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Abstract

This paper develops a simple model that analyses the relationship between a country's oil endowment and the duration of its autocratic leader. The dictator uses the rents from oil extraction for both personal gain and to pay-off potential opposition and chooses an optimal level of oil exploitation. A group of kingmakers, on the other side, decides whether to stage a coup d'état and establish a new dictator. The relationship between oil endowment and the duration of the dictatorial regime is modulated by the price of oil. Applying an empirical survival model on data for the duration of 106 dictatorships supports the predictions of the theoretical model.

Keywords: Natural resources, dictatorship, political economy, duration.

JEL Classifications: Q34, D72, H11.

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1 Introduction

The academic literature does not get to a clear-cut conclusion concerning whether natural resources are a boone or a bane for dictators. The differences in the outcomes are mainly related to the preliminary assumptions made on the benefits of a coup d'état. The first strand of literature - and the majority of empirical studies - follows the theoretical tradition of Olson (1965) that a regime change creates social benefits and the issue of non-excludability raises a public good problem that the challengers need to overcome. Olson (1965) suggests that a successful deposition of the dictator results in social benefits either in a total regime change to more democracy or the sole replacement by a ruler favorable for other groups in society. In either case, the insurgents face a public good problem as they may not (fully) exclude other individuals from the benefits of a coup d'état. The survival of a dictator is assumed to depend on his ability to deter opposing groups in society from cooperation. A higher endowment of resources gives the dictator the opportunity to counteract cooperation of oppositional groups and increase his probability of staying in power. Empirical studies analysing the persistence of autocratic systems (e.g. Ross 2001, Tsui 2005) have applied this theoretical context and conclude that oil is, in general, an impediment to regime change.

The standard political economic model of the behavior of dictators is rather straightforward: The dictator's objective function is the maximization of personal utility via the increase of political rents and subject to the constraint of maintaining political power (Acemoglu, Robinson and Verdier 2004). Dictators collect resources from the population and increase personal and family gain as well as amenities of the ruling elite. These inefficient transfer policies are accompanied by a decline in economic development and the degradation of living conditions for at least some groups in society. Sooner or later, unsatisfied citizens might demand a regime change or the deposition of the dictator. Therefore, some of the political rents are used to deter citizens from oppositional activities and to ensure that the dictator stays in power. In order to remain in power, a dictator can choose to invest in increasing the loyal base of supporters and/or repressing of oppositional groups.[1]

Wintrobe (1990) uses the notation of a simple production function with the input factors "loyalty" and "repression" and the output "political survival" to describe the relationship between political survival and the instruments of asserting political power. An increased use of the production factors results in more political power, however, with diminishing returns. Factor prices are assumed to be exogenously given and the factor input is subject to a budget constraint, which basically equals the tax revenue. Although the dictator has a self-interest in setting the tax-rate at a level that does not completely distort incentives for social production (McGuire and Olson 1996), inefficient policies and possible economomic degradation increase the risk of a coup d'état. Under the assumptions that most of the rents from natural resources are absorbed by the dictator (e.g. royalties) and that the ruler cannot influence the price of the input factors loyalty and

[1]Regarding the former instrument, Becker (1983) argues that the behavior of a dictator is comparable to the behavior of a democratic politician trying to increase its base of support among citizens and interest groups. The autocratic institutional setting, however, enables the dictator to apply additional mechanisms to incentivate support.

repression, autocratic leaders of countries with a bigger endowment of natural resource have a less constrained budget and may use more of the instruments ensuring their power.

The second strand of literature argues that natural resource endowment can become a 'curse' not just for the overall economy, but also for its ruler. One prominent example is Nigeria, the world's 8^{th} largest oil producer, that has witnessed 8 successful coup d'état between its independence in 1960 and 1993 (Caselli 2006). This theory combines two different ideas: The first one is that regime change is more driven by private incentives of the challengers or insurgents rather than by the overall social benefit of deposing the dictator (e.g. Grossman 1991). The second one is that natural resources are rents that are more easily appropriated by the ruling elite and thus itensify the rent-seeking contest between various groups in society (Caselli 2006, Hodler 2006).[2]

A recent theoretical paper by Acemoglu, Ticchi and Vindigni (2008) studies the role of the military in non-democratic regimes. In their model the military can act as the dictatorship's tool of repression. However, in cases where ruling elite insufficiently compensates the generals and soldiers, the army might stage a coup and replace the existing ruling elite by a military dictatorship. Adding natural resources to their model results in two opposing effects for the regime: One the one hand, greater natural resource abundance allows the nondemocratic regime to finance repression through the military and thus increases its likelihood to persist. On the other hand, greater natural ressource endowment increases the benefits of the army to stage a coup d'état, install a military dictatorship and thus decreases the survival likelihood of the existing regime.

This paper provides a comprehensive analysis on the relationship between natural resource endowment, in particular oil reserves, and dictator duration that combines aspects of both strands of literature. We develop a theoretical framework that models the behaviour of the dictator and oppositional group based on the expected benefits from natural resources. The model concludes that a higher endowment of natural ressources leads to a lower probability of the oppositional group staging a coup d'état. Using a dataset on 106 dictators, our empirical analysis provides supports the predictions of the theoretical model. The theoretical model is presented in Section 2 and the empirical results are presented in Section 3. Section 4 concludes.

2 A theoretical model of dictator turnover and natural resources

We propose a slightly modified version of the leadership turnover model put forward by Gallego and Pitchik (2004) as theoretical background to the problem that we approach in this contribution.

[2]An econometric analysis of the probability of civil war by Collier and Hoeffler (2004) supports this idea.

