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By **Alessandro Cologni,** Edison Trading, Edison S.p.A., Italy

Matteo Manera, Department of Statistics, University of Milan-Bicocca and Fondazione Eni Enrico Mattei, Italy

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Summary

Natural resources are generally associated to negative effects on the political environment of a country. This paper explores the impact that oil revenues have on the establishment of a given political system. Based on previous literature, a political economy perspective is employed. A simple game theoretical approach in order to explain the relationships between oil revenues, political instability (*conflicts*) and emergence of different political systems is presented. The implementation of particular redistributive fiscal policies together with the possibility that paternalistic or "predatory" autocracies emerge are considered. Under certain circumstances, a process of full democratization is argued not to represent an optimal choice for the oil-rich authoritarian nations. Since governments prefer to remain nondemocratic, in order to prevent internal conflicts from occurring, authoritarian countries have to undertake redistributive activities. Under other assumptions, governments of oil-rich nations prefer to introduce large military sectors. The present analysis determines how the emergence of redistributive of predatory policies depends on relevant parameters related to initial income, oil revenues and social inequality. Finally, we study the importance of socio-ethnical fragmentation in determining the political transition of oil producing nations.

Keywords: Natural Resources, Rentier States, Conflict and Endogenous Political Regimes

JEL Classification: C72, D74, O13, P16

Address for correspondence:

Matteo Manera
Department of Statistics
University of Milan-Bicocca
Via Bicocca degli Arcimboldi, 8 - Building U7
20126 Milan
Italy
Phone: +39 0264485819
Fax: +39 0264485878
E-mail: matteo.manera@unimib.it

Oil Revenues, Ethnic Fragmentation and Political Transition of Authoritarian Regimes

Alessandro Cologni[a], Matteo Manera[b,c,*]

[a]*Edison Trading, Edison S.p.A., Milan, Italy*
[b]*Department of Statistics, University of Milan-Bicocca, Milan, Italy*
[c]*FEEM, Fondazione Eni Enrico Mattei, Milan, Italy*

Abstract

Natural resources are generally associated to negative effects on the political environment of a country. This paper explores the impact that oil revenues have on the establishment of a given political system. Based on previous literature, a political economy perspective is employed. A simple game theoretical approach in order to explain the relationships between oil revenues, political instability (*conflicts*) and emergence of different political systems is presented. The implementation of particular redistributive fiscal policies together with the possibility that paternalistic or "predatory" autocracies emerge are considered.

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*Corresponding author
Email addresses: `alessandro.cologni@edison.it` (Alessandro Cologni), `matteo.manera@unimib.it` (Matteo Manera)

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1. Introduction

This paper is aimed at studying the causal relationship between oil rents and political transition in authoritarian regimes. How do natural resource endowments interact with the emergence of a particular type of political regime? Why do oil rich countries often switch towards paternalistic or "predatory" regimes instead of choosing a democratic regime?

With regard to the factors that determine the emergence of redistributive or military systems, this research points out that, in order to study how managing natural resources revenues affect the socio-political institutions of country, a researcher has to employ a political economy perspective. Based on previous literature (see, *inter alia* [1], [2], [3] and [4]), this paper considers an intuitive game theoretical model in order to link the onset of internal conflicts to the possibility that alternative political systems emerge. In particular, the transition of an authoritarian regime towards either one of three different political regimes, namely, democratic systems, redistributive or military autocracies is modelled by employing a simple framework. One of the objectives of the present study is to investigate why either redistributive fiscal policies or predatory activities may arise under equilibrium in authoritarian political regimes.

The channel by means of which oil affect the emergence of a particular regime we focus on is the so-called "rentier effect".[1] Wealth from the exploitation of natural resources is employed in order to reduce threats of internal conflict.[2] The main idea of the theoretical model can be better specified as follows: since natural resource-rich countries are characterized by higher levels of grievances by the population (in order to allow for a better redistribution of natural resource) a high degree of political violence may, consequently, arise. The possibility to employ oil wealth in order to offset threats of political conflict is considered by the government's ruler. If some conditions are satisfied, a complete transition through authoritarian to a democratic system may occur. However, this political transition may not represent a first best choice. Rather, in authoritarian political systems, incumbent politicians are able to employ natural resource wealth in order to maintain support and

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[1]According to [5], a rentier state is "a state that derives a large fraction of its revenues from external rents".

[2]In this paper, the terms "conflict", "revolution", "revolt" and "political instability" are used interchangeably.

even consolidate their political power through either a redistributive policy or the adoption of a predatory autocratic -or military- regime.[3]

The most relevant contribution of the present work to the existent literature is the introduction of a theoretical framework which endogenizes the emergence of different political regimes in a context of a rentier state. [8], [9] and [10] present formal theories in order to explain why, under some circumstances, resource wealth is able to impede democracy. Even if some conclusions are similar to ours (for instance, the fact that the size of the natural resource represents a relevant factor in determining authoritarian regimes), the present analysis focuses on the emergence of different typologies of political systems. The taxonomy of authoritarian regimes introduced by [11] is employed. In addition, we examine the importance that ethnic (as well as socio-political) fragmentation has on the political transition of an oil-rich country.

As far as the main insights of our analysis are concerned, the theoretical model predicts that factors that affect political changes towards redistributive or predatory activities are the size of the natural resource endowment, social inequality and ethnic fragmentation, and, finally, on parameters that represent the warfare technology. In particular, numerical simulations of the theoretical model suggest that, under certain conditions, the convenience to implement redistributive policies increases as the level of ethnic fragmentation of the country increase. On the contrary, countries with low-levels of fragmentation can prefer to adopt military regimes. As an additional result, under certain cases, incentives to implement paternalistic autocratic regimes increases as oil revenues increase. On the contrary, in countries with relatively low amount of natural resource military regimes could emerge. Finally, a glance at the data for a sample of authoritarian oil exporting countries seems to confirm this theoretical evidence.

The paper is organized as follows. Section 2 reviews the previous literature on the effects of exogenous oil shocks on the political transition of author-

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[3]As, for instance, the experience of Congo Brazzaville during the early 1990s shows. In this country, because of the pressures for a better redistribution of oil revenues, democracy under Lissouba proved incapable to consolidate and a civil war represented the "end of Congo's democratic experiment" ([6]). A military regime was able to regain control over state (and, hence, oil) revenues. President Sassou reintegrated a form of "neo-patrimonial state" ([7]) in which resources have been deployed (in an effort to build up a political support base) through military employment benefits, investments in the civil sector and inefficient spending programs in education.

itharian regimes. Section 3.1 introduces the theoretical model. Section 3.2 illustrates the structure of the game. A sequential three-stage game is introduced. Section 3.3 presents the main assumptions of the game. Section 4 studies the conditions under which political instability arises in oil exporting countries. In Section 5 we discuss the actions that can be implemented by the ruling party of an authoritarian regime in order to prevent a civil conflict. In particular, the conditions under which either redistributive policies, military authoritharian regime or democratic systems emerge are examined and commented in Section 5.2. Section 6 is devoted to some exercises of comparative statics whereas some numerical simulation exercises namely aimed at describing processes of political transition in oil-rich nations are presented in Section 7. The last Section is devoted to concluding remarks and discussions.

2. Literature Review

Natural resources endowments (and oil, in particular) are often argued to affect in a negative manner both the economic and political stance of a country ("resource curse"). According to a wide literature (see, among others, [12], [13], [14], [15], [16], [17], [18]) there seems to be evidence that natural resources affect positively the likelihood of internal conflicts. An important channel by means of which a curse of natural resources endowments may arise is represented by the "oil-impedes-democracy" claim (see [5]): natural resources (and oil, in particular) have negative effects on the democratization process of a country.[4,5,6]

Consequently, different works (both theoretical and empirical) attempt to describe the channels by which resource wealth negatively influences the poli-

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[4]Earlier studies that links natural resources to the emergence of authoritarian regimes are the analyses by [19] and [20].

[5]According to [21], even a phenomenon with "numerous complex social and historical causes" like the Iranian Revolution (1979) can be interpreted as a social movement directed at a better distribution of oil revenues.

[6]As a partial consequence of these phenomena, several authors (for instance, [22], [23], [24], [25], [26], [27], [28], [29], [30], [31] - for a different viewpoint, see, among others, [32]) argue that there is strong evidence that countries with large natural resources tend to grow slower than countries with small amounts of the natural resource. In particular, recent works (see, *inter alia*, [33], [30], [29], [31] and [34] have argued that natural resource-rich countries could avoid negative economic effects from a resource boom should they adopt good policies and institutions.

ties of exporting countries. [5] argues that oil affects democracy through, mainly, three main mechanisms of transmission: a "rentier hypothesis", oil revenues are employed by governments in an attempt to reduce grievances by the population; a "repression" mechanism, natural resource wealth is used for military or "internal security spending"[7] and a "modernization" effect: according to this theory, economic development is a key factor in boosting a democratization process. Since a resource boom is not able to "produce cultural and social changes", a democratization process is prevented from occurring.[8]

Econometric evidence seems to confirm these assertions. Empirical results are consistent with a negative and statistically significant impact of oil on the process of democratization of countries ([5]). [37] finds a strongly significant relationship between resource dependence (as measured by the ratio of primary exports to gross domestic product, GDP) and the emergence of authoritarian regimes. [15]'s results support, from an empirical point of view, the linkages between natural resource abundance and the emergence of authoritarian political regimes for African nations. By using as indicator of democracy the thirty-year change in the policy index, [38] shows negative effects of oil discoveries on the levels of democracy of a country, an effect that persists even if large Middle East countries are included in the analysis. In an analysis aimed at determining the impact of oil wealth on regime failure, antistate protests and domestic armed conflict, [36] argues that the oil dependence variable (ratio of the value of oil exports to GDP) does affect in a positive manner the durability of a regime. By contrast, the impact on the level of protests and civil wars is suggested to be negative. According to the author, the investment of oil revenues in order to establish good institutions could be able to guarantee the "regime survival".

[39] examines the relationship between "rentierism" (that is, rent revenues as a fraction of total government revenues) and democracy indexes. According to empirical evidence, the net effect of rentierism on democracy is not statistically relevant.[9]

Finally, [41] and [42] describe detrimental effect of oil on democracy and economic growth. According to their analysis, the ownership structure of

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[7]See also [35].

[8]Similarly, [36] considers as factors that may help to explain the linkages between "oil wealth and regime survival" the "rentier state", the repression and the rent-seeking theses.

[9]Similar results are obtained by [40] in an analysis of U.S. data.

the national oil industry and how revenues are distributed represent, respectively, the main explanation of the causality link.

Other articles try to categorize exporting nations by specifying different tipologies of political regimes. [43] suggests a classification based on the definitions of "autonomous" (in the two versions of "benevolent" and "predatory" states) and "factional" states (with the two categories of "oligarchic" state and "majoritarian" democracies). Similarly, in an effort directed at extending the classification of the economic policies of oil-exporting nations, [11] compare ("mature" or "factional") democratic systems and autocracies. Hence, while in "predatory" autocracies, the self-seeking of the ruling party is directed at maximizing net rents from the sale of the natural resource, in "reformist" (or "paternalistic") autocracies natural resource revenues are employed in order to boost economic growth and raise population's living standards.

In a study aimed at studying the relationship between natural resources rents and the policies implemented by governments, [44] find that governments may reduce the provision of public goods in order to "facilitate patronage politics". According to [26], "predatory" and "factional" governments are the result of dependence of the economy of the country on the export of natural resources. In such a context, repression may emerge as an instrument to ensure political legitimacy.

3. The Theoretical Model

3.1. Introduction

Consider a society consisting of two types of individuals: the ruling party (*rich*, agent B) and the poor (*peasant*, agents A). The population consists of one group of rich agents and $N-1$ socio-political groups of poor citizens ($N > 2$). For simplicity, the size of the population of a country is normalized to unity. That is to say, all groups are composed by a fraction $\frac{1}{N}$ of individuals. The rich and poor agents have fixed income y_B and y_A, respectively ($y_A < y_B$). All groups of peasants are assumed to be *ex-ante* homogenous with respect to their income but different from an ethnical point of view.

