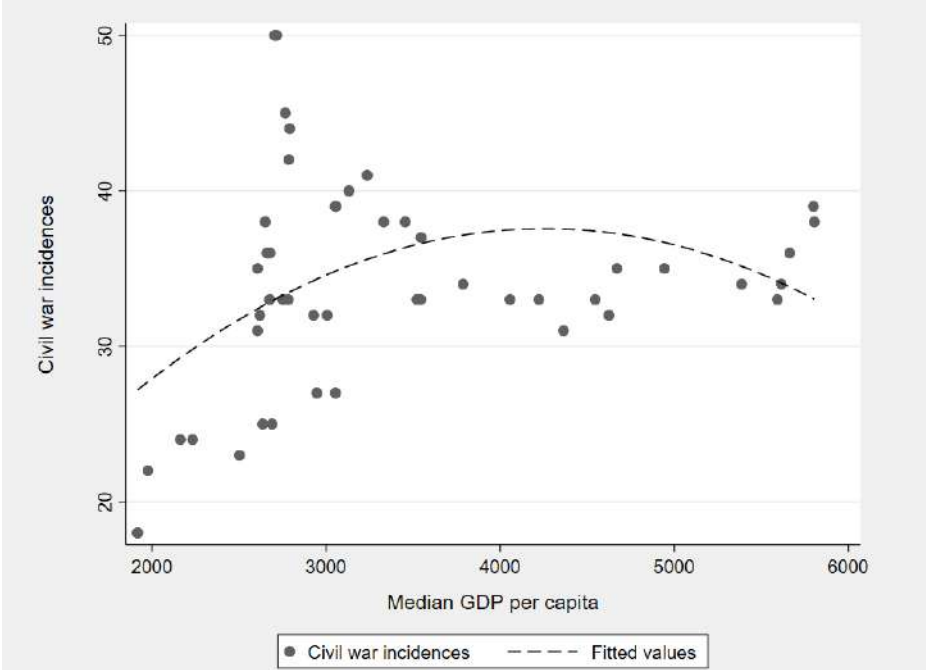
Source: Authors' own elaboration.

To further investigate this non-linear relationship between per capita rents and civil war incidence, Figure 9 shows that, over time, while conflicts tend to increase in for the 5th to 7th deciles, they were rather stable for all other deciles except the 10th one.