Consider a dictator which is supported by a group of $n-1$ kingmakers in order to remain in power (so that the group we consider - dictator plus kingmakers - is of size n). The country exports a natural resource, say oil, which is traded at an exogenous price p in the international market. Competition between the dictator and the group of kingmakers is modelled as a game which is played over an indefinite number of periods. In each period, the dictator observes the realized price of the export, p (an i.i.d. random variable) and decides on an effort level $x \in [0,1]$ aimed at exploiting the natural resource further (by engaging in new oil drillings, for instance). The production of the natural resource is an increasing, concave, positive function of effort $Y(x)$, where $Y(0) = Y_0 \geq 0$ represents the country's natural resource endowment. For simplicity, assume a function $Y(x) = Y_0 + \tilde{Y}(x)$, where $\tilde{Y}(0) = 0$ and $\tilde{Y}(x) \geq 0$, $\tilde{Y}'(x) > 0$, $\tilde{Y}''(x) < 0$. The revenue of the export, $pY(x)$ is divided among the dictator and the kingmakers, each receiving $pY(x)/n$. The dictator receives an extra payoff of W and has to bear a cost of effort, $C(x)$, where $C(x) > 0$, $C'(x) > 0$, $C''(x) > 0$ and $C(0) = 0$.

A representative kingmaker decides whether to stage a coup d'état (which is assumed to be successful with probability π) by comparing the benefits of remaining a kingmaker with those of becoming the new dictator. The benefits of remaining a kingmaker is given by

$$B_k(p) = \frac{pY(x)}{n} + \delta \mathtt{E}K, \tag{1}$$

where δ is the discount factor and $\mathtt{E}K$ is the expected present value of a kingmaker's future earnings. On the other hand, the benefit of staging a coup d'état is given by

$$B_d(p) = \pi \left[\left(1 - \frac{1}{n-1}\right) \left(\frac{pY(x)}{n} + \delta \mathtt{E}K\right) + \frac{1}{n-1} \left(\frac{pY(x)}{n} + \delta \mathtt{E}D\right) \right], \tag{2}$$

where $\mathtt{E}D$ is the expected present value of a dictator's future earnings and if the coup is not successful the expected future flow of earnings is assumed to be zero. The expression in (2) takes into account that only one of the $n-1$ kingmakers can become a dictator. We assume that all kingmakers have equal probability of becoming a dictator if the coup is successful, and that unanimity among kingmakers is necessary for the coup to be carried out.

The level of effort of the dictator that makes the kingmaker indifferent between staging or not a coup is given by $x^*(p)$, which equalizes (1) and (2), that is,

$$x^*(p) = \tilde{Y}^{-1} \left(\left[\frac{\pi}{1-\pi} \times \frac{n}{n-1} \left(\delta \mathtt{E}D - \delta \mathtt{E}K\right) - n\delta \mathtt{E}K \right] \frac{1}{p} - Y_0 \right), \tag{3}$$

which is decreasing on Y_0, the natural resource endowment, and p, the price of the export. The representative kingmaker decides to carry out the coup d'état if the level of effort that the dictator decides to invest is lower than $x^*(p)$.

The dictator's expected payoff is given by

$$\tilde{B}_d(p) = \frac{pY(x)}{n} + W - C(x) + \delta \mathtt{E}D, \qquad x \geq x^*(p) \tag{4}$$

if he[3] decides to meet the level of effort required by the no-coup condition, and

$$\tilde{B}_c(p) = (1-\pi)\left(\frac{pY(x)}{n} + W - C(x) + \delta \mathtt{E}D\right) \qquad x < x^*(p) \tag{5}$$

if he decides to invest a lower effort level. Let $\tilde{x}(p)$ be the level of effort that maximizes dictator profits for a given level of export price,

$$\tilde{x}(p) = \arg\max_x \left(\frac{p\tilde{Y}(x)}{n} - C(x)\right). \tag{6}$$

If, for a realized price $\bar{p}$, $\tilde{x}(\bar{p}) > x^*(\bar{p})$, the dictator chooses $\tilde{x}(\bar{p})$ and no coup takes place. On the other hand, for the case $\tilde{x}(\bar{p}) < x^*(\bar{p})$, the dictator would choose $\tilde{x}(\bar{p})$ if

$$(1-\pi)\left(\frac{\bar{p}Y(\tilde{x}(p))}{n} + W - C(\tilde{x}(p)) + \delta \mathtt{E}D\right) > \frac{\bar{p}Y(x^*(\bar{p}))}{n} + W - C(x^*(\bar{p})) + \delta \mathtt{E}D. \tag{7}$$

If the probability of success in the coup is low enough, the dictator would not meet the level of effort required by the kingmakers, and they would stage a coup. Figure 1 shows $\tilde{x}(p)$ against $x^*(p)$ for a price process with a continuous distribution function $F(p)$ with support on $[p_{min}, p_{max}]$. The probability of a coup d'état is given by $F(p^*)$. Ceteris paribus, a country with a higher endowment of the natural resource (see gray line in Figure 1) will have a lower probability of a coup, $F(p^{**})$. The theoretical model concludes that for a given realization of the oil price, the dictator of a country with a larger oil endowment has a lower probability of being challenged by the kingmakers group and therefore dictatorships in oil-rich countries should, *ceteris paribus*, have a longer duration.

3 Empirical evidence: A duration model for dictators

The basic result of the theoretical model is that oil abundancy increases the duration of dictatorships. In this section we specify a duration model for dictatorships to test this hypothesis using a dataset including information on 106 dictators.