The share of total income accruing to the rich is given by ϑ. Hence, we

have:[10]

$$y_t^A = y^A = \frac{(1-\vartheta) \cdot Y}{N-1} \tag{1}$$

$$y_t^B = y^B = \vartheta \cdot Y \tag{2}$$

at all dates t. Here, Y denotes the average income in this society:

$$Y_t = Y = \sum_{i=1}^{N} \frac{y^i}{N}$$

3.2. Timing of Events

The timing of the events of the infinitely repeated discounted game $G^\infty(.)$ is as follow:

1. In the **first stage** of the game, the state of the nature related to the amount of oil revenues (*low* or *high*) is revealed.[11] We assume that the rent accrues to the ruling party (government). Equation (2) can therefore be rewritten as:

$$y_t^B = y^B(R) = \vartheta \cdot Y + R$$

where R is the value of oil revenues R_t at the date when the threat of revolution took place, $R = \{R_L, R_H\}$. On the contrary, $y_t^A = y^A(R) = y^A$.[12]

2. A political transition of the oil producing country may occur in the **second stage** of the game. As pointed out by, for instance, [4] and [11], this can happen in three different ways:
   (a) First, the ruling party can start a process of democratization;
   (b) Second, the rich agents can choose to maintain political power, $\phi = 0$, but redistribute through taxation;

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[10]Condition $y^A < Y < y^B$ requires $\frac{(1-\vartheta)Y}{N-1} < Y < \vartheta \cdot Y \Rightarrow \vartheta > \frac{1}{N}$.

[11]In this paper, we focus on the discovery of an oil field. In fact, as argued by [45] in a survey of articles on natural resources and civil wars, oil discoveries and the onset of conflicts are positively correlated. On the contrary, "lootable" commodities (e.g. gemstones and drugs) are associated to the duration of the conflict.

[12]For simplicity, this paper assumes that in the *low* state, $R_t = R_L = 0$.

(c) Third, the ruling party can introduce a predatory autocratic regime.

3. In the **third stage** of the game, the other $N-1$ excluded agents collectively decide whether to form a coalition and start a conflict against the ruling party, $\rho \in \{0, 1\}$. In other words, poor citizens can pose a revolutionary threat. They can overthrow the existing regime in any period $t \geq 0$. A revolution in this environment corresponds to the citizens forming a coalition to overwhelm the ruling party in a nondemocratic political regime. Conflict aims at providing a better distribution of the overall income of the country.[13] In particular, each of the N peasants has to support the insurrection or to remain neutral. As far as the revenues which derive from a successful conflict, if they accept to join the coalition they agree to share the income expropriated to the ruling party according to a fixed sharing rule ψ (see also Section 4.1). If $\rho = 1$, they share the remaining income forever.

If a coalition of poor agents forms ($\rho = 1$) and the ruling party decides to democratize ($\phi = 1$), the tax rate τ^D is set by the median voter (a poor citizen). If $\rho = 0$ and a redistributive authoritarian regime is introduced ($\phi = 0$), the tax rate is $\tau^P < \tau^D$. This fiscal policy program based on a redistribution of the economic resources of the country is, nevertheless, able to prevent an insurrection.

The game is solved by backward induction. According to the timing of events of the stage game outlined above, the government move before the citizens.

3.3. Assumptions

3.3.1. Conflict Decision

The decision by the peasants to provoke an insurrection is modelled by considering the following assumptions:

- **Assumption I.1** The probability that a revolt will succeed in the next period is given by λ. If the citizens decide to undertake a revolution the probability to succeed depends on the number of socio-political groups that take part in the revolts. In particular, λ depends on the proportion of agents that decide to oppose to the government, $\xi = \frac{N^W}{N}$. In

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[13]In our analysis, conflict is defined as *a set of actions, strategies, coordination policies among agents aimed at obtaining a better redistribution of resources. The redistribution of resources is assumed to take the form of a fiscal policy aimed at providing a non-rival public goods to the citizens.*

addition, λ depends on an (exogenous) parameter δ that reflects the socio-political similarities among the groups of citizens.[14] λ is positive for any value ξ, $\delta > 0$, $\lambda(0, \delta) = 0$. λ is assumed to be an increasing function of both ξ and δ, i.e. $\frac{\partial \lambda(\cdot)}{\partial \xi}$, $\frac{\partial \lambda(\cdot)}{\partial \delta} > 0$, that is, as the percentage of groups who support the protests and similarities increase, the probability the peasants have to succeed in the protests increases as well. For simplicity, it is assumed that $\lambda = \lambda(\xi, \delta) = \xi^{1/\delta}$, where $\delta > 0$;

- **Assumption I.2** A revolution is assumed to lead to a postrevolutionary society in which the control passes from the rich to the poor political groups. In other words, a postrevolutionary society is one in which the citizens divide the resources of the economy;

- **Assumption I.3** After the conflict the income of losers is expropriated by the members of the winning coalition and distributed among all groups of citizens who take part in the protests (N^W). The increase of income is assumed to be permanent;

- **Assumption I.4** The whole country is interested by the civil conflict. In addition, it is assumed that if the revolution takes place, a fraction ϵ_t of the income of the society is destroyed.

REMARK 1.
It is worth noticing that $\epsilon_t = \epsilon$ should not be lower than $\widetilde{\epsilon}^*$, where $\widetilde{\epsilon}^* = 1 - \frac{1-\vartheta}{\lambda(N-1)}$. This condition ensures that:

$$V^A(W, R = R_L) \leq V^A(P, R = R_L)$$

In other words, Remark 1 states that, in the state $(P, R = R_L = 0)$, the government stay in power and there is no threat of revolution. That is, $\phi = \vartheta = 0$ and $\tau^P = \tau^B = 0$ (there is no political transition and the rich agents set their preferred tax rate, zero). Since the citizens would never attempt revolution when $R_t = R_L = 0$, the only case considered in the following Sections is represented by state $R_H > 0$.

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[14]Parameter δ increases as socio-political similarities among ethnic groups are higher.

3.3.2. Political Regimes: Definition

In the framework under analysis, each of the major types of government is defined by who controls the government and by the economic and fiscal conditions that best serve their interests. To the purpose of this analysis, an *authoritarian government* is defined as one controlled by a specific autocrat; in particular in these regimes requirements for voting are enhanced.
On the other hand, democratic systems are defined as "those regimes in which governmental offices are filled as a consequence of contested elections" (see, e.g., [46]). In particular, this model of democracy represents an indirect mechanism of social consensus; in other words, governments are ruled according to a majority rule ([47]). The decision by autocrats to introduce such a political regime is defined as *(full) democratization* of the country.[15]

3.3.3. Role of Government and Other Assumptions

As for the role of the government (agent B) in the economy, it is assumed that:

- **Assumption II.1** All resources available to the government comes from a tax on total income, $\widetilde{Y} = Y + R$;

- **Assumption II.2** The government may decide to implement a redistributive fiscal policy by financing lump-sum transfers of income. In particular, it is assumed that they take the form of the provision of public goods. Let τ_t and G_t denote (1) the percentage of income the worker has to pay to the government as taxes and (2) the aggregate level of government spending on the provision of the public good, respectively. Following [48] it is assumed that $G_t = \left(\tau_t - \frac{\tau_t^2}{2}\right)\widetilde{Y}$.[16]

- **Assumption II.3** The government can prevent a revolution by spending a part α of its income in predatory activities. Accordingly, a military sector is introduced in order to grant defense from internal threats. This additional spending by the government can be seen as a form of insurance against political instability (see [49]).

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[15]For a definition of redistributive and military ("predatory") authoritarian regimes, see Section 5.

[16]From this assumption, it follows that the collection of taxes is costly. In particular, at tax rate t there is a deadweight cost of $\frac{\tau_t^2}{2} \cdot \widetilde{Y}$.

Under assumptions II.1 to II.2, individual utility is defined over the discounted sum of post-tax incomes with discount factor $\beta \in (0, 1)$; therefore, for individual i at time $t = 0$, it is:

$$U^i = E_0 \sum_{t=0}^{\infty} \beta^t \cdot \widehat{y}_t^i$$

where E_0 is defined as the expectation based on the information set available at time $t = 0$ and

$$\widehat{y}_t^i(R) = \begin{cases} (1 - \tau_t)E\left[y^i(R)\right] + \left(\tau_t - \frac{\tau_t^2}{2}\right)\widetilde{Y} & \text{if a revolution took place before } t \\ y_W^i(R) & \text{otherwise} \end{cases}$$

The discount factor is given by $\beta \in \{0, \ 1\}$.

4. On the Political Instability in Oil Producing Countries

4.1. Introduction

The decision of the peasants to enter in a conflict over resource redistribution is studied in a very simple model of conflict. Let Σ denote the political state of the oil producing country (*Peace* - nondemocracy - or *Democracy*, that is - $\Sigma \in \{P, D\}$). In this game the current opportunity for revolution is represented by the discovery of the oil field.

According to our theoretical framework, poor agents may decide to form a coalition and to initiate revolution. In particular, let $\pi_k(.)$ denote the collective action of the poor agents. This is assumed to depend on the state of oil revenues and the decisions of the ruling party, $\pi_k(R)$. In our model, $\pi_k(.) = \{A_k, N - 1 \backslash A_k\} = \{1, \ldots, k\} \{k + 1, \ldots, N - 1\}$. In words, in the country the coalition of citizens that decide to revolt has cardinality k. In addition, when the political state is $\Sigma = D$, they set the tax rate $\tau^D \in [0, 1]$. A group of peasants[17] (say, $\widehat{i}$) proposes to form a coalition (coalition A) and enter in conflict against the government in order to provide a better redistribution of the income of the country. In turn, the other political groups

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[17]We assume that this group is randomly chosen among all groups of poor citizens.

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decide whether to join the coalition or to remain neutral.[18]

If an agent decides to join a coalition A, she agrees to share the outcome from the expropriation of the natural resource endowment of the rival coalition and to set a fiscal policy that is able to maximize the total post-tax income of the group. It is supposed that entering in a conflict over government's total resource endowments under coalition A implies a binding commitment to a particular sharing rule ψ. In the analysis that follows, we make the simplifying assumption that coalition members equally share the amount of natural resource endowment expropriated to the rival coalition.[19]

4.2. Solution of the Game

Let $NE(G^\infty)$ denote the set of the Nash equilibrium coalition structure of game G^∞. The equilibrium strategy by the peasants results from the following Proposition:

PROPOSITION 1. *In the present model of coalition formation and conflict, the equilibrium structure satisfies one of the following two cases:*
(i) $\pi_{N-1} = \{A_{N-1}, 0\} \in NE(G^\infty)$ (conflict) if and only if:

$$0 < \delta < 1 \tag{3}$$

and

$$R_H > \widetilde{R}_H \tag{4}$$

where

$$\widetilde{R}_H = \frac{Y \cdot [1 - \vartheta - \lambda \cdot (1 - \epsilon)]}{\lambda (1 - \epsilon)}$$

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[18]Technically, the (sub)-game under analysis can be structured as follows: each prospective member of coalition A has to respond whether to join coalition A or remain neutral in a predetermined order rule. In this stage, a strategy of group i ($i \neq \widehat{i} = 1,\ 2,\ \ldots,\ N$) σ_i is, therefore, represented by: $\sigma_i^A(s) \in \{Yes,\ No\}$, where s represents the number of the groups that have already joined the coalition.

[19]In this analysis, for simplicity, only conflicts that may take place against the ruling party are considered. However, as [50] points out, since members of a coalition have to agree on how to distribute the income among themselves, "within" group conflicts can also arise.

and

$$\lambda(N-1) = \left(\frac{N-1}{N}\right)^{1/\delta}$$

(ii) If either condition (3) or (4) is not satisfied, the unique Nash equilibrium coalition structure is given by $\pi_0 = \{0, A_{N-1}\} \in NE(G^\infty)$ (i.e. no agent decides to fight, peace equilibrium).

4.3. Political Instability in Oil Producing Countries. Discussion

Let us define $V^A(W, R_H, N^W)$ as the return to poor citizens if there is revolution and N^W poor agents decide to protest. According to Assumptions I.1, I.3, I.4, if a revolution takes place, each poor agent receives an expected net income of:

$$V^A(W, R_H, N^W) = \begin{cases} \frac{(1-\epsilon)\cdot\widetilde{Y}}{N^W} & \text{with probability } \lambda(\delta, \xi) \\ 0 & \text{with probability } 1 - \lambda(\delta, \xi) \end{cases}$$

where $V^A(R, N^W)$ denotes the utility to the citizen in a postrevolutionary society conditional on S and on the number of the groups of citizens who take part (N^W). Here, $(1-\epsilon) \cdot \widetilde{Y}$ is the total income they will divide among themselves and there are N^W poor agents that participate in the revolution. In other words, the utility of an agent who has taken part in revolutionary activities is given by the postrevolution payoff minus the cost of revolution activities.

Thus, the value of the revolution for a poor citizen is:

$$V^A(W, R_H, N^W) = E_0 \sum_{t=0}^{\infty} \beta^t \cdot \left\{ \lambda \cdot \frac{(1-\epsilon) \cdot \widetilde{Y}}{N^W} + (1-\lambda) \cdot 0 \right\}$$

or

$$V^A(W, R_H) = \frac{\lambda \cdot \frac{(1-\epsilon)\cdot\widetilde{Y}}{N^W}}{1 - \beta} \tag{5}$$

(per-period return from revolution for the infinite future discounted to the present).