Figure 9. Evolution of Civil War Incidence by Deciles

Graphs by Deciles of per capita rents, 2010 $
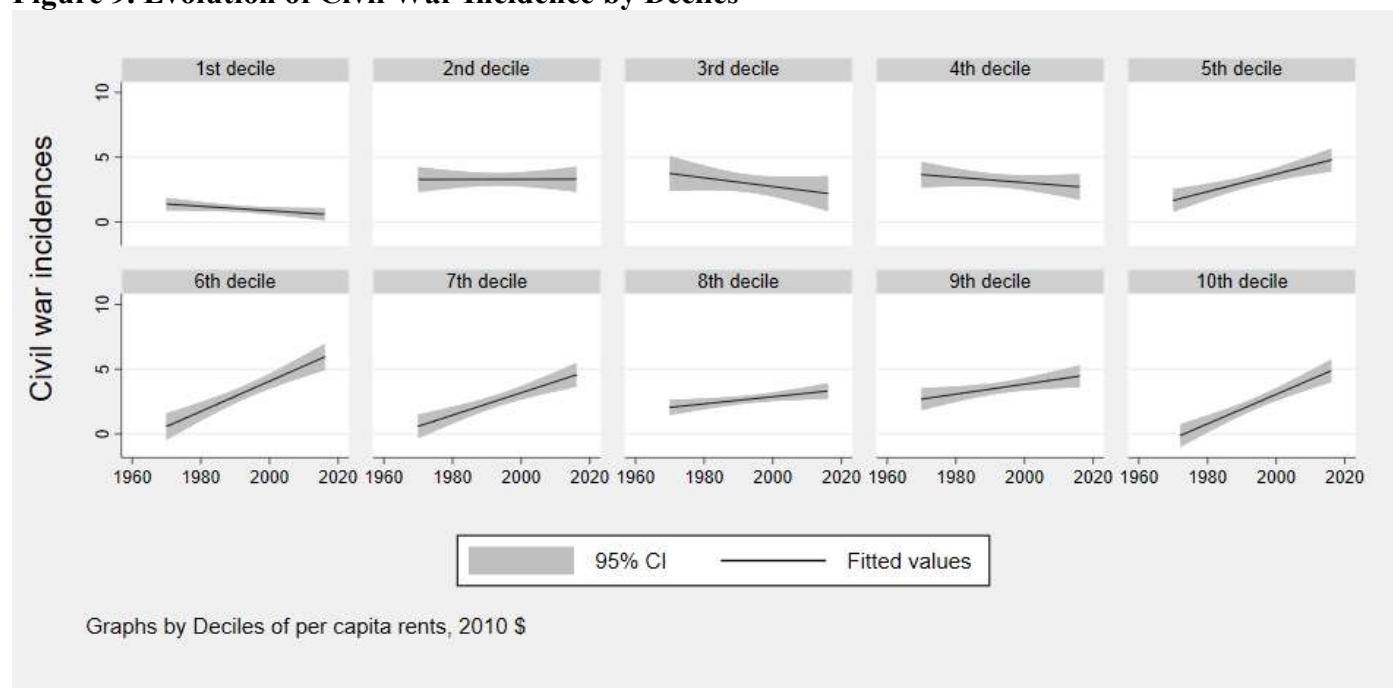
Source: Authors' own elaboration.

On the nexus between natural resources rents, institutions and conflicts, Table 2 presents the distribution of conflicts by the deciles of resource rents per capita. Four remarks are worth to be mentioned. First, the highest number of civil wars is associated to the middle deciles (5th-7th) of rents per capita regardless the regime type. Second, as it was mentioned before, partial autocracies are characterized by a larger number of conflicts when compared to full autocracies. In addition, democracies in conflict appear to boast the least resource rents, of all groups compared to the overall sample. Third, in the top decile, whereas full autocracies have the highest median rent/capita followed by partial ones and full democracies, the maximum number of civil wars is the same. Fourth, countries located in the lowest deciles of resources rents per capita, are characterized by a low likelihood of conflicts onset. This confirms the non-linear relationship between civil wars and natural resources rents.

Table 2. Polity, Rents and Civil Conflict

Resource Rents/capita deciles	Full autocracy				Partial autocracy			
	Maximum # of civil wars	Median rents/capita	Number of countries	Median GDP/capita growth	Maximum # of civil wars	Median rents/capita	Number of countries	Median GDP/capita growth
1st decile	4	0.01	4	3.39	1	0.23	5	14.24
2nd decile	5	6.26	22	5.30	4	5.07	16	5.85
3rd decile	17	18.00	29	3.37	4	16.43	23	3.08
4th decile	6	28.94	41	6.59	5	29.33	28	3.65
5th decile	18	44.21	32	7.24	20	44.98	32	4.88
6th decile	19	67.44	38	7.74	22	66.33	28	4.55
7th decile	10	112.15	30	5.60	11	109.09	26	4.98
8th decile	8	197.76	30	7.60	4	226.88	23	4.63
9th decile	9	490.88	21	4.20	6	467.18	17	3.00
10th decile	9	5,134.60	14	2.14	9	1,851.90	9	5.37
	Full democracy				Partial democracy			
	Maximum # of civil wars	Median rents/capita	Number of countries	Median GDP/capita growth	Maximum # of civil wars	Median rents/capita	Number of countries	Median GDP/capita growth
1st decile	4	0.64	7	10.98	5	0.21	6	3.96
2nd decile	7	7.18	28	6.72	3	5.47	21	9.84
3rd decile	15	16.88	44	6.24	6	18.53	30	7.97
4th decile	21	29.25	51	7.38	7	29.70	37	5.90
5th decile	20	44.02	50	6.86	5	43.98	34	3.50
6th decile	23	64.71	54	5.66	23	63.92	37	4.89
7th decile	16	114.69	54	7.10	12	106.14	34	5.52
8th decile	12	207.79	45	7.75	12	191.58	30	4.14
9th decile	3	480.86	32	6.39	8	516.32	19	5.04
10th decile	9	1,803.67	13	5.15	9	1,384.99	12	8.52

Source: Authors' own elaboration.