3.1 The specification of the duration model for dicators

The empirical investigation on the duration of dictatorships can be carried out by formulating a survival model for dictators. Survival models are applicable for data where for each observational unit i at any point in time t the state of a certain criterion is reported. In our case, the survival criterion is defined by dictator i being in power in year t. The time until the event of failure of a dictator occurs is the variable of interest and the sum

[3]We decided not to use gender-neutral language, since only two very short term in office dictators in our sample are female.

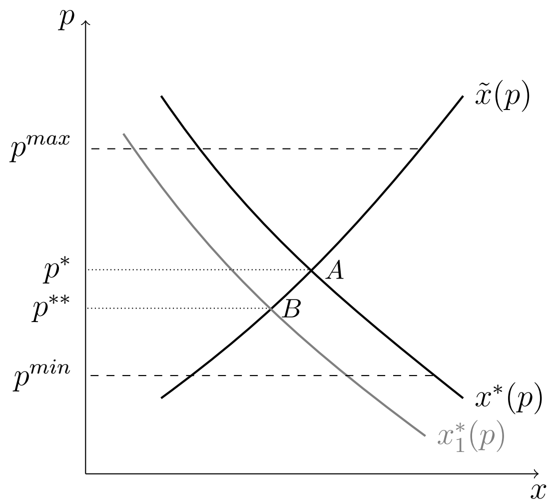

Figure 1: Natural resource endowment and the probability of a coup d'état

of the years a given dictator i is in power gives his duration.

We will specify the survival of dictators by means of a standard (parametric) proportional hazard model (see e.g. Kalbfleisch and Prentice 2002, Cleves, Gould and Gutierrez 2004) , which is given by

$$h_{ic}(t|\mathbf{x}_{ic}) = h_0(t)\exp(\mathbf{x}_{ic}\boldsymbol{\beta}_x), \tag{8}$$

where h_{ic} is the hazard a dictator i faces in a country c. $h_{ic}(t)$ is proportional to the baseline hazard h_0, at time t and depends on a row vector x_{ic} of explaining variables with the corresponding column vector of regression coefficients $\boldsymbol{\beta}_x$. The exponential function assures that $h_{ic}(t)$ remains non-negative. The functional form of $h_0(t)$ has to be specified.[4] Since the interest of this investigation lies in the duration of dictatorships we reformulate the standard hazard model in the log-time metric, which yields

$$\ln(t_{ic}) = \mathbf{x}_{ic}\boldsymbol{\beta}_x + \epsilon_i, \tag{9}$$

where the distribution of the error term depends on the assumed distribution of $\tau_{ic} = \exp(\mathbf{x}_{ic}\boldsymbol{\beta}_x)t_{ic}$. From $\tau_{ic} = \exp(-\mathbf{x}_{ic}\boldsymbol{\beta}_x)t_{ic}$ follows that $t_{ic} = \exp(\mathbf{x}_i\boldsymbol{\beta}_x)\tau_{ic}$ and that

$$\ln(t_{ic}) = \mathbf{x}_{ic}\boldsymbol{\beta}_x + \ln(\tau_{ic}). \tag{10}$$

The distribution of $\ln(\tau_{ic})$ depends on the distributional assumption of τ_{ic}. In empirical applications the choice of the distribution of τ_{ic} determines the distribution of the error term. Moreover τ_{ic} is usually assumed to have mean β_0. If one, for example, assumes $\tau_{ic} \sim \text{Exponential}\{\exp(\beta_0)\}$ then: $\ln(t_{ic}) = \beta_0 + \mathbf{x}_{ic}\boldsymbol{\beta}_x + \mu_{ic}$, where the error term μ_{ic} follows the extreme-value distribution.

[4] In principle, one is free to pick any positive function for $h(0)$, however, commonly used functional forms are, for example, the exponential, Weibull or Gompertz functions.

In our empirical investigation we estimate equations like (10) for five different distributional assumptions on τ_{ic}. The baseline specification of the accelerated failure time model for dictators for a given year t is given by

$$\begin{aligned}\ln(t_{ic}) = {} & \beta_1 \ln \text{Age}_i + \beta_2 \ln \text{Median Survival}_c + \beta_3 \ln \text{GDP p.c.}_c \\ & + \beta_4 \text{GDP p.c. Growth}_c + \beta_5 \ln \text{Population}_c + \beta_6 \ln \text{Rents - other Resources}_c \\ & + \beta_7 \ln \text{Oil Production}_c + \beta_8 \ln \text{Oil Price} \\ & + \beta_9 \ln(\text{Oil Production}_c \times \text{Oil Price} + \ln(\tau_{ic}). \end{aligned} \tag{11}$$

The corresponding proportional hazard specification, assuming $h_0(t)$ to be Gompertz distributed, can be written as:

$$\begin{aligned}h_{ic}(t|\mathbf{x}_{ic}) = {} & \exp(\gamma t) \exp(\beta_1 \ln \text{Age}_i + \beta_2 \ln \text{Median Survival}_c + \beta_3 \ln \text{GDP p.c.}_c \\ & + \beta_4 \text{GDP p.c. Growth}_c + \beta_5 \ln \text{Population}_c + \beta_6 \ln \text{Rents - other Resources}_c \\ & + \beta_7 \ln \text{Oil Production}_c + \beta_8 \ln \text{Oil Price} \\ & + \beta_9 \ln(\text{Oil Production}_c \times \text{Oil Price}), \end{aligned} \tag{12}$$

where γ describes the shape of the baseline hazard. For $\gamma = 0$ the Gompertz distribution reduces to the exponential hazard form, while a positive (negative) γ indicates that $h_0(t)$ increases (decreases) with time.