It is readily checked that this function exhibits spillovers (that is, the decision

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by a political group to join the coalition has an effect on the payoff of a group).
Let us now determine whether these spillovers are negative or positive.

For the analysis to follow, it proves useful to express the payoff differential a group of agent receives from the decision by an external agent (i) to join the coalition. Suppose that $n < N - 1$ groups of peasants belong to the initial coalition structure ($\pi_n = \{A_n, A_{N-1-n}\}$). Let $\pi_{n+1} = \{A_{n+1}, A_{N-2-n}\}$ denote the new coalition structure resulting from i's decision. Using equation (5), it is easy to compute the payoffs of agents A in the two cases:

$$V^A(W, R_H | \pi = \pi_n) = \frac{\left(\frac{n}{N}\right)^{1/\delta} \cdot \frac{(1-\epsilon)\cdot\widetilde{Y}}{n}}{1 - \beta}$$

$$V^A(W, R_H | \pi = \pi_{n+1}) = \frac{\left(\frac{n+1}{N}\right)^{1/\delta} \cdot \frac{(1-\epsilon)\cdot\widetilde{Y}}{n+1}}{1 - \beta}$$

Taking logs, we obtain:

$$\ln\left(V^A(W, R_H | \pi = \pi_{n+1})\right) - \ln\left(V^A(W, R_H | \pi = \pi_n)\right) =$$
$$\frac{1 - \delta}{\delta}\left[\ln(n + 1) - \ln(n)\right] > 0 \Leftrightarrow 0 < \delta < 1$$

Now we have to check whether the poor citizens have an incentive to form a coalition and start a revolution. Let us define the payoffs that would apply if society remains in nondemocracy all the time (i.e., no revolution, $V^A(P, R_H)$) and the ruling party never redistributes to the citizens (i.e., $\tau^P = \tau^r$). We clearly have:

$$V^A(P, R_H) = E_0 \sum_{t=0}^{\infty} \beta^t y_A(R) = \frac{y_A}{1 - \beta}$$

because the citizens always receive the income $y_A(R)$ as there is no taxation, and this future income stream is discounted to the present at the discount factor β.

We say that there is threat of a civil conflict if the peasants prefer revolution in the state $R_t = R$ rather than to live in nondemocracy without any redistribution;[20] that is, if:

$$V^A(W, R_H) > V^A(P, R_H)$$

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[20]It is assumed that, if the payoffs agents receive under the two scenarios (revolution or peace) are the same, the equilibrium outcome is *no war*.

or,

$$\frac{\lambda \cdot \frac{(1-\epsilon) \cdot \widetilde{Y}}{N^W}}{1 - \beta} > \frac{y_A}{1 - \beta} \text{ where } N_W = N$$

$$V^A(W, R_H) > V^A(P, R_H) \Leftrightarrow R_H > \widetilde{R}_H \tag{6}$$

where

$$\widetilde{R}_H = \frac{Y \cdot [1 - \vartheta - \lambda \cdot (1 - \epsilon)]}{\lambda (1 - \epsilon)}$$

and

$$\lambda(N - 1) = \left(\frac{N - 1}{N}\right)^{1/\delta}$$

5. On the Political Transition of Oil Producing Countries

5.1. Introduction

The different strategies that can be undertaken by the (authoritarian) government in order to prevent revolts are here considered and discussed. A strategy that can be implemented by the ruling party is the introduction of a redistributive fiscal policy. Revenues that come from the sale of natural resources are employed to provide a non-rival public good to the citizens. Under *redistributive* authoritarian political regimes, the political group which rules the country, in order to avoid an insurrection, may embark on important investment programs often directed at building basic infrastructure or at providing essential public services to the population. An often cited example is that of the Persian Gulf countries which, thanks to oil revenues, have been able to raise living standards of the whole population. In other words, latent pressures for democratization are eliminated by a spending policy carried out by the authoritarian regime.[21] The possibility that "paternalistic"

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[21]This is the point of, for instance, [51] and [52] which consider the process of democratization for Saudi Arabia and Libya, respectively. [53] documented the capacity of large oil producers to prevent social unrest by employing oil revenues in order to finance the provision of public goods and services.

or "reformist" autocracies ([11]) arise is, therefore, considered by analyzing a specific result of the model.

To the other extreme, if other conditions are satisfied, the commitment by the ruling party to implement a redistributive fiscal policy is not able to prevent an internal conflict. According to Proposition 2 a predatory autocratic regime could emerge. In this case the ruling party decides to increase the military spending such that any threats of revolution is avoided (military regime or "predatory" autocracy). Natural resource wealth may allow governments to spend more in order to grant internal security. The permanence of the status quo is guaranteed by the use of natural resources with the aim to preserve the power from internal threats. Natural resources revenues are not employed in order to finance productive activities but they are rather used as a repression instrument. Consequently, the level of revenues inequality tends not to decrease.

Examples of this type of political regime are Iran during the 1970s (see [54]), Nigeria, country which has experienced a succession of military dictatorships ([11]), Ecuador during the 1970s, as well as Angola, after oil and diamonds were discovered (early 1990s, see, [55]). For all these countries, as a consequence of the oil boom, military spending was increased considerably.[22, 23]

Finally, under other circumstances, a process of *(full) democratization* is shown to be the equilibrium outcome. In this case,, the tax rate and the quality of the public good are those preferred by the country's median income voter (equation 12).

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[22]In Nigeria, regimes of military dictatorships employed oil rents in order to boost programs of public capital spending. However, resources were appropriated mainly by a corrupt elite or fuelled distorted and wasteful economic sectors ([56]). As a consequence, the general welfare of the population did not increase.

[23]As for Ecuador, the prospect of vast oil reserves expected to transform country's feable economy was a fundamental factor in determining the military coup that overthrew president Ibarra's government in 1972. General Lara's government decided to employ oil resources to implement social policies and an economic agenda directed at modernizing agriculture and introduce a program of industrial development in order to foster growth and reduce national economy's dependence from abroad. However, since it was not able to include the powerful business elite into any of the governmental structures and decision-making processes, in 1976 it was removed.

5.2. Solution of the Game

Let us now determine the (Markov) perfect equilibrium of the game, that is the strategy combination $\left\{\widetilde{\sigma}^B, \widetilde{\sigma}^A_i\right\}$, such as $\widetilde{\sigma}^B$ and $\widetilde{\sigma}^A$ are best responses to each other for all R_t and Σ.

Here $\sigma^A_i = \left\{\pi_k\left(.\right), \tau^D\left(.\right)\right\}$ $(i = 1, \ldots, N-1)$ and $\sigma^B = \left\{\upsilon(.), \phi(.), \tau^B(.)\right\}$ denote, respectively, the actions of a poor agent and the notation for the actions related to the political transition of the country taken by the ruling party. In particular, $\phi \in \{0, 1\}$ denote, respectively, the decision to introduce a military regime and to extend the democratic regime and $\tau^B \in [0, 1]$ represents the tax rate set by the ruling party. Clearly if $\phi = 0$, Σ remain at P (nondemocratic regime). To prevent a revolution from occurring, the government may decide to introduce a military regime ($\upsilon = 1$) and set a tax rate τ^B. On the contrary, if $\phi = 1$ democracy is extended and Σ switches from P to D from now on.

The following Proposition can now be proved:

PROPOSITION 2. *Let $\widehat{R}_H$, $\widehat{\alpha}$, α^*, τ_A and $\widehat{\tau}$ be defined as in Table 1.*

[INSERT TABLE 1 ABOUT HERE]

Let us also assume that $R_H > \widetilde{R}_H$. The infinitely repeated discounted game $G^\infty(\beta)$ examined here has a unique Markov perfect equilibrium $\left\{\widetilde{\sigma}^B, \widetilde{\sigma}^A\right\}$.

1. ***Implementation of a redistributive fiscal policy:*** *As long as $\tau_A \geq \widehat{\tau}$ and $\alpha \geq \alpha^*$, in state R_H the ruling party implements a fiscal policy aimed at redistributing income to avoid a revolution. The ruling party sets a tax rate equal to $\widehat{\tau}$;*

2. ***Emergence of a predatory autocratic regime:*** *A predatory autocratic regime emerges in state R_H as long as one of the following three cases arises:*
   (a) *$\tau_A \geq \widehat{\tau}$ and $\alpha < \alpha^*$ or*
   (b) *$\tau_A < \widehat{\tau}$, $\alpha < \widehat{\alpha}$ and $R_H \leq \widehat{R}_H$ or*
   (c) *$\tau_A < \widehat{\tau}$, $\alpha \geq \widehat{\alpha}$ and $R_H > \widehat{R}_H$*

3. ***Process of democratization:*** *If $\tau_A < \widehat{\tau}$, $R_H \leq \widehat{R}_H$ and $\alpha \geq \widehat{\alpha}$ a redistributive fiscal policy is not able to avoid a revolution and the process of militarization of the country is relatively costly. In this case, in state R_H a democratic regime emerges.*

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On the contrary, if $R_H \leq \widetilde{R}_H$, the poor agents are not able to form a coalition to undertake a revolution. There is no political transition of the oil producing country.

5.3. Political Transition of Oil Producing Countries. Discussion

According to Proposition 1 we have to consider two cases:

- **1st case: $R_H \leq \widetilde{R}_H$.**
  A revolution may occur at time t only provided that $R_H > \widetilde{R}_H$. In other words, oil revenues need to be sufficiently high (i.e., R_H sufficiently high) for the possibility that a coalition of poor agents forms. If oil revenues are not that high so that we have $R_H \leq \widetilde{R}_H$, there is no threat of revolution even in the state $R_t = R_H$ and the ruling party does not implement any redistributive fiscal policy. In this case, the rich agents always set their unconstrained best tax rate, $\tau^P = \tau^B = 0$ and there will be no revolution along the equilibrium path.

- **2nd case: $R_H > \widetilde{R}_H$.**
  The more interesting case is the one in which the constraint (6) is satisfied. In this case, if the rich agents set $\tau^P = \tau^B = 0$ in the threat state $R_t = R_H$, there will be revolution. As long as $R_H > \widetilde{R}_H$, without any distribution or democratization, the citizens in the oil exporting country prefer to initiate revolution.
  In the second stage of the game, the ruling party decides whether to introduce a predatory autocratic regime, $\upsilon \in \{0, 1\}$. In other words, spending in the defense sector is increased in order to reduce the likelihood of a civil conflict. If $\upsilon = 1$, the poor agents do not form any coalition against the government and the stage game ends. On the contrary, if $\upsilon = 0$, the ruling party decides whether to democratize ($\phi = 1$) or to introduce a redistributive fiscal policy. If they decide not to democratize ($\phi = 0$), they set the tax rate τ^P.

To determine equilibrium actions, we need to compare the payoffs to the ruling party from staying in power using redistribution and from democracy to the cost associated to the militarization of the country.

5.3.1. Democratization

The first strategy to prevent revolution we consider is the introduction of a democratic regime, $\psi = 1$. Let us denote the equilibrium tax rate and the aggregate level of public spending by τ_A and $G = \left(\tau_A - \frac{\tau_A^2}{2}\right)\widetilde{Y}$, respectively. The returns to the poor and rich agents in democracy are, therefore:

$$V^i(D, R_H, \tau_P = \tau_A) = \frac{y_i(R_H) + \tau_A(\widetilde{Y} - y_i(R_H)) - \frac{\tau_A^2}{2}\widetilde{Y}}{1 - \beta} \quad i = \{A, B\}$$

The condition for democratization to prevent revolution is $V^A(D, R_H) \geq V^A(W, R_H)$.[24] This condition is equivalent to:[25]

$$V^A(D, R_H, \tau_P = \tau_A) \geq V^A(W, R_H) \Leftrightarrow \frac{y_A(R_H) + \tau_A(\widetilde{Y} - y_A(R_H)) - \frac{\tau_A^2}{2}\widetilde{Y}}{1 - \beta} \geq$$

$$\frac{\lambda(N-1)\cdot\frac{(1-\epsilon)\cdot\widetilde{Y}}{N^W} + [1 - \lambda(N-1)]\cdot 0}{1 - \beta}$$

$$R_H \leq \widehat{R}_H$$

where

$$\widehat{R}_H = Y \cdot \left\{\frac{(\vartheta - 1)(1 - \tau_A)}{\tau_A \cdot (1 - \tau_A/2)\cdot(N-1) + \lambda\cdot(\epsilon-1)} - 1\right\}$$

REMARK 2.