In the empirical part, when measuring natural resource we opt for resource rents per capita instead of per GDP, as we are interested in measuring the impact of resource abundance rather than resource dependence (Mohtadi, Ross, and Ruediger 2015).

4. Econometric Specification

This paper examines the effect of natural resources, political institutions and social grievances on the probability of new incidences of civil conflict. To do this, we run a country fixed effect Ordinary Least Squares (OLS) model as follows:

$$War_{ct} = \alpha_c + \beta_1 Rents_{ct} + \beta_2 Rents_{ct}^2 + \beta_3 Polity_{ct} + \beta_4 Polity_{ct}^2 + \beta_5 X_{ct} + \varepsilon_{ct} \qquad (1)$$

Where War_{ct} stands for civil war incidence in country c and year t. α_c represents a vector of country fixed effects, which can control for any unobservable time-invariant differences across countries. $Rents_{ct}$ and $Rents_{ct}^2$ stands for per capita natural resource rents and its square term for each country and year to capture the non-linear effect on conflicts. $Polity_{ct}$ and $Polity_{ct}^2$ measure the polity score and its square term, later polity is replaced by the Liberal Democracy Index for robustness checks. X_{it} is a vector of control variables including population density, 3-year per

capita GDP growth, discriminated population, and equality of resources distribution as measures of social characteristics; and ε_{ct} is the discrepancy term.

Equation (1) is regressed in 4 different ways: first by estimating the baseline model which control for resource rents, population density and per capita GDP growth; second, by controlling for social grievances to investigate if the effect of natural resource change; third, by controlling for Polity in the full specification model to measure the effect of resource rents more conservatively; fourth, we also look for heterogenous effects of fully democratic and fully autocratic regimes by splitting our sample by the Polity score.

We extend the analysis by also showing the different threshold effects of natural resource rents per capita for each of the model specifications by calculating the partial derivatives of the coefficients of natural resources and its square - β_1 and β_2, respectively.

Finally, we test the robustness of our findings by running different specifications and model structure similar to equation (1). We estimate a fixed effect Logit model and a random error Probit model using the same model structure as in equation (1). Also, we re-estimate equation (1) using the Liberal Democracy Index from the Varieties of Democracy (VDEM) project to address some of the criticisms in the literature regarding the operationalization of the Polity2 score as it was mentioned before.

5. Empirical Results

Table 3 presents the results of our baseline model. First, regarding our control variables, while population density is insignificant in the regressions, GDP per capita growth exerts a negative effect on the probability of a civil war. As per our main variables of interest, institutions measured by polity index do not have a linear effect as while its level is positive and significant, its squared term is negative and statistically significant. This non-linear effect holds also for natural resources showing that these lootable assets constitute an easy source of rebel start-up finance providing an opportunity for insurgencies (Collier and Hoeffler 2004). As per the social characteristics, whereas the equal distribution of resources is insignificant, the higher the share of discriminated population, the higher the probability of having a conflict. Indeed, discrimination is in general associated to precarious conditions that discourage identity and thus increases the likelihood of conflicts eruption. It is worthy to note that our results are robust whether we use random or fixed effects. Yet, the results of Hausman test show that the fixed effects model is consistent, hence we opt for it in the following regressions.