From equations (11) and (12) one can easily see that the interpretation of the estimated coefficients will be different. A positive (negative) effect of a given variable in the log-time metric extends the expected time to failure which corresponds to a negative (positive) impact of the variable on the hazard rate in the proportional hazard metric. Therefore, we expect the signs of the estimated effects in equation (12) to be exactly the opposite of the effects obtained using log-metric formulation.

The empirical specification assumes that the duration of dictators depends on a mixture of dictator-specific and country-specific determinants. We follow the existing literature on leadership duration and in particular Bienen and van der Walle (1992) to identify potential control variables which might be able to explain differences in the duration across dictators in different countries. Due to bounded life expectancy, the first obvious candidate as explanatory variable is the dictator's entry age. We expect dictators of advanced age when coming into power will have a shorter log-time to failure, simply due to natural death or less physical strength to defend oneself from a coup d'état. To account for the country-specific tradition in staging coup d'états we additionally include the median survival time of the political leaders in each country since 1870. We expect dictators to survive longer in countries where traditionally leaders are in power for long time periods. Lipset (1960) holds that political stability and therefore the duration of political leaders depends on the economic environment in which the leader acts. In democratically organized countries we would expect decreasing hazard rates with higher GDP growth rates and a higher income level, although this relationship must not necessarily be true for countries which are governed by dictators.

The development of sound economic conditions is often associated with the size of a country. The literature on viability of countries tends to find that large countries are sustainable in economic terms (Robinson 1960). On the other hand governability of countries seems to become more difficult in large countries. Therefore, the effect of the size of a country on dictator survival is in principle ambiguous. However, the size of the country should influence the duration of dictators and we control for this effect including a country's population as a proxy variable. We enlarge the baseline specification with variables proxying the role of natural resources on the duration of dictators. Since we are interested on the sole effect of oil on the duration, we control for rents obtained from other natural resources. We include a variable which captures the sum of all rents obtained from different natural resources.[5] The variables of interest in the model are oil production and the oil price. Since our model implies that for a given number of kingmakers the per-kingmaker revenue from the exported oil increases with $Y(x)$ the probability of staging a coup d'état decreases with oil production, and therefore the expected duration of a dictator increases. The duration of an oil-blessed dictator is expected to ceteris paribus exceed the length of a dictatorial term in a country which is not endowed with oil.

The logic of the theoretical model presented above implies that the oil price realization mediates between the incentives of dictator and kingmakers and results on an equilibrium being chosen where either a coup d'état is staged or the dictatorial status quo remains in place. We therefore add the world oil price as an extra regressor as well as its interaction with oil production in order to account for possible parameter heterogeneity on the response to price changes depending on the size of the oil sector.

3.2 Data and Descriptive Statistics

Information on oil production is available only for the years 1980 until 2004, thus limiting the scope of our analysis to this time period. The information on entry, exit and on the entry age of the dictators is taken from ARCHIGOS, a panel data set on political leaders from 1875 until 2004 for 188 countries (see Goemans, Gleditisch and Chiozza 2007). ARCHIGOS is used to calculate the duration of the dictators and serves to construct the country-specific median survival variable, which is the median duration of political leaders in a given country since 1875. Real GDP per capita and its growth rate, as well as population data are obtained from the Penn World Table 6.2 (REF).[6] The information on the rents from different natural resources is taken from the World Bank's Adjusted Net Savings data and measured in US-Dollars. Information on oil production and on the annual average oil price is provided by the Energy Information Administration. Oil pro-

[5] Information is available for rents obtained from natural gas, bauxite, copper, gold, lead, nickel, ore, phosphate, tin, zinc, silver, hardcoal and softcoal.

[6] In our robustness analysis we additionally include explanatory variables such as inflation, which is obtained from the World Bank's World Development Indicators 2005 Database and the average years of education of countries population. The education data are taken from the IIASA-VID dataset, which contains broad information on educational attainment. Details on this dataset are provided by Lutz, Goujon, Samir and Sanderson (2007) and Crespo-Cuaresma, Lutz and Sanderson (2008).

duction is measured in thousand barrels per day, while the oil price is stated in US Dollars.

The restriction of the dataset to dictators is done using information provided by the Polity IV Project (see Marshall and Jaggers 2005). The Polity IV database offers a score variable (polity2) which combines two other score variables (Democ and Autoc) and proxies the political system in a country. The Democ and Autoc scores include information on competitiveness and openness of executive recruitment, constraints on chief executive, regulation and competitiveness of participation. The polity2 measure is defined as Democ minus Autoc and ranges from +10 to-10 with -10 implying a strongly autocratic regime and +10 a strongly democratic regime. Unfortunately, the use of a score variable as restriction of the data set requires an *ad hoc* decision on the cut-off level. We decide to include only dictators with a polity2 score smaller than -6 into the final data set. This cut-off level seems to be restrictive enough and leaves us with 647 dictator-year observations and 106 dictators.[7] However, in our robustness analysis we extend our data set to the most autocratic political systems as well.

Table 1 shows the descriptive statistics for the variables from the baseline specification and for the variables used in the robustness analysis. On average, the observed dictators are in power for about 12 years with a relatively high standard deviation of 10 years. 12 out of the 106 observed dictators failed within the first year of their dictatorship. The maximum dictatorship duration in our sample is 45 years and is associated with the regency of Cuba's Fidel Castro.[8]

In terms of the explanatory variables, Table 1 shows some interesting data characteristics. The dictators analyzed here came into power with an average age of about 47 years. The entry age at the beginning of their leadership varies between 17 and 79 years. On average the observed dictators stay about 3.5 years longer in power compared to the median survival of their political predecessors. The annual GDP per capita growth rate between 1980 and 2004 for the countries in our sample is 0.8 percent points, with very large cross country and time variation. Regarding the size of the countries, the average country population in the sample is about 50.8 million. On average, 669 thousand barrels of oil are produced per day. Restricting the sample to oil-producing countries alone, the average value increases to a production of 1,082 thousand oil barrels daily. The distribution concerning oil producing versus non-oil producing dictators shows that the majority of the observed dictators engage in oil production. In 395 out of the 647 dictator-year observations a non-zero value of oil production is observed. Saudi Arabia represents the country with the maximum amount of oil production in our sample. Other large oil producers are China, Iraq, Kuwait and the United Arab Emirates.