In the present work we assume that $\theta \geq \widehat{\theta}$ where

$$\widehat{\theta} = 1 - \frac{(\vartheta Y + R)(1 - \tau_D) + \widetilde{Y}(\tau_D - \tau_D^2/2)}{[1 - \lambda(N-1)]\,(\vartheta Y + R)} \tag{7}$$

here θ and τ_D denote the fraction of the income of the rich agents destroyed in the counter-revolution and the tax rate set up in a democratic regime,

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[24]With regard to the strategy of the ruling party strategy, we assume that condition $V^B(D, R_H) \geq V^B(W, R_H)$ is always satisfied. That is, a political transition to a democratic regime is always preferred to political instability.

[25]Recall that we assumed that the citizens would never attempt revolution when $R = R_L = 0$. Therefore, the only relevant state of nature is $R = R_H$.

respectively.

This condition ensures that, when the political regime of the country switches to democracy, it is stable and it will remain democratic forever. In other words (see Acemoglu and Robinson [3] and Acemoglu and Robinson [4]), condition $\theta \geq \widehat{\theta}$ guarantees that a democracy is fully consolidated and there is no incentive for the rich agents to mount a coup in the future to re-introduce a nondemocratic regime.[26]

5.3.2. Redistributive Fiscal Policy in an Oil Producing Country
In the case the ruling party decides to maintain political power, $\phi = 0$, but redistribute through a positive fiscal policy, the value function $V^i (P, R_H, \tau_P)$ $(i = \{A, B\})$ can be written as:

$$V^i (P, R_H, \tau_P) = \frac{y_i(R_H) + \left[\tau \left(\widetilde{Y} - y_i(R_H) \right) - \frac{\tau^2}{2} \widetilde{Y} \right]}{1 - \beta} \tag{8}$$

$$i = \{A, B\}$$

here τ is the specific value of the tax rate chosen by the ruling party $(\tau < \tau_A)$. In other words, the rich agents redistribute to the citizens, taxing all income at the rate τ. The peasants, therefore, receive their income y^A from their own earnings and a net trasfer of $\tau \left(\widetilde{Y} - y^A \right) - \frac{\tau^2}{2} \widetilde{Y}$.

To determine whether the ruling party can prevent revolution with the redistribution strategy, let us compare the maximum utility that can be given to the citizens without democratizing $\left(V^A (P, R_H, \tau_P = \tau) \right)$ with the incentive to start a conflict $(V^A (W, R_H))$.

If $V^A (P, R_H, \tau_P = \tau) < V^A (W, R_H)$, the fiscal transfer that can be made when $R_t = R_H$ is not sufficient to prevent revolution. In other words, a revolution threat can be avoided as long as this condition is satisfied:

$$V^A (P, R_H, \tau_P = \tau) \geq V^A (W, R_H)$$

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[26]To save space, the derivation of expression (7) is presented in the Appendix available from the authors upon request.

or if:

$$\frac{y_A + \left(\tau\left(\widetilde{Y} - y_A\right) - \frac{\tau^2}{2}\widetilde{Y}\right)}{1 - \beta} \geq \frac{\lambda\left(N - 1\right) \cdot \frac{(1-\epsilon)\cdot\widetilde{Y}}{N^W}}{1 - \beta}$$

When $R_H > \widetilde{R}_H$, the government can, therefore, prevent revolution by using oil revenues to redistribute income. In this case, the tax that the ruling party sets $(\widehat{\tau})$ will be chosen exactly to leave the citizens indifferent between revolution and accepting fiscal redistribution under a nondemocratic regime. That is, $\widehat{\tau}$ satisfies the equation:[27]

$$V^A\left(P, R_H, \tau_P = \widehat{\tau}\right) = V^A\left(W, R_H\right) \tag{9}$$

where

$$\widehat{\tau} = \frac{b - (b^2 - 2 \cdot \widetilde{Y} \cdot c)^{1/2}}{\widetilde{Y}} \tag{10}$$

$$b = \widetilde{Y} - \frac{(1 - \vartheta) \cdot Y}{N - 1}$$

$$c = \frac{\lambda \cdot (1 - \epsilon) \cdot \widetilde{Y} - (1 - \vartheta) \cdot Y}{N - 1}$$

Finally, if condition $\widehat{\tau} < \tau_A$ holds, a redistributive fiscal policy is always preferable to the ruling party when the alternative is democratization.

5.3.3. Emergence of a Predatory Autocratic Regime

Let us denote the values to the ruling party in the state M by $V^B(M, R_H, \alpha)$ where:

$$V^B(M, R_H, \alpha) = \frac{y_B(R_H)(1 - \alpha)}{1 - \beta} \tag{11}$$

---

[27]Another condition to be satisfied when $R_H \leq R_H^*$ is $V^B\left(P, R_H, \tau_P = \widehat{\tau}\right) \geq V^B\left(W, R_H\right)$. In words, the payoff the ruling party obtain by implementing a redistributive fiscal policy should be higher than the expected value of a civil conflict. For simplicity we assume that this condition is always satisfied.

To understand when a predatory nondemocratic regime emerges, we need to compare $V^B(M, R_H, \alpha)$ to $V^B(D, R_H)$,

$$V^B(D, R_H) = \frac{y_B(R_H) + \tau_A(\widetilde{Y} - y_B(R_H)) - \frac{\tau_A^2}{2}\widetilde{Y}}{1 - \beta}$$

when the alternative is democratization (that is, $\tau_A < \widehat{\tau}$).

Let $\widehat{\alpha}$ be such that the ruling party is indifferent between democratization and militarization, that is, $V^B(D, R_H) = V^B(M, R_H, \widehat{\alpha})$ where $V^B(M, R_H, \widehat{\alpha})$ is given by equation (11). This equality implies that:

$$\frac{y_B(R_H) + \tau_A(\widetilde{Y} - y_B(R_H)) - \frac{\tau_A^2}{2}\widetilde{Y}}{1 - \beta} = \frac{y_B(R_H)(1 - \alpha)}{1 - \beta}$$

or

$$\widehat{\alpha} = \frac{[\frac{\tau_A^2}{2} - \tau_A(1 - \vartheta)]Y + \frac{\tau_A^2}{2}R_H}{\vartheta Y + R_H}$$

On the other hand, a military regime is preferable to a redistributive fiscal policy when $V^B(M, R_H, \alpha)$ is higher than $V^B(P, R_H, \tau_P = \widehat{\tau})$ when $\tau_A \geq \widehat{\tau}$, that is:

$$V^B(P, R_H, \tau_P = \widehat{\tau}) = \frac{y_B(R_H) + [\widehat{\tau}(\widetilde{Y} - y_B(R_H)) - \frac{\widehat{\tau}^2}{2}\widetilde{Y}]}{1 - \beta}$$

when $\tau_A \geq \widehat{\tau}$.

Now, we have to determine the condition under which the rich agents are indifferent between promising redistribution at the tax rate $\tau_P = \widehat{\tau}$ and militarization, that is $V^B(P, R_H, \tau_P = \widehat{\tau}) = V^B(M, R_H, \alpha^*)$. This condition is satisfied as long as $\alpha = \alpha^*$ where:

$$\frac{y_B(R_H) + \widehat{\tau}(\widetilde{Y} - y_B(R_H)) - \frac{\widehat{\tau}^2}{2}\widetilde{Y}}{1 - \beta} = \frac{y_B(R_H)(1 - \alpha)}{1 - \beta}$$

$$\alpha^* = \frac{[\frac{\widehat{\tau}^2}{2} - \widehat{\tau}(1 - \vartheta)]Y + \frac{\widehat{\tau}^2}{2}R_H}{\vartheta Y + R_H}$$

where, as we have seen before, $\widehat{\tau}$ is the tax rate set by the ruling party that leaves the poor agents indifferent between to start a conflict and accepting

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the provision of public goods under a redistributive nondemocratic regime. Formally, $\widehat{\tau} = \tau | V^A(P, R_H, \tau = \widehat{\tau}) = V^A(W, R_H)$.[28]

All in all, the ruling party prefers to adopt a military regime when one of the following three cases arises:

1. $\tau_A \geq \widehat{\tau}$ and $\alpha < \alpha^*$ or
2. $\tau_A < \widehat{\tau}$, $\alpha < \widehat{\alpha}$ and $R_H \leq \widehat{R}_H$ or
3. $\alpha \geq \widehat{\alpha}$ and $R_H > \widehat{R}_H$

It is immediate to notice that, since $\tau_A \geq \widehat{\tau}$, $\widehat{\alpha} > \alpha^*$. In other words, if the ruling party prefers a military regime to a redistributive fiscal policy, a predatory autocracy is also preferred to a democratic regime.

As far as the political transition of oil-rich nations, the following remarks on Proposition 2 are opportune.

REMARK 3.

1. **Implementation of a redistributive fiscal policy:** Under assumptions $R_H > \widetilde{R}_H$, $\tau_A \geq \widehat{\tau}$ and $\alpha \geq \alpha^*$, in state R_H the implementation of a redistributive fiscal policy is less expensive than the introduction of either a military sector or a democratic regime. The tax rate set by the government is represented by $\widehat{\tau}$ (see Table 1). This tax rate ensures that:

$$V^A(P, R_H, \tau_P = \widehat{\tau}) = V^A(W, R_H)$$

As a consequence, poor agents do not have any incentive to start a conflict.

2. **Emergence of a predatory autocracy:** As far as the emergence of a predatory autocracy, we may have one of the following three cases:
   (a) As long as $R_H \leq \widehat{R}_H$, $\tau_A < \widehat{\tau}$ and $\alpha < \widehat{\alpha}$, both the introduction of a redistributive fiscal policy and the democratization of the country are too costly for the government. Therefore, the ruling party spends a fraction α of its income in military activities and the poor agents do not undertake a revolution.

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[28]Finally, we need to compare the payoff the ruling party obtains with the introduction of a military sector and its expected value in case of a civil conflict. In other words, we need to verify that the condition $V^B(M, R_H, \alpha) \geq V^B(W, R_H)$ is satisfied. For simplicity we assume that this assumption is always met.

(b) Under assumptions $\tau = \widehat{\tau}$, $\tau_A \geq \widehat{\tau}$ and $\alpha < \alpha^*$, the implementation of a redistributive fiscal policy could prevent a revolution. However, for the ruling party, the introduction of a military sector is less expensive than a fiscal policy. In this case, a fraction α of the income of the ruling party is spent in military activities and no revolution takes place.

(c) Provided that $R_H > \widehat{R}_H$, $\tau_A < \widehat{\tau}$ and $\alpha \geq \widehat{\alpha}$, for the government a fiscal policy based on the tax rate τ_A is a better alternative to predatory activities. However, the implementation of such a redistributive activity can not avoid a civil conflict (in fact, $V_A(D, R_H, \tau_A) < V^A(W, R_H)$). Therefore, since $V_B(M, R_H, \widehat{\alpha}) > V^B(W, R_H)$, a fraction α of the income of the rich agents is, nevertheless, spent in predatory activities. A military regime prevents a revolution from occurring.

3. **Process of democratization:** As long as $\tau_A < \widehat{\tau}$, $\alpha \geq \widehat{\alpha}$ and $R_H \leq \widehat{R}_H$, the implementation of a redistributive fiscal policy based on the tax rate $\widehat{\tau}$ is too expensive for the ruling party. However, for agent A, a revolution is more costly than accepting a democratic transition of the country. Similarly, for the rich agents, the democratization of the country is a more viable alternative to predatory activities. Therefore, in state R_H the oil-producing country democratizes. The fiscal policy implemented by the new government implies a tax rate τ_t^D:

$$\tau_t^D = \tau_t^A$$

Since $N > 2$, in a democracy the median voter is a peasant (agent A). The equilibrium tax rate set in a democratic regime is, in particular, represented by:

$$\tau_t^A = \tau^A = \frac{N - 2 + \vartheta}{N - 1} \qquad (12)$$

Table 2 shows the unique Markov perfect equilibria of the infinitely repeated discounted game $G^\infty(\beta)$ studied in the present paper. The final outcome of the model is determined by comparing the value functions of the two economic agents (A and B) under different assumptions on key parameters.

[INSERT TABLE 2 ABOUT HERE]

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6. Comparative Statics

Proposition 1 states that, provided that R_H is higher than $\widetilde{R}_H$, a collective action by a wide coalition of different social groups can originate (see Section 4.3). This action is aimed at reacting to considerable distortions in the distribution of income and oriented to affect a better redistribution of oil rents. Viceversa, $R_H \leq \widetilde{R}_H$, the grand coalition where all agents decide not to fight (*peace equilibrium*) represents the $NE(G^\infty)$: the possibility of internal conflicts (or political instability) does not represent a threat for both authoritarian and democratic systems.