Table 3. Hausman Test for Random or Fixed Effects

	Fixed Effects	Random Effects
Per capita rents [ab]	0.020[**]	0.014[*]
	(0.008)	(0.007)
Per capita rents square [ab]	-0.002[**]	-0.001
	(0.001)	(0.001)
Population density [ab]	-0.007	0.013
	(0.019)	(0.012)
3-year GDP pc growth [a]	-0.001[***]	-0.001[***]
	(0.000)	(0.000)
Polity [a]	0.004[***]	0.003[***]
	(0.001)	(0.001)
Polity square [a]	-0.003[***]	-0.003[***]
	(0.000)	(0.000)
Disc. population [a]	0.248[***]	0.266[***]
	(0.046)	(0.045)
Equal dist. of resources [a]	0.067	-0.071
	(0.058)	(0.048)
Constant	0.319[**]	0.269[***]
	(0.126)	(0.087)
Observations	5865	5865
RE, FE Hausman Chi-sqr	33.64[***]	

Standard errors in parentheses
[+] $p < 0.11$, [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$
[a] Lagged variable
[b] Natural log

Table 4 extends the results of Table 3 in two ways. First, it calculates the threshold of rents per capita and second compares different political regimes. The first three columns show how the non-linear effect of natural resources on conflicts holds in all specifications (ranging from the baseline one to the one that adds institutions and social grievance)[9]. Based on the results of these regressions, the threshold of rents per capita is estimated to be 148.4 USD. Interestingly, when we distinguish between autocratic and democratic regimes, the threshold of the former is much higher than the latter (almost 20 times higher). This shows to what extent autocratic regimes have to mobilize more resources that should lead to more stable regimes. By contrast, democratic ones, thanks to a higher political participation, tend to have more inclusive political institutions that are a to be key for conflict prevention. Figure 10 confirms these findings where the marginal effect of natural resources per capita on conflict incidence is much steeper for full autocracies than for full democracies. In addition, Figure 11 shows that the effect of GDP growth on the likelihood of conflict eruption is stronger in democracies than in autocracies.

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[9] Note that column (3) is identical to the fixed effect estimation of Table 3.

Table 4. Non-monotonic resource rents and institutions

	Baseline Model	Controlling for Grievances	Controlling for Polity	Full autocracy	Full democracy
Per capita rents [ab]	0.018**	0.015**	0.020**	0.046***	0.028*
	(0.007)	(0.007)	(0.008)	(0.012)	(0.015)
Per capita rents square [ab]	-0.002**	-0.002**	-0.002**	-0.003***	-0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Population density [ab]	0.051***	0.078***	-0.007	-0.099**	0.120***
	(0.015)	(0.016)	(0.019)	(0.039)	(0.031)
3-year GDP pc growth [a]	-0.001***	-0.001***	-0.001***	-0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
Discriminated population [a]		0.292***	0.248***	0.117	1.168***
		(0.045)	(0.046)	(0.111)	(0.228)
Equal dist. of resources [a]		-0.062	0.067	0.435**	-0.155
		(0.055)	(0.058)	(0.186)	(0.100)
Polity [a]			0.004***		
			(0.001)		
Polity square [a]			-0.003***		
			(0.000)		
Constant	-0.175*	-0.330***	0.319**	0.499**	-0.705***
	(0.100)	(0.105)	(0.126)	(0.213)	(0.217)
Rents threshold (per capita 2010 USD)	90.0	42.5	148.4	2,143.1	106.7
Observations	6163	6046	5865	1300	2550