Since the aim of the paper is to investigate differences in the duration of oil producing and non-oil producing dictators, Figures 2 and 3 provide a first picture of the relationship

[7]Compared to the classification by Alvarez, Cheibub, Limongi and Przeworski (1996) the dataset used here represents a more restrictive sub-sample of dictators. See our robustness analysis for the sensitivity of our results to changes in the definition of dictatorial regimes.

[8]Note that the duration of the dictatorship is calculated relative to 2004 for leaders which are still in power at the end of our sample period.

Table 1: Descriptive Statistics

Variable	# of Observations	Mean	Std. Dev.	Min	Max
Years in Power	647	12.230	10.331	0	45
Entry Age	647	46.764	14.932	17	79
Median Survival	647	8.682	8.840	1	33
Real GDP p.c. (in US $)	557	7,702.575	9,587.376	403.895	52,382.580
Real GDP p.c Growth (in %)	517	0.8	9.3	-100.4	46.3
Population (in 1000)	632	50804.050	214941.600	230.640	1,294,846
Rents From Other Natural Resources	647	1,230,000,000	4,090,000,000	0	70,667,400,000
Oil Production (in 1000 Barrels per Day)	647	668.873	1479.424	0	9,900
Oil World Price (in US $)	647	22.437	7.508	10.76	35.15
Average Years of Education	318	4.802	2.859	0.245	9.927
Inflation (%)	421	48.371	193.753	0.064	2773.377

Notes:

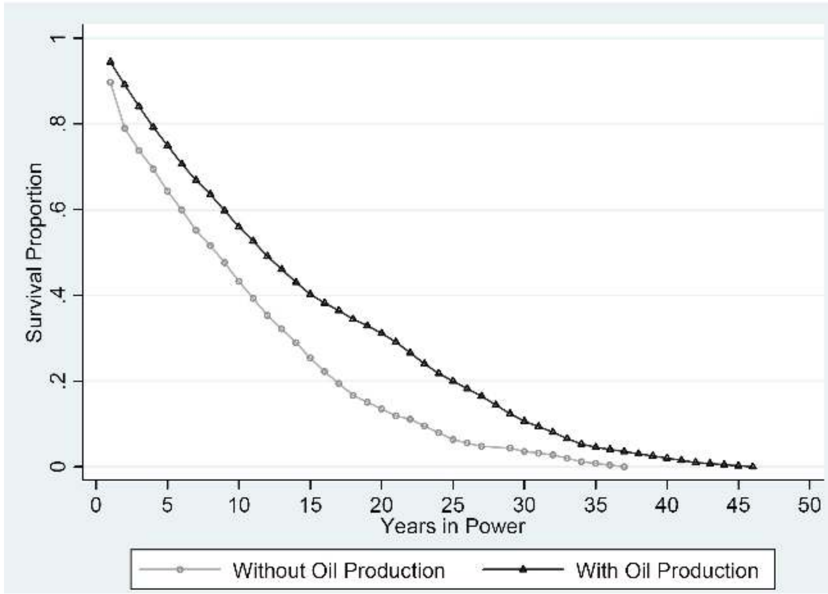

Figure 2: Lifetable Dictators Without and With Oil Production

between oil production and dictators survival. In Figure 2 the proportion of surviving to failing dictators is plotted against their years in power. The share of surviving dictators is always higher for those countries which engage in oil production. In particular, 70.63 percent of the dictators who engage in oil drilling are still in power after 5 years of dictatorship, while only 59.92 percent of the non-oil producing dictators survive the first 5 years. The difference in the proportion of survives achieves its maximum between 15 and 25 years duration of a regency (i.e 29.11 percent of all dictators who are blessed with oil 'survive' until a dictatorship duration of 20 years while for their counterparts only 11.90

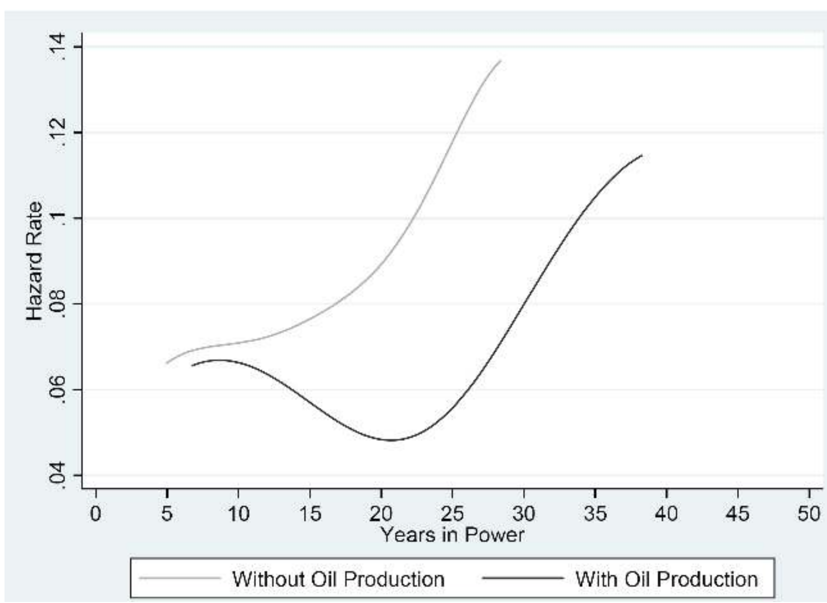

Figure 3: Unconditional Hazard Rate Estimation over Time

percent stay in power after this time).