From a political economy perspective, civil conflict is an activity with a low probability of success and high potential costs. Problems due to the organization of revolts may also arise (according to this model negative spillovers arise when $\delta > 1$). These results are consistent with a theory of rebel motivation ([7]). This theory is based on the argument that, despite the presence of grievances by the population, a coalition may form only if appropriate effective conditions are satisfied. Hence, groups of individuals can mount effective revolts (aimed at a better redistribution of income) only under predetermined conditions which could prove difficult to achieve.

From straightforward calculations the following remark follows:

REMARK 4.

$\widetilde{R}_H$ (*threshold* value of R_H such that if $R_H > \widetilde{R}_H$ all *peasants* have an incentive to fight the government) is a decreasing function of the number of social groups of the country, N. $\widetilde{R}_H$ is also inversely related to the level of inequality of the country (ϑ) and to parameter δ. On the contrary, $\widetilde{R}_H$ depends positively on no-oil income (Y) and on the fraction destroyed in the civil conflict (ϵ).

According to Remark 4, as the level of ethnic fragmentation of the country and the degree of inequality in the society (ϑ) increase, $\widetilde{R}_H$ decreases. In other words, it become more convenient to form a coalition and start a civil conflict.

As far as Proposition 2 is concerned, the signs of the first derivatives of $\widehat{\tau}$ with respect to relevant parameters are shown in Table 3.

[INSERT TABLE 3 ABOUT HERE]

Taking the first derivatives of the expression for $\widehat{\tau}$ with respect to the amount of oil revenues that accrue to the government (R_H) we can show that this is positive.[29] Similarly, $\widehat{\tau}$ is also positively related to ϑ. This relationship can be explained by observing that a higher level of inequality in the redistribution of the income in the country will increase the option value of poor agents to start a conflict.

On the contrary, the theory for endogenous political regime transitions of oil-rich countries proposed in this paper predicts a clear negative correlation between the level of initial income (Y) and the equilibrium tax rate, $\widehat{\tau}$. The tax rate that the ruling party has to set in a redistributive authoritarian regime in order to prevent a conflict is also negatively associated to the fraction of wealth destroyed in the conflict (parameter ϵ).

Finally, the relationship between the level of social fragmentation of the country and the tax policy of the ruling party is analitically derived. Results suggest that the $\widehat{\tau}$ depends in a nonlinear way on the level of social fragmentation, N. Numerical results are, hence, obtained by simulating the theoretical framework proposed in the paper under varying assumptions on key parameters of the model. Figures 1 and 2 depicts the effect of varying the level of social fragmentation on $\widehat{\tau}$. The results reported are consistent with the fact that higher levels of social fragmentation are, generally, associated with lower values of $\widehat{\tau}$. However, under certain conditions, a significant positive association between N and the size of $\widehat{\tau}$ may also arise. In particular, Figures 3 and 4 shows several cases under which the first derivative of $\widehat{\tau}$ with respect to N is, *ceteris paribus*, positive.

[INSERT FIGURES 1 TO 4 ABOUT HERE]

All in all, the relationships between the equilibrium tax rate, $\widehat{\tau}$, and the relevant parameters of the number can be summarized as follows:

REMARK 5.

The tax rate set in a redistributive authoritarian regime ($\widehat{\tau}$) is positively related to the total amount of oil revenues (R_H). $\widehat{\tau}$ is also an increasing function of the level of inequality of the country (ϑ). On the contrary, $\widehat{\tau}$ depends negatively on initial income (Y) and on the fraction of wealth destroyed in the civil conflict (ϵ). Finally, $\widehat{\tau}$ is related to the level of social

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[29]Analytical results are not shown to save space but are available from authors upon request.

fragmentation (N) in a nonlinear way.

Finally, in Figures 5 to 6 we report the relationships between N and α^* (that is, the threshold level of military expenses such that if $\alpha < \alpha^*$ and $\tau_A \geq \widehat{\tau}$ a predatory autocratic regime will emerge). As these Figures show, between N and α^*, there exists a nonlinear relationship.

[INSERT FIGURES 5 AND 6 ABOUT HERE]

7. Simulation of the Game

In order to provide some examples of the outcomes of the theoretical model, the results obtained by simulating the infinitely repeated game described in the paper are shown (see Tables 4 to 8). In particular, the entries of the Tables are determined by varying the relevant parameters of the model (i.e., δ, ϵ, N, R_H, ϑ and Y) and calculating the equilibrium tax rate, $\widehat{\tau}$ and the threshold levels α^*, $\widehat{\alpha}$ and $\widehat{R}_H$. Evidence on the adoption of a given policy by the government is, hence, obtained by computing the value function of both the ruling party and the poor agents associated with a particular political regime.

Table 4 shows that, as the number of (socio-political) groups increases, governments can move from military regimes to redistributive autocracies. This is due to the fact that the higher the fragmentation of a country, the lower the level of public (redistributive or military) expenses to sustain. However, the reduction of redistributive expenses by the government (represented by $\widehat{\tau}$) is higher with respect to the reduction in military spending (reduction of α^*). As a consequence, in order to avoid an insurrection, the implementation of a redistributive fiscal policy becomes a more convenient option than predatory activities.

Table 6 shows the response of the government changes as the endowment of the natural resource which is discovered increases. Results suggest that natural resources poor-countries will tend to adopt military regimes. However, as the amount of the natural resource increases, the authoritarian leaders will be better off by introducing redistributive autocracy regimes. This is the case of, for instance, Saudi Arabia, by definition the classic "rentier state" (e.g. [57]). Because of its huge oil reserves (approximately, 25 percent of world's proven oil reserves), this country was able to establish an important welfare state. The possibility to employ natural resources revenues in order

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to finance investment programs and, contemporaneously, reduce the level of taxation enables this country to avoid extensions of political rights to large shares of the population (such as representiveness in institutions).

Another evidence of the model is that, as Y increases (see Table 7), the likely response strategies of the ruling party shifts from the adoption of redistributive fiscal policies to predatory activities. Finally, Table 8 shows how the equilibrium strategy changes as the level of parameter ϵ changes. According to the theoretical model, as the fraction of wealth that is destroyed in the conflict increases, the incentive by the ruling party to undertake redistributive policies increases as well.

[INSERT TABLES 4 TO 8 ABOUT HERE]

How can we reconcile theoretical evidence with observed data for oil-rich nations? Figures 7 and 8 illustrate some relevant statistics on government expenses on military activities as well as for consumption goods for a sample of oil producing countries.[30]

In Figure 7 the relationship between the military/government final consumption ratio[31] and the log of population (or the crude oil production) is examined by controlling for different ranges of the ethno-linguistic fractionalization (ELF) index.[32, 33] As the Figure shows, as the level of fractionalization increases the incentive to implement redistributive policies increases as well. In other words, *ceteris paribus*, the average ratio of military expenditure to total government consumption expenses will tend to be higher for low social fragmented (*solid line*) relative to high-fragmented countries (*dashed line*).

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[30]These figures have been obtained by employing data for 27 countries (Algeria, Angola, Azerbaijan, Cameroon, China, Egypt, Indonesia, Iran, Kazakhstan, Kuwait, Libya, Malaysia, Mexico, Nigeria, Oman, Pakistan, Peru, Russia, Saudi Arabia, Sudan, Syria, Tunisia, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Vietnam) over the 1988-2002 sample. Results do not change if, for relevant variables, averages on ten-year periods are considered.

[31]Source of data: World Development Indicators, World Bank, 2007.

[32]A Herfindahl-based index defined as: $ELF = 1 - \sum_i s_i^2$ (here, s_i is the share of group i over the total of the population) is, in particular, employed in order to represent the probability that two persons which are selected randomly from a given country will belong to different social groups (see [58]).

[33]Countries are classified as either high or low fractionalized according to their value of the ELF index (higher or less than 0.5) (Source: [59]).

29

[INSERT FIGURE 7 ABOUT HERE]

Finally, Figure 8 show that as oil endowments increase, the implementation of redistributive policies is preferred to military expenditure programs.[34, 35] In average small oil exporting countries (*solid line*) are more likely to have a higher military spending/government final consumption ratio with respect to large oil producers (*dashed line*).

[INSERT FIGURE 8 ABOUT HERE]

8. Concluding Remarks

Does natural resources (and oil, in particular) affect the process of political transition of authoritarian regimes? Why do either paternalistic or "predatory" regimes often emerge?

In this paper, a simple game-theoretical model aimed at assessing the impact of natural resource discoveries on the set-up of a particular political regime has been introduced. The possibility that a coalition forms in order to allow for a better redistribution of the natural resource is argued to be the main channel through which natural resources affects political regimes changes. This analysis relies on the conclusions by [12], [13] and [15] (among others) according to which natural resource wealth has a positive impact on civil war. Consequently, the study focuses on the relationships between natural resources and the emergence of different political systems. The channel by means of which oil affect the transition towards a particular regime we focus on is the so-called *rentier effect*, i.e. wealth from the exploitation of natural resources is used in order to reduce threats of internal conflict.

A first result that emerges from this study is that the commitment by a democratic government to employ the natural resource revenues by means of a redistributive fiscal policy can not be able to avoid political instability. This result is consistent with the analyses by [3], according to which "in societies where a large fraction of GDP is generated from natural resources -

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[34]Countries are classified as small or large producers depending on the fact that their annual production is less or more than 1 million barrels per day (bpd, Source: U.S. Department of Energy, Energy Information Administration).

[35]Figure 8 plots the ratio of military to government final consumption expenditure on the level of population (and on the fractionalization index) by accounting for the relative size of crude oil production.

democracies may be harder to consolidate", and [11] which, similarly, argue that, in oil exporting countries, the emergence of a "factional" democracy is a possible outcome.

Another point stressed by this work is that, as revenues from the sale of natural resources accrues to authoritarian governments, political leaders are better off (rather than by introducing a fiscal sector) by implementing a redistributive program or by introducing a military regime. The likely explanation is the hope for the ruling party to gain "legitimacy" ([57]). Evidence is, therefore, consistent with the existence of a positive and strongly statistically significant relationship between the wealth from natural resources and the "tenure of leaders" (see [60].

In other words, our point of view is that, provided that some conditions are satisfied, a process of (full) democratization may occur. However, as this political transition proves not to represent a first best choice, incumbent authoritarian rulers may prefer to maintain support by deploying natural resources rents in order to consolidate their political power through either a redistributive policy or adopting a military regime (see, also, [5] and [11]).

Moreover, according to the result of the theoretical model it follows that the choice between implementing redistributive or "predatory" activities depends on factors such as the size of the natural resource endowment, the number of political groups that compose the country and on parameters that describe the technology of warfare. Numerical simulations of the theoretical model suggest that, under certain conditions, the convenience to implement redistributive policies increases in more fragmented countries. On the contrary, countries with low-levels of fragmentation can prefer to adopt military regimes. Moreover, under certain cases, incentives to implement paternalistic autocratic regimes increases as oil revenues increase. On the contrary, in countries with relatively low amount of natural resource military regimes could emerge. Finally, evidence from data analysis seems to confirm all the conclusions drawn on the basis of the theoretical model.

To conclude, we have to remark some economic implications of political transitions in oil-rich countries. How can the emergence of a particular political regime in oil producing nations be reconciled with economic growth theory? According to common wisdom, mature democracies (such as Norway) are in the best position to afford the socio-economic issues raised by oil booms. In these countries, stable party systems, high degrees of social consensus, competent and well-functioning bureaucracies and a good rule of law all allow policy stability and transparency. Consequently, high levels of competitive-

ness as well as policies aimed at economic stabilization can be reasonably introduced.

Other political systems that are often argued to perform well in facing socio-economic pressures associated to oil booms are reformist autocracies. By employing natural resource revenues in productive investments aimed at diversifying the economic activities of these countries, these political systems are (in many cases) able to foster economic development. In addition, political stability together with stabilization and fiscal restraint measures implemented by technocratic elites are usually associated to good economic performances.[36]

On the contrary, bad economic performances are usually associated to "factional" democracies or paternalistic autocracies. In fact, in these political regimes public expenditure is often directed towards protected and low inefficient economic sectors (often, public enterprises).[37]

Finally, other political regimes that can emerge in oil producing countries are "predatory" autocracies. As pointed out by [61], while some countries were able to manage well oil resources (for instance, Indonesia between 1950 and the late 1990s), in other nations ruling elites had no similar concern about economic liberalization and poverty reduction (e.g. Nigeria during the same period).[38]

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[36]Indonesia during the Suharto period is an interesting case study of the emergence of a reformist political regime. The agricultural sector was protected in an efficient way, while an attempt was made to reduce the role of the oil sector in the economy. Finally, an equilibrated budget law was introduced to avoid expansions of unproductive programs of social spending (see, *inter alia*, [22] and [61]).