Standard errors in parentheses
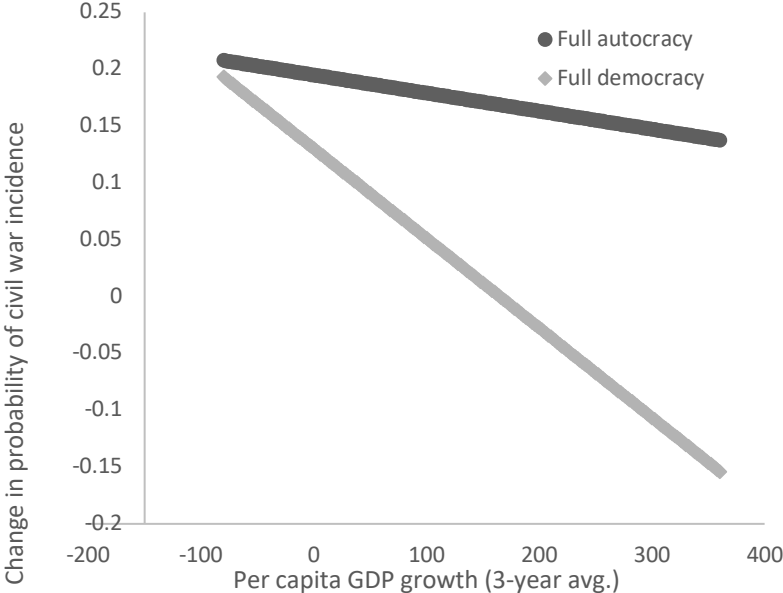[+] $p < 0.11$, [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$
[a] Lagged variable
[b] Natural log

Figure 10. Marginal Effects of Natural Resources Rents on the Probability of Civil War Incidence – By Regime Type
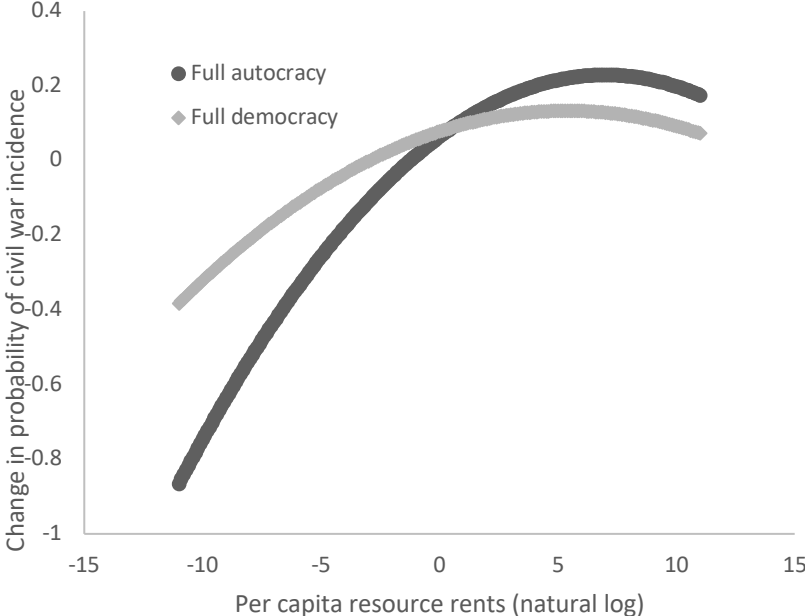
Source: Authors' own elaboration.

Figure 11. Marginal Effects of GDP per Capita Growth on the Probability of Civil War Incidence – By Regime Type

Source: Authors' own elaboration.

In Table 6, we further investigate the non-monotonic relationship between natural resources rents per capita and conflicts incidence by interacting the natural log of rents per capita with dummies of the rents' deciles. While the interaction with the first decile is significant in the baseline model, the general one and for both types of regimes (full democracy and full autocracy), higher deciles are in general insignificant except for full autocracy. Indeed, for the latter, the sixth, seventh and eighth deciles are positive and statistically significant pointing out the high level of inflection point when compared to the same deciles for full democracy.