Figure 3 shows (unconditional) kernel estimates for the coup d'état hazard rate at each point in time. The (estimated) hazard rate for dictators in countries without significant oil production always exceeds the corresponding hazard probability for oil-disposing autocrats. Moreover, the kernel estimates suggest that the hazard rate (i.e the risk of a successfull coup d'état) is a non-linear function of dictatorship duration. Especially, the hazard rate for oil producing dictators decreases after 9 years in power and begins to increase again after a duration of about 21 years. Additionally, the marginal hazard rate tends to increase with dictators years in power capturing the increasing rate of natural deaths for older dictators. Interestingly, the increase in the marginal hazard rate takes place earlier for the group of dictators who are not endowed with oil reserves.

Summing up, the descriptive statistics and the (unconditional) kernel estimates suggest that dictatorship duration of oil-blessed autocrats tends to last for a longer time period than for their non-oil-endowed counterparts, thus supporting the results of our simple theoretical model. To control for other (potential) driving forces of this difference in leadership duration we estimate the above mentioned models given by equation (11) and (12).

3.3 Estimation Results

Table 2 provides the results concerning the baseline specifications for 6 different functional forms of the baseline hazard. Due to data limitations in the explanatory variables we lose 213 dictator-year observations corresponding to 29 dictators. At the bottom of Table 2 we report the Bayesian information criterion (BIC) for each functional form specification. According to the BIC, the (parsimonious) exponential functional form model is preferred. The exponential hazard function disposes of only one shape parameter, which is restricted to 1. For this reason, the exponential distribution assumes constant hazard rates over time indicating that in our sample the baseline survival probability for dictators is independent of the years in power.

The estimation results in Table 2 confirm many of the expectations put forward in our model. The estimation results across functional forms are very similar. We base our discussion here on the exponential form of the model, since according to the BIC it is the preferred one . In detail, dictators with advanced entry age have – ceteris paribus – a significantly shorter log-time to failure. This result is not very surprising and well in line with previous research. Using a sample of all political leaders, Bienen and van der Walle (1992) find that an additional year of entry age adds 2 percent risk of losing power. The political tradition in the analyzed countries affects dictatorship duration in the sense that in countries where the median survival time of political leaders is historically higher the duration of the considered dictatorships is significantly increased. Interestingly, neither the wealth of a country (measured via the level of real GDP per capita) nor economic growth (measured in terms of annual average real GDP per capita growth) are able to significantly explain differences in duration across dictators. On average, a higher level of GDP p.c tends to to decrease the log-time to failure while higher GDP p.c growth rates

Table 2: Estimation Results of the Baseline Duration Model

Distribution	Gamma	Weibull	Exponential	Gompertz	Lognormal	Loglogistic
Metric	AFT	AFT	AFT	PH	AFT	AFT
	(1)	(2)	(3)	(4)	(5)	(6)
Variable						
Entry Age	−0.968	−0.871***	−0.865**	1.000***	−1.173**	−1.061
	(0.592)	(0.321)	(0.348)	(0.348)	(0.572)	(0.880)
Median Survival	0.433**	0.414***	0.429***	−0.459***	0.456***	0.554***
	(0.169)	(0.132)	(0.139)	(0.143)	(0.166)	(0.177)
Real GDP p.c	−0.053	−0.061	−0.055	0.072	−0.111	0.001
	(0.226)	(0.219)	(0.231)	(0.245)	(0.224)	(0.276)
Real GDP Growth	1.051	1.333	1.478	−1.413	−0.646	0.43
	(3.414)	(2.246)	(2.467)	(2.460)	(2.94)	(4.045)
Population	−0.393	−0.464***	−0.474***	0.515***	−0.267	−0.184
	(0.350)	(0.167)	(0.178)	(0.197)	(0.167)	(0.183)
Rents From Other Natural Resources	0.011	0.008	0.009	−.008	0.013	0.019
	(0.014)	(0.010)	(0.011)	(0.011)	(0.011)	(0.013)
Oil Production	0.325	0.368***	0.378***	−0.412***	0.263*	0.177
	(0.221)	(0.136)	(0.145)	(0.156)	(0.142)	(0.191)
Oil World Price	−2.527**	−2.679***	−2.752***	2.982***	−2.362**	−2.027*
	(1.114)	(0.978)	(1.033)	(1.097)	(0.996)	(1.180)
Oil Production * Oil World Price	−0.096	−0.109**	−0.113**	0.122**	−0.077*	−0.052
	(0.069)	(0.044)	(0.047)	(0.049)	(0.046)	(0.059)
Constant	14.880***	15.782***	15.862***	−17.584***	14.196***	11.477*
	(5.113)	(3.749)	(3.920)	(4.740)	(4.278)	(6.417)
Shape Parameter 1 (κ, p, -, γ, σ, γ)	0.631	1.084	-	0.016	0.987***	0.558***
	(1.128)	(0.089)	-	(0.017)	(0.076)	(0.064)
Shape Parameter 2 (σ, -, -, -, -, -)	0.968***	-	-	-	-	
	(0.143)	-	-	-	-	-
# of Observations	434	434	434	434	434	434
# of Dictators	77	77	77	77	77	77
BIC	220.125	214.438	208.951	214.157	214.980	216.762

Notes: Clustered standard errors for 77 Dictators are given in parenthesis. The symbols *, ** and *** stand for significant at the 10%, 5% and 1% level. AFT stands for the accelerated failure-time formulation while PH denotes the proportional hazard model. The standard errors for the shape parameters are reported for the test against zero.

tend to promote the duration of dictatorships. However, both of the effects are consistently insignificant and, therefore, economic welfare (as measured by these variables) seems to have very limited explanatory power in models of dictatorship duration. In contrast, country size tends to matter. Dictators in countries with large populations face a longer log-time to failure. The corresponding effect in the preferred model is statistically significant at the 1 percent level. Finally, the inclusion of additional rents from other natural resources besides oil exhibit a positive but insignificant effect on the duration of dictators.