[37]As already outlined, examples of paternalistic autocracies are given by the Persian Gulf monarchies. For these countries, a large share of the rents from oil exports is often allocated in order to raise population's standard livings. Consequently, programs of public spending aimed at raising the education and health levels of the population are implemented. However, although massive programs of investments in infrastructure are undertaken, they are quite inefficient. Since the quality of the services often remains low, these countries are not able to guarantee a significant self-sustained economic growth of the private sector (see [62]).

[38]Other countries where military regimes were not able to introduce significant processes of economic development despite important oil revenues are Syria and Angola. In the former country, primary oil production started in 1967 (Source: Syrian Petroleum Company). Revenues from the sale of the natural resource have been employed in order to enhance government autonomy from the other social classes. A large fraction of government revenues from aid and oil rent was absorbed by military and military-related activities. The

large coalition that formed between the ruling Baath party, the army and the bureacracy had the effect to confine the productive industrial bourgeoisie ([63]) to the periphery of the society with detrimental economic effects. Similarly, in Angola, a large fraction of oil rents (in 1999, 41 percent of total government expenditure accrued to the military sector, [55]) has been employed in order to serve security interests or to "sustain a clientele beyond the military apparatus, building a degree of legitimacy among those rewarded and allowing support or resistance to reforms, according to a short-term expediency".

Tables and Figures

Table 1: Proposition 2. Definition of variables.

Variable	Expression
$\widehat{R}_H =$	$Y \cdot \left\{ \frac{(\vartheta-1)(1-\tau_A)}{\tau_A \cdot (1-\tau_A/2) \cdot (N-1) + \lambda \cdot (\epsilon-1)} - 1 \right\}$
$\widehat{\alpha} =$	$\dfrac{\left[\frac{\tau_A^2}{2} - \tau_A(1-\vartheta) \right] Y + \frac{\tau_A^2}{2} R_H}{\vartheta Y + R_H}$
$\alpha^* =$	$\dfrac{\left[\frac{\widehat{\tau}^2}{2} - \widehat{\tau}(1-\vartheta) \right] Y + \frac{\widehat{\tau}^2}{2} R_H}{\vartheta Y + R_H}$
$\tau^A =$	$\dfrac{N-2+\vartheta}{N-1}$
$\widehat{\tau} =$	$\dfrac{b - (b^2 - 2 \cdot \widetilde{Y} \cdot c)^{1/2}}{\widetilde{Y}}$
where	$b = \widetilde{Y} - \dfrac{(1-\vartheta) \cdot Y}{N-1}$
	$c = \dfrac{\lambda \cdot (1-\epsilon) \cdot \widetilde{Y} - (1-\vartheta) \cdot Y}{N-1}$

Table 2: Political transition of an oil producing country. Main results (Proposition 2)

Case	Condition	Equilibrium
$R_H > \widetilde{R}_H$	$V_A\left(W, R_H\right) > V_A\left(P, R_H\right)$	C) A coalition of peasants
$0 < \delta < 1$		forms
$\tau = \widehat{\tau}$	$V_A\left(P, R_H, \tau_P = \widehat{\tau}\right) = V_A\left(W, R_H\right)$	C1) A redistributive fiscal policy
$\alpha \geq \alpha^*$	$V^B\left(P, R_H, \tau_P = \widehat{\tau}\right) \geq V^B\left(M, R_H, \alpha^*\right)$	is implemented
$\tau_A \geq \widehat{\tau}$	$V_B\left(P, R_H, \tau_P = \widehat{\tau}\right) \geq V_B\left(D, R_H, \tau = \tau_A\right)$	
$\tau = \widehat{\tau}$	$V_A\left(P, R_H, \tau_P = \widehat{\tau}\right) = V_A\left(W, R_H\right)$	
$\tau_A \geq \widehat{\tau}$	$V_B\left(P, R_H, \tau_P = \widehat{\tau}\right) \geq V_B\left(D, R_H, \tau = \tau_A\right)$	
$\alpha < \alpha^*$	$V^B\left(P, R_H, \tau_P = \widehat{\tau}\right) < V^B\left(M, R_H, \alpha^*\right)$	
$R_H \leq \widehat{R}_H$	$V_A\left(D, R_H, \tau = \tau_A\right) \geq V_A\left(W, R_H\right)$	C2) A military regime
$\tau_A < \widehat{\tau}$	$V_B\left(P, R_H, \tau_P = \widehat{\tau}\right) < V_B\left(D, R_H, \tau = \tau_A\right)$	emerges
$\alpha < \widehat{\alpha}$	$V_B\left(D, R_H, \tau = \tau_A\right) < V_B\left(M, R_H, \widehat{\alpha}\right)$	
$\tau_A < \widehat{\tau}$	$V_B\left(P, R_H, \tau_P = \widehat{\tau}\right) < V_B\left(D, R_H, \tau = \tau_A\right)$	
$R_H > \widehat{R}_H$	$V_A\left(D, R_H, \tau = \tau_A\right) < V_A\left(W, R_H\right)$	
$\alpha \geq \widehat{\alpha}$	$V_B\left(D, R_H, \tau = \tau_A\right) \geq V_B\left(M, R_H, \widehat{\alpha}\right)$	
$\tau_A < \widehat{\tau}$	$V_B\left(P, R_H, \tau_P = \widehat{\tau}\right) < V_B\left(D, R_H, \tau = \tau_A\right)$	C3) A democratic regime
$\alpha \geq \widehat{\alpha}$	$V_B\left(D, R_H, \tau = \tau_A\right) \geq V_B\left(M, R_H, \widehat{\alpha}\right)$	is introduced
$R_H \leq \widehat{R}_H$	$V_A\left(D, R_H, \tau = \tau_A\right) \geq V_A\left(W, R_H\right)$	

Table 3: Sign of the first derivatives of $\widehat{\tau}$.

Derivative	Sign
$\partial \widehat{\tau}/\partial N$	?
$\partial \widehat{\tau}/\partial Y$	< 0
$\partial \widehat{\tau}/\partial R_H$	> 0
$\partial \widehat{\tau}/\partial \vartheta$	> 0
$\partial \widehat{\tau}/\partial \epsilon$	< 0

Table 4: Simulation results. Sensibility to N ($Y = 7$, $R_H = 100$, $\epsilon = 61\%$, $\vartheta = 0.7$, $\alpha = 0.40\%$, $\beta = 0.95$, $\delta = 0.8$).

N	3.00	4.00	5.00
$\widetilde{R}_H$	1.94	0.71	0.12
τ_A	15.00%	43.33%	57.50%
$\widehat{\tau}$	11.55%	8.87%	7.18%
$\widehat{\alpha}$	0.85%	8.71%	15.71%
α^*	0.45%	0.22%	0.12%
$\widehat{R}_H$	-48.94	-8.59	-7.66
Outcome	Military Regime	Redistr. Policy	Redistr. Policy
$V^A(W, R_H)$	251.38	194.17	157.86
$V^B(W, R_H)$	331.84	252.09	203.15
$V^A(P, R_H, \widehat{\tau})$	251.38	194.17	157.86
$V^B(P, R_H, \widehat{\tau})$	2088.60	2093.30	2095.50
$V^A(M, R_H, \alpha)$	21.00	14.00	10.50
$V^B(M, R_H, \alpha)$	2089.60	2089.60	2089.60
$V^A(D, R_H, \tau_A)$	314.78	734.34	881.19
$V^B(D, R_H, \tau_A)$	2.080.20	1915.30	1768.40

Table 5: Simulation results. Sensibility to ϑ ($N = 3$, $Y = 7$, $R_H = 50$, $\epsilon = 60\%$, $\alpha = 0.20\%$, $\beta = 0.95$, $\delta = 0.8$).

ϑ	0.40	0.48	0.56	0.64
$\widetilde{R}_H$	10.43	8.11	5.78	3.46
τ_A	30.00%	26.00%	22.00%	18.00%
$\widehat{\tau}$	9.12%	9.63%	10.13%	10.64%
$\widehat{\alpha}$	2.47%	1.84%	1.30%	0.86%
α^*	-0.28%	-0.16%	-0.04%	0.10%
$\widehat{R}_H$	-17.93	-19.74	-22.95	-30.85
Outcome	Redistr. Policy	Redistr. Policy	Redistr. Policy	Redistr. Policy
$V^A(W, R_H)$	137.35	137.35	137.35	137.35
$V^B(W, R_H)$	181.31	181.31	181.31	181.31
$V^A(P, R_H, \widehat{\tau})$	137.35	137.35	137.35	137.35
$V^B(P, R_H, \widehat{\tau})$	1058.90	1068.90	1078.80	1088.50
$V^A(M, R_H, \alpha)$	42.00	36.40	30.80	25.20
$V^B(M, R_H, \alpha)$	1053.90	1065.10	1076.20	1087.40
$V^A(D, R_H, \tau_A)$	320.10	284.80	247.24	207.40
$V^B(D, R_H, \tau_A)$	1029.90	1047.60	1064.40	1080.20

Table 6: Simulation results. Sensibility to R_H ($N = 3$, $Y = 7$, $\epsilon = 60\%$, $\vartheta = 0.6$, $\alpha = 0.50\%$, $\beta = 0.95$, $\delta = 0.8$)

R_H	50.00	100.00	150.00	200.00
$\widetilde{R}_H$	4.62	4.62	4.62	4.62
τ_A	20.00%	20.00%	20.00%	20.00%
$\widehat{\tau}$	10.39%	11.56%	11.98%	12.20%
$\widehat{\alpha}$	1.07%	1.52%	1.67%	1.75%
α^*	0.03%	0.38%	0.51%	0.59%
$\widehat{R}_H$	-25.82	-25.82	-25.82	-25.82
Outcome	Redistr. Policy	Redistr. Policy	Military Regime	Military Regime
$V^A(W, R_H)$	137.35	257.83	378.31	498.79
$V^B(W, R_H)$	181.31	340.34	499.38	658.42
$V^A(P, R_H, \widehat{\tau})$	137.35	257.83	378.31	498.79
$V^B(P, R_H, \widehat{\tau})$	1083.70	2076.20	3068.20	4060.00
$V^A(M, R_H, \alpha)$	28.00	28.00	28.00	28.00
$V^B(M, R_H, \alpha)$	1078.60	2073.60	3068.60	4063.60
$V^A(D, R_H, \tau_A)$	227.60	407.60	587.60	767.60
$V^B(D, R_H, \tau_A)$	1072.40	2052.40	3032.40	4012.40

Table 7: Simulation results. Sensibility to Y ($N = 3$, $R_H = 50$, $\epsilon = 60\%$, $\vartheta = 0.6$, $\alpha = 0.40\%$, $\beta = 0.95$, $\delta = 0.8$)

Y	7.00	7.00	7.00	7.00
$\widetilde{R}_H$	4.62	4.62	4.62	4.62
τ_A	20.00%	20.00%	20.00%	20.00%
$\widehat{\tau}$	10.39%	11.56%	11.98%	12.20%
$\widehat{\alpha}$	1.07%	1.52%	1.67%	1.75%
α^*	0.03%	0.38%	0.51%	0.59%
$\widehat{R}_H$	-25.82	-25.82	-25.82	-25.82
Outcome	Redistr. Policy	Redistr. Policy	Military Regime	Military Regime
$V^A(W, R_H)$	137.35	257.83	378.31	498.79
$V^B(W, R_H)$	181.31	340.34	499.38	658.42
$V^A(P, R_H, \widehat{\tau})$	137.35	257.83	378.31	498.79
$V^B(P, R_H, \widehat{\tau})$	1083.70	2076.20	3068.20	4060.00
$V^A(M, R_H, \alpha)$	28.00	28.00	28.00	28.00
$V^B(M, R_H, \alpha)$	1079.70	2075.70	3071.70	4067.70
$V^A(D, R_H, \tau_A)$	227.60	407.60	587.60	767.60
$V^B(D, R_H, \tau_A)$	1072.40	2052.40	3032.40	4012.40

Table 8: Simulation results. Sensibility to ϵ ($N = 3$, $Y = 7$, $R_H = 50$, $\vartheta = 0.6$, $\alpha = 0.50\%$, $\beta = 0.95$, $\delta = 0.8$).

