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Political repression in autocratic regimes*

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Abstract

Theoretical models on autocracies have long grappled with how to characterize and analyze state sponsorship of repression. Moreover, much of the existing formal literature sees dictators' behavior as determined by one type of opposition actor alone and disregards the potential role played by other types of actors. We develop a contest model of political survival with a ruler, the elite and the opposition, and show how the ruler needs to respond to revolutionary pressures while securing the allegiance of his own supportive coalition. We find that the ruler's reliance on vertical and horizontal repression is antithetically affected by the country's wealth and the optimal bundle of vertical and horizontal repression has important consequences for the regime's political vulnerability. Our hypothesis about the impact of oil on repression is strongly borne out by the empirical results, which are robust to endogeneity concerns.

Keywords: Authoritarian Regimes; Repression; Natural Resources

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1 Introduction

Dictatorship has been the prevalent system of governance historically and about one third of the world's countries are still ruled by autocrats. The lack of democratic accountability characterizing autocratic regimes does not equate to the polity descending into chaos; instead, by carefully balancing the degree of repression and co-optation, dictators manage to maintain peaceful polities that abruptly plunge into violence when revolutions and military coups are attempted. Despite the volume of research on autocratic regimes, a number of questions are still debated. Why do some authoritarian governments favor widespread repression, while others seek to mollify popular dissent by permitting a range of civil rights? Why were some regimes betrayed by the institutions intended to protect them while in others the elite have so far remained loyal and have prevented a transition? To help addressing these important questions, we need to understand autocrats' behavior, in particular the logic of rulers' strategies to