With regard to our variables of interest, as predicted by our model a higher level of oil production increases the log-time to failure for the considered dictators, and one may conclude that crude oil reserves strengthen the political power of dictators. The second variable of special concern is the average annual world price. The world average oil price exhibits a highly significant negative impact on the log-time to failure for the dictators in our sample indicating that an increase in the oil price increases the probability of a successful coup d'état, resulting in a regime change. In the internal logic of our model, kingmakers enhance their expectations concerning the future rents of being the king when observing a higher oil price and, therefore, more probably stage a coup d'état. The parameter estimate for the interaction effect between the oil price and oil production gives evidence that this effect is more pronounced for countries with high oil production.

To investigate the robustness of our results we vary our analysis in two ways: Firstly, we exclude some of the variables which enter insignificantly in the preferred baseline specification and/or add some additional regressors. Secondly, we split our sample into several sub-samples according to our selection variable (polity2) to assess whether our baseline results are driven by the *ad hoc* definition of dictators. Tables 3 and 4 illustrate the corresponding results. The bottom of Table 3 shows that due to different model specifications the included number of observation in the estimation procedure varies between 161 dictator-year observations (corresponding to 43 different dictators) for the largest model and 536 dictator-year observations (including 90 dictators) for parsimoniously specified models. In the first four columns we report estimation results excluding the level of real GDP p.c. and/or real GDP p.c growth and the rents from other natural resources. The BIC of the model where only the level of GDP p.c. is excluded indicates that this model should be preferred to the baseline specification.[9] The results of this specification are virtually identical to the baseline, especially the level of significance of certain variables is not affected by this modification. Columns 2 to 4 in Table 3 depict comparable results with a few exceptions. While the effect of oil production is relatively unchanged, the effects of entry age and especially the oil world price are very sensitive to several modifications. The exclusion of those variables which enter insignificantly increases the effect of the entry age from -0.865 (baseline specification) to -1.195 (model without level of real GDP p.c, GDP p.c growth and rents from other natural resources. More interestingly, the corresponding oil world price effect declines from -2.752 to -1.307 which, moreover, is statistically not different from zero. This result suggests that the negative effect of the average annual world oil price might be specific to the subsample of dictators where infor-

[9]Since, the first specification is the only one with the same number of observations and, therefore, directly comparable to the baseline specification. In all other robustness checks the number of observations differ from the baseline specification, rendering a direct comparison in terms of BIC impossible.

Table 3: Robustness Checks: Different Models

Distribution	Exponential	Exponential	Exponential	Exponential	Exponential	Exponential	Exponential
Metric	AFT	AFT	AFT	AFT	AFT	AFT	AFT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variable							
Entry Age	−0.884**	−1.012***	−1.168***	−1.195***	−0.745	−0.930**	−0.486
	(0.359)	(0.320)	(0.321)	(0.323)	(0.573)	(0.367)	(0.543)
Median Survival	0.419***	0.561***	0.447***	0.448***	0.343**	0.420**	0.284
	(0.135)	(0.115)	(0.116)	(0.115)	(0.174)	(0.159)	(0.184)
GDP p.c		−0.204			−0.020	−0.044	−0.220
		(0.183)			(0.264)	(0.260)	(0.297)
GDP Growth	1.519				1.097	1.364	−0.700
	(2.452)				(2.529)	(2.603)	(2.915)
Population	−0.463**	−0.564***	−0.413**	−0.408**	−0.784**	−0.533***	−0.839***
	(0.182)	(0.161)	(0.169)	(0.168)	(0.214)	(0.221)	(0.233)
Rents From Other Natural Resources	0.008	0.006	0.006				
	(0.010)	(0.010)	(0.010)				
Education					0.328		0.523**
					(0.239)		(0.255)
Inflation						0.127	0.033
						(0.117)	(0.131)
Oil Production	0.377***	0.430***	0.343***	0.356***	0.606***	0.429**	0.647***
	(0.145)	(0.127)	(0.130)	(0.126)	(0.165)	(0.182)	(0.186)
Oil World Price	−2.791***	−2.124**	−1.278	−1.307	−4.454***	−2.899**	−4.069***
	(1.004)	(1.009)	(1.023)	(1.018)	(1.207)	(1.327)	(1.386)
Oil Production * Oil World Price	−0.114**	−0.123***	−0.100**	−0.103**	−0.183**	−0.126**	−0.197***
	(0.047)	(0.040)	(0.041)	(0.041)	(0.054)	(0.058)	(0.063)
Constant	15.408***	16.767***	12.166***	12.205***	21.693***	16.574***	20.942***
	(3.638)	(3.895)	(3.939)	(3.917)	(4.997)	(4.798)	(5.336)
# of Observations	434	469	536	536	231	302	161
# of Dictators	77	84	90	90	46	69	43
BIC	202.931	261.899	276.166	270.194	134.795	178.951	124.776