ϵ	40.00%	55.00%	70.00%	85.00%
$\widetilde{R}_H$	0.75	3.33	8.49	23.99
τ_A	20.00%	20.00%	20.00%	20.00%
$\widehat{\tau}$	17.60%	12.13%	7.00%	2.14%
$\widehat{\alpha}$	1.07%	1.07%	1.07%	1.07%
α^*	0.72%	0.15%	-0.10%	-0.09%
$\widehat{R}_H$	1547.70	-32.19	-19.49	-15.31
Outcome	Military Regime	Redistr. Policy	Redistr. Policy	Redistr. Policy
$V^A(W, R_H)$	206.02	154.52	103.01	51.51
$V^B(W, R_H)$	271.96	203.97	135.98	67.99
$V^A(P, R_H, \widehat{\tau})$	206.02	154.52	103.01	51.51
$V^B(P, R_H, \widehat{\tau})$	1076.20	1082.40	1085.10	1084.90
$V^A(M, R_H, \alpha)$	28.00	28.00	28.00	28.00
$V^B(M, R_H, \alpha)$	1078.60	1078.60	1078.60	1078.60
$V^A(D, R_H, \tau_A)$	227.60	227.60	227.60	227.60
$V^B(D, R_H, \tau_A)$	1072.40	1072.40	1072.40	1072.40

Figure 1: $\widehat{\tau}$ as a function of social fragmentation. Numerical Simulations, $R_H = 50$ and $R_H = 100$.
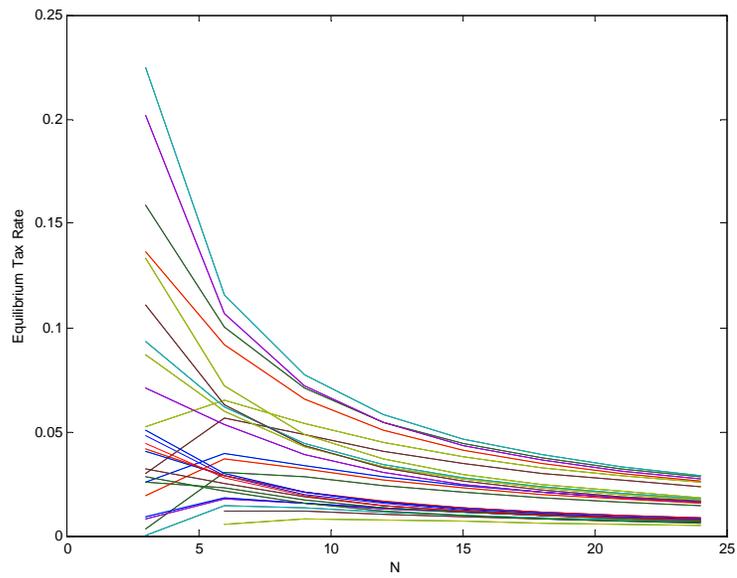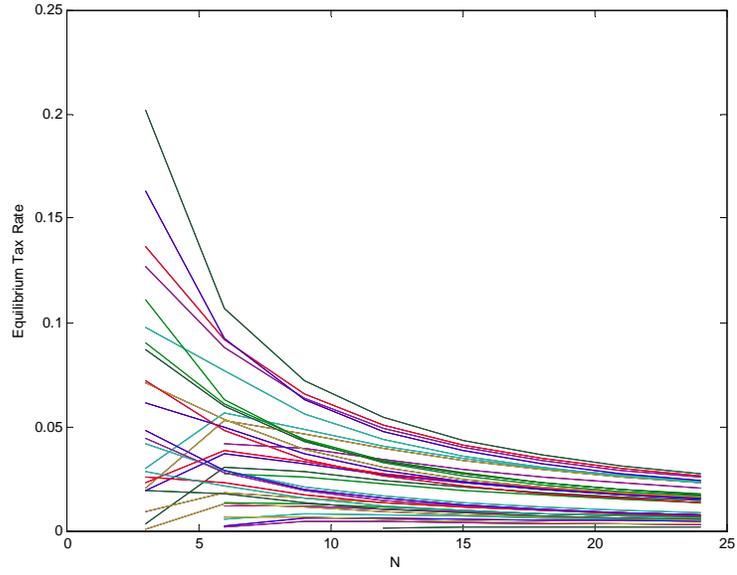
Figure 2: $\widehat{\tau}$ as a function of social fragmentation. Numerical Simulations, $R_H = 150$.
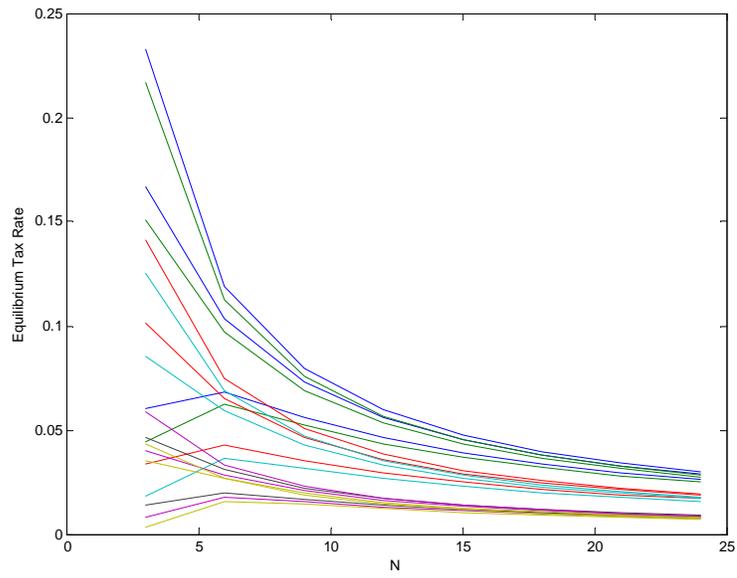
Figure 3: $\widehat{\tau}$ as a function of social fragmentation. $N = 10$, $R_H = 20$, $Y = 3$, $\vartheta = 0.7$, $\beta = 0.95$, $\delta = 0.8$, $\epsilon = 0.6$.
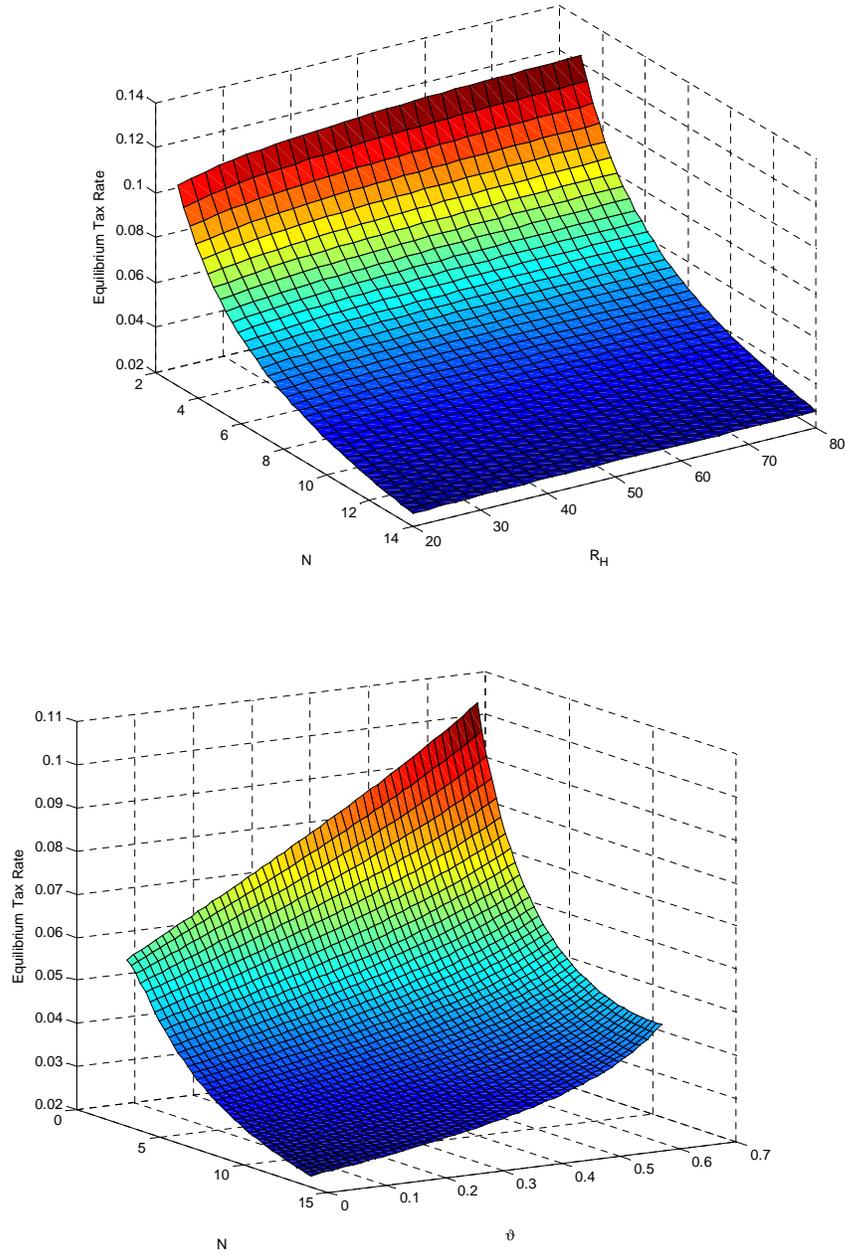
Figure 4: $\widehat{\tau}$ as a function of social fragmentation. $N = 10$, $R_H = 20$, $Y = 3$, $\vartheta = 0.7$, $\beta = 0.95$, $\delta = 0.8$, $\epsilon = 0.6$ (ctd).
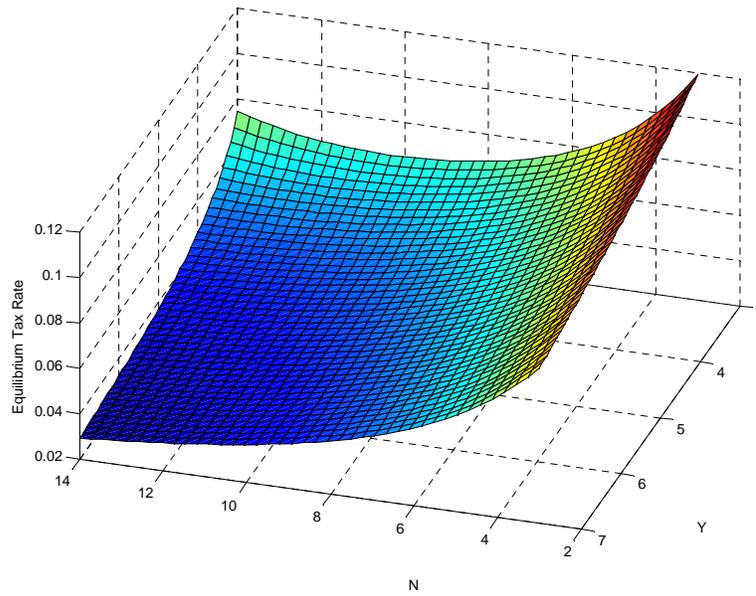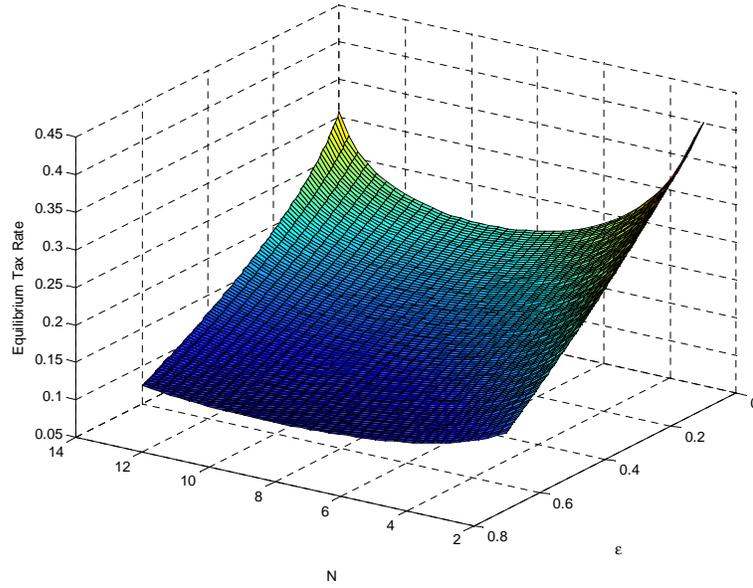
Figure 5: α^* as a function of social fragmentation. $N = 10$, $R_H = 20$, $Y = 3$, $\vartheta = 0.7$, $\beta = 0.95$, $\delta = 0.8$, $\epsilon = 0.6$.
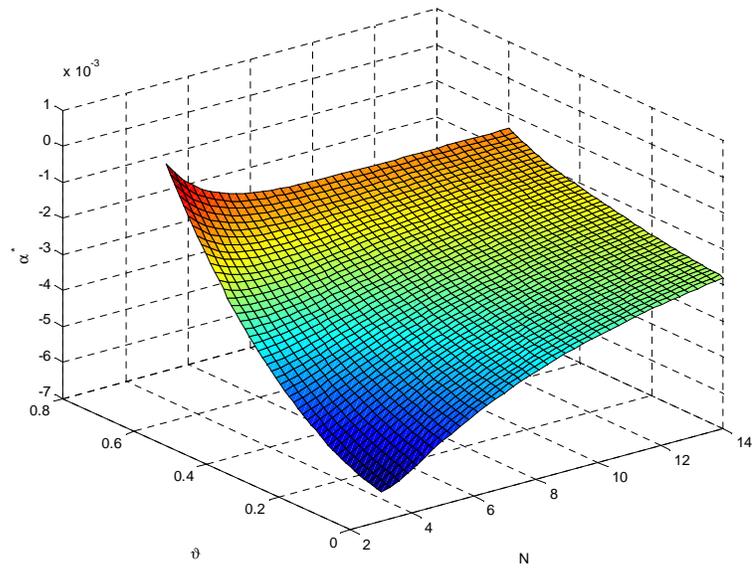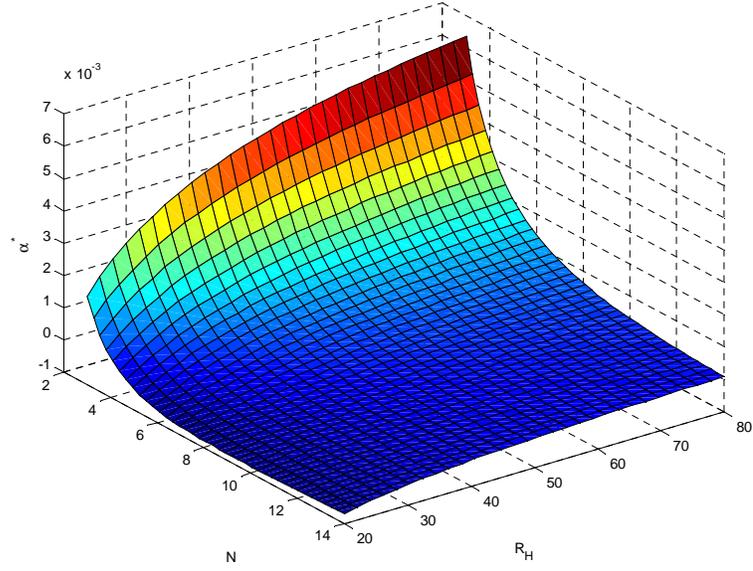
Figure 6: α^* as a function of social fragmentation. $N = 10$, $R_H = 20$, $Y = 3$, $\vartheta = 0.7$, $\beta = 0.95$, $\delta = 0.8$, $\epsilon = 0.6$ (ctd).
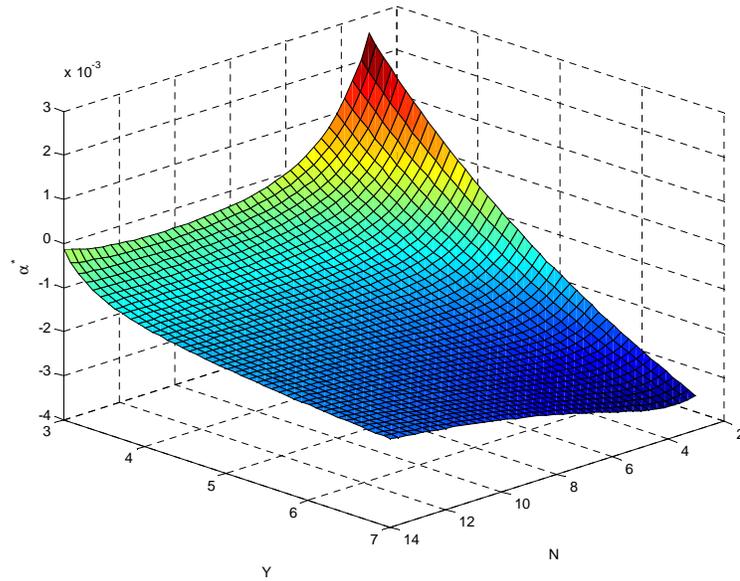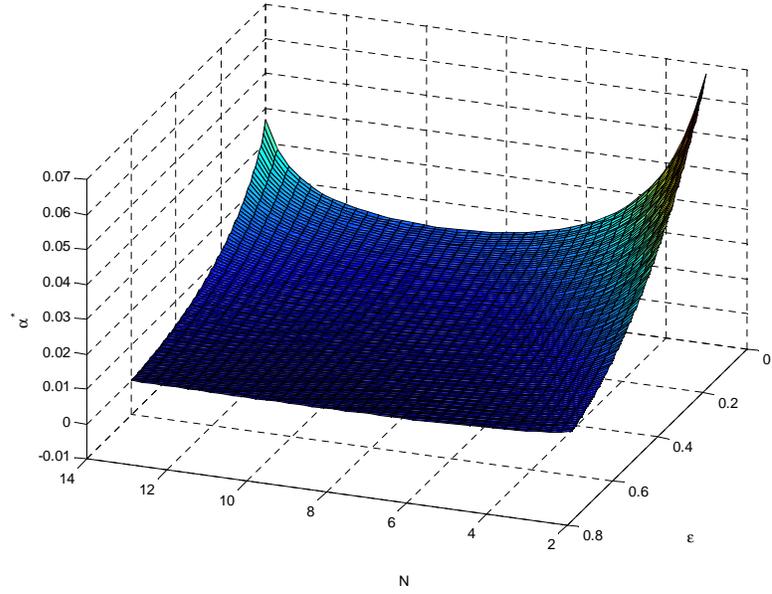
Figure 7: Oil production and emergence of a redistributive or military autocratic regime. Social fractionalization