Table 5. Non-monotonic resource rents and polity

	Baseline model	Controlling for Polity	Full autocracy	Full democracy
1st decile # Rents	0.061***	0.066***	0.092***	0.054+
	(0.016)	(0.017)	(0.021)	(0.033)
2nd decile # Rents	-0.034**	-0.033**	-0.020	-0.040**
	(0.014)	(0.014)	(0.024)	(0.016)
3rd decile # Rents	-0.024**	-0.019*	0.042**	-0.016
	(0.010)	(0.010)	(0.020)	(0.012)
4th decile # Rents	-0.009	-0.003	0.042**	-0.007
	(0.009)	(0.009)	(0.018)	(0.011)
5th decile # Rents	-0.008	-0.005	0.025	-0.016+
	(0.008)	(0.008)	(0.017)	(0.010)
6th decile # Rents	-0.005	-0.002	0.034**	-0.004
	(0.008)	(0.008)	(0.015)	(0.009)
7th decile # Rents	-0.010	-0.006	0.024*	-0.008
	(0.007)	(0.007)	(0.014)	(0.009)
8th decile # Rents	-0.006	-0.001	0.042***	-0.007
	(0.007)	(0.007)	(0.013)	(0.008)
9th decile # Rents	-0.011*	-0.006	0.002	-0.009
	(0.006)	(0.006)	(0.012)	(0.007)
10th decile # Rents	-0.012*	-0.007	0.012	-0.007
	(0.006)	(0.006)	(0.012)	(0.007)
Population density ab	0.079***	-0.006	-0.077**	0.123***
	(0.017)	(0.019)	(0.039)	(0.033)
3-year GDP pc growth a	-0.001***	-0.001***	-0.001	-0.001
	(0.000)	(0.000)	(0.001)	(0.000)
Disc. population a	0.301***	0.256***	0.104	1.231***
	(0.046)	(0.047)	(0.112)	(0.229)
Equal dist. of resources a	-0.066	0.062	0.405**	-0.148
	(0.057)	(0.059)	(0.190)	(0.103)
Polity a		0.004***		
		(0.001)		
Polity square a		-0.003***		
		(0.000)		
Constant	-0.261**	0.382***	0.393*	-0.625***
	(0.111)	(0.132)	(0.228)	(0.224)
Observations	5882	5708	1283	2471

Standard errors in parentheses
+ $p < 0.11$, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
a Lagged variable
b Natural log

6. Robustness Checks

We test the robustness of our results in two ways. First, we change our estimation technique and second, we change the Polity variable since it was criticized.

Table 6 shows the estimates in using Random Error Panel Probit. While the Hausman test showed that fixed effect estimations are more consistent, it worth investigating the results of a Probit model. Our empirical findings remain robust since per capita rents' effect is still non-monotonic and statistically significant, the share of discriminated population has a positive and significant effect and the quality of institutions is also non-linear. Our results remain robust even when use a Fixed Effects Panel Logit model (see Table 7).

Table 6. RE Probit: Non-monotonic resource rents and polity

	Baseline Model	Controlling for Grievances	Controlling for Polity
Per capita rents ab	0.119***	0.108**	0.096**
	(0.046)	(0.047)	(0.048)
Per capita rents square ab	-0.013**	-0.011**	-0.011**
	(0.005)	(0.006)	(0.006)
Population density ab	0.172**	0.296***	0.000
	(0.072)	(0.074)	(0.082)
3-year GDP pc growth a	-0.010***	-0.010***	-0.009***
	(0.002)	(0.002)	(0.002)
Disc. population a		0.958***	0.775***
		(0.222)	(0.234)
Equal dist. of resources a		-1.069***	-0.505
		(0.317)	(0.335)
Polity a			0.017**
			(0.007)
Polity square a			-0.015***
			(0.001)
lnsig2u	1.662***	1.367***	1.187***
	(0.185)	(0.198)	(0.198)
Constant	-3.533***	-3.564***	-0.863
	(0.543)	(0.563)	(0.604)
Threshold rents (2010 USD / capita)	97.5	135.6	78.3
Observations	6163	6046	5865

Standard errors in parentheses
[+] $p < 0.11$, [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$
[a] Lagged variable
[b] Natural log

As it was highlighted before, *Polity2* data set has been criticized in the political science literature for measurement errors (Cheibub, Gandhi, and Vreeland, 2010 and Treier and Jackman, 2008) which could potentially produce misleading results. This is why we rely on the recently issued Varieties of Democracy (V-Dem). The latter provides a multidimensional and disaggregated dataset that reflects the complexity of the concept of democracy as a system of rule that goes beyond the presence of elections. Hence, it takes into consideration five principles of democracy: electoral, liberal, participatory, deliberative, and egalitarian. Qualitatively, our results remain the

same for all the variables. Moreover, population density becomes now positive and statistically significant, showing how more populous countries in specific areas are more likely to witness civil wars than less populous ones.