Notes: Clustered Standard errors in parenthesis. The symbols *, ** and *** stand for significant at the 10%, 5% and 1% level. The BIC values are only comparable for models with the same number if observations.

mation on real GDP per capita and its growth rate as well as rents from other resources is available.[10] The last three columns of Table 3 report estimation results for models where information on the country's average years of education and the annual inflation rate is additionally included. The inclusion of these variables can be justified as an additional robustness check that controls for differences in the probability of a coup being successful, since macroeconomic stability and human capital are usually claimed to be important determinants of civil conflict in empirical cross-country and panel studies (see Collier and Hoeffler 2004). The incorporation of both of these variables dramatically reduces our dataset to a minimum number of 161 dictator-year observations (corresponding to 43 dictators), however, the results are robust against this modification, at least the signs of all variables are unchanged and only the effect of the entry age becomes insignificant. Both inflation and education tend to increase the log-time to failure, but the only significant effect is observable for education in the very small sample.

Table 4: Robustness Checks: Sub Samples

Distribution Metric	Exponential AFT (1)	Exponential AFT (2)	Exponential AFT (3)
Variable			
Entry Age	-6.614^{**}	-0.105	-5.459^{**}
	(1.732)	(0.559)	(2.351)
Median Survival	-0.269	0.487^{**}	33.872
	(1.196)	(0.256)	(45.030)
GDP p.c	-2.676^{***}	0.358	2.595
	(1.112)	(0.366)	(6.766)
GDP Growth	-2.669	5.162^{*}	13.952
	(4.048)	(2.979)	(10.806)
Population	-0.337	-0.771^{***}	-1.914
	(0.306)	(0.227)	(3.592)
Rents From Other Natural Resources	0.080	0.021	0.624
	(0.073)	(0.015)	(0.687)
Oil Production	0.844^{***}	0.504^{***}	0.704^{*}
	(0.316)	(0.192)	(0.405)
Oil World Price	-1.044^{***}	-4.680^{***}	-3.847^{***}
	(1.061)	(1.412)	(1.333)
Oil Production * Oil World Price	-0.200^{**}	-0.169^{***}	-0.353^{***}
	(0.088)	(0.062)	(0.077)
Constant	52.00^{***}	17.173^{***}	-65.265
	(19.402)	(5.480)	(61.549)
# of Observations	182	197	73
# of Dictators	22	52	11
Subsample (polity2)	-10, -9	-8, -7	-10
BIC	68.662	130.026	39.500

Notes: Clustered Standard errors in parenthesis. The symbols *, ** and *** stand for significant at 10%, 5% and 1% level. The BIC values are only comparable for models with the same number if observations.

[10] This finding is supported by the fact that the oil world price effect becomes significantly again if we restrict the model from column 4 to the sample used in the baseline specification.

Table 4 shows the estimation results using the baseline specification for sub-samples of our data set. Again, the number of observations becomes small, which (at least partially) leads to sensitive results. For this reason, we limit the discussion of the results to the robustness of the direction of the influence (i.e. signs) and their statistical significance. The first two columns of Table 4 show the estimation results for a more and less severe dictatorship definition, while the results in the last column correspond to the most severe dictators according the polity2 indicator. In comparison to the baseline specification, we lose some observations due to the reason that only dictators which remain in the corresponding subgroup (i.e show a polity2 value of -10 to -9, or -8 to -7 ,or -10) over their whole leadership duration are included in the estimation procedure. The effects of several control variables on the dictatorship duration for the sub-samples are mostly ambiguous. Only for the impact of country size and rents from other natural resources on dictator duration does the direction of influence remain unaffected. Additionally, almost all variables change their level of significance in the different sub-samples. However, the impact of the variables of interest (oil production and world oil price) are hardly affected by the sample modifications. Especially, oil production (significantly) increases the duration of a dictatorship for both, relatively large sub-sample as well as the sample of the 11 most terrifying dictators, while the oil price exhibits a strong negative impact in various subsamples. This result indicates that the theoretically expected enforcing effect of oil production on the stability of dictatorship appears very robust to several different definitions of dictatorship.

4 Conclusions

The main goal of this paper is to explain whether oil is a boon or a bane for dictators. Anecdotical evidence gives us contradictory examples relating oil abundance and dictatorship duration: Muammar al-Gaddafi, being in power since 1969 in oil-rich Lybia is a prominent example that oil can be a dictator's friend. In contrast, the large amount of coup d'états in Nigeria indicate that oil could become a curse for a dictator. In order to provide a systematic analysis of this contraticting anecdotal observations, we develop a theoretical model the explains the duration of dicators as the equilibrium from the incentives to maximize oil profits from the side of the dictator and the incentives to take over power from the group of kingmakers. It suggests that autocratic rulers of countries with higher oil endowment stay longer in power. In addition, these theoretical predictions are strongly supported by our empirical findings. Our results contribute to the broad discussion on the natural resource curse and the relationship between oil and democracy.

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Jesus Crespo Cuaresma, Harald Oberhofer and Paul Raschky

Oil and the duration of dictatorships

Abstract

This paper develops a simple model that analyses the relationship between a country's oil endowment and the duration of its autocratic leader. The dictator uses the rents from oil extraction for both personal gain and to pay-off potential opposition and chooses an optimal level of oil exploitation. A group of kingmakers, on the other side, decides whether to stage a coup d'état and establish a new dictator. The relationship between oil endowment and the duration of the dictatorial regime is modulated by the price of oil. Applying an empirical survival model on data for the duration of 106 dictatorships supports the predictions of the theoretical model.

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