a)

b)

47
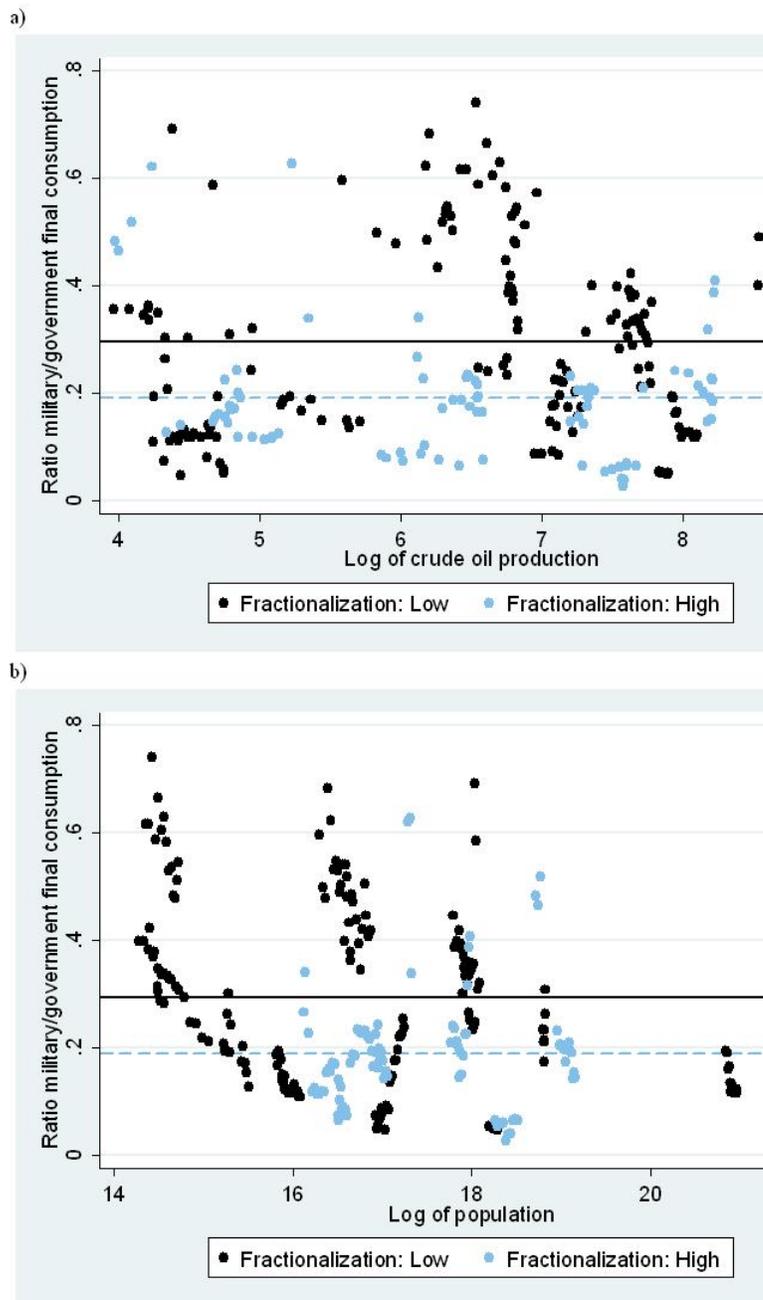
Figure 8: Oil production and emergence of a redistributive or military autocratic regime. Crude Oil Production

a)

b)

48
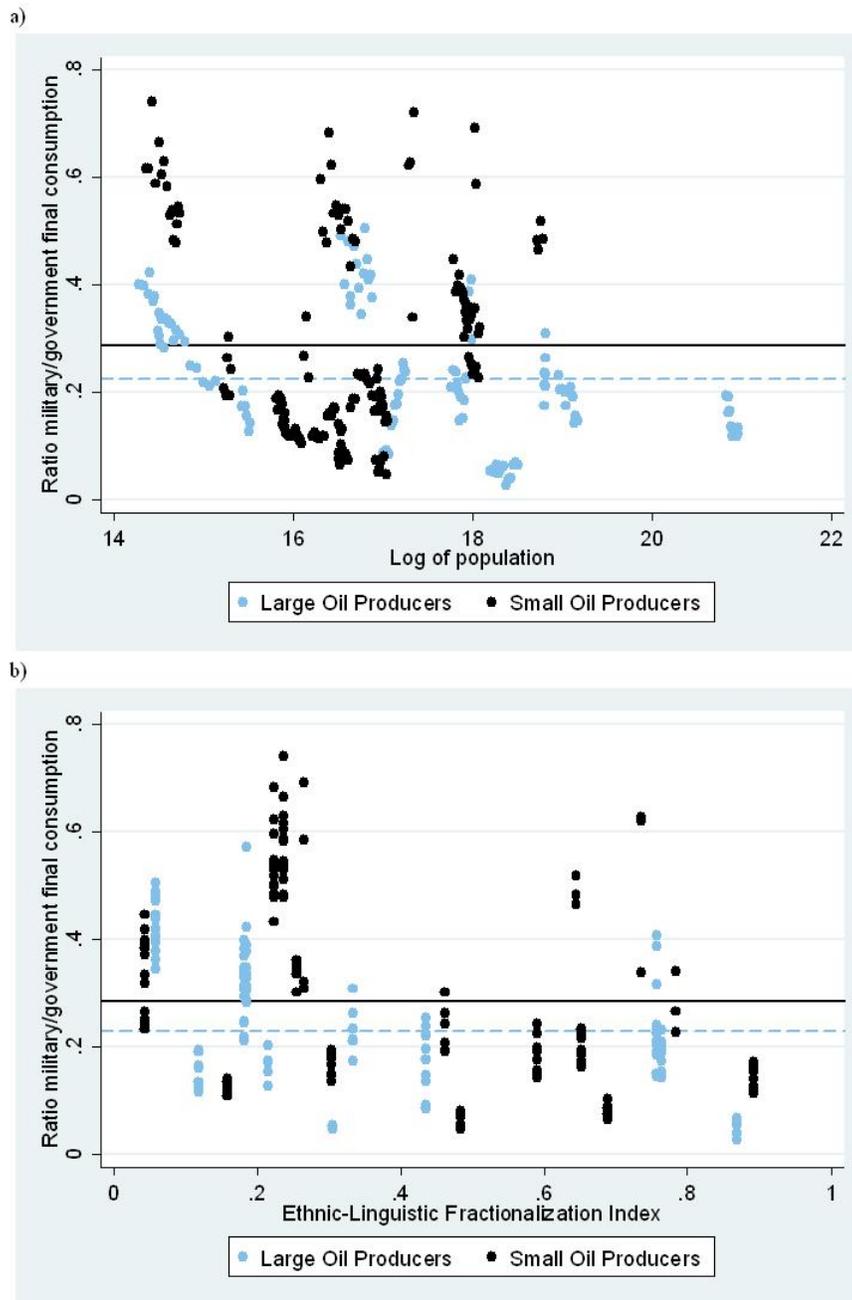
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