Table 7. FE Logit: Non-monotonic resource rents and polity

	Baseline Model	Controlling for Grievances	Controlling for Polity
Per capita rents [a][b]	0.190[**]	0.177[*]	0.215[**]
	(0.093)	(0.097)	(0.102)
Per capita rents square [a][b]	-0.022[*]	-0.023[**]	-0.022[*]
	(0.011)	(0.012)	(0.012)
Population density [a][b]	0.544[***]	0.840[***]	-0.184
	(0.166)	(0.185)	(0.231)
3-year GDP pc growth [a]	-0.019[***]	-0.020[***]	-0.017[***]
	(0.004)	(0.004)	(0.004)
Disc. population [a]		1.880[***]	1.221[***]
		(0.377)	(0.394)
Equal dist. of resources [a]		-0.369	0.884
		(0.613)	(0.654)
Polity [a]			0.037[***]
			(0.013)
Polity square [a]			-0.026[***]
			(0.003)
Threshold rents (2010 USD / capita)	75.2	47.0	106.7
Observations	3164	3162	3133

Standard errors in parentheses
[+] $p < 0.11$, [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$
[a] Lagged variable
[b] Natural log

Table 8. Non-monotonic resource rents and institutions (using the VDem Liberal Democracy Index)

	Baseline Model	Controlling for Grievances	Controlling for Polity
Per capita rents [a][b]	0.018[**]	0.015[**]	0.015[**]
	(0.007)	(0.007)	(0.007)
Per capita rents square [a][b]	-0.002[**]	-0.002[**]	-0.002[**]
	(0.001)	(0.001)	(0.001)
Population density [a][b]	0.051[***]	0.078[***]	0.103[***]
	(0.015)	(0.016)	(0.018)
3-year GDP pc growth [a]	-0.001[***]	-0.001[***]	-0.001[***]
	(0.000)	(0.000)	(0.000)
Discriminated population [a]		0.292[***]	0.274[***]
		(0.045)	(0.045)
Equal dist. of resources [a]		-0.062	0.066
		(0.055)	(0.059)
Liberal Democracy Index [a]			0.007
			(0.110)
Liberal Democracy Index square [a]			-0.294[**]
			(0.143)
Constant	-0.175[*]	-0.330[***]	-0.518[***]
	(0.100)	(0.105)	(0.114)
Observations	6,163	6,046	6,026

Standard errors in parentheses
[+] $p < 0.11$, [*] $p < 0.10$, [**] $p < 0.05$, [***] $p < 0.01$
[a] Lagged variable

Liberal Democracy Index from the VDem project

7. Conclusion

This paper examines the nexus between civil war onset, natural resource rents, and social cohesion. Indeed, the main hypothesis is centered on the role of the hydrocarbon resource in promoting conflicts, especially in societies characterized by discrimination. Hence, using a comprehensive dataset, this paper's contribution is twofold. First, we test the non-linear effect of institutions and rents on the likelihood of civil war onset. Second, we introduce several measures of social cohesion and institutions. Our main findings show that both political institutions and rents have a non-linear effect on the outbreak of civil wars. Moreover, social cohesion variables measured by the share of discriminated population increases the probability of a civil war onset. These results remain robust in different econometric specifications, various estimation techniques and diverse measures.

At the policy level, this proposal hopes to inform the policy debate about the causes behind the eruption of large scale and high-intensity violence in the aftermath of regime transitions in some Arab countries or the transformation of popular uprisings into armed conflicts in others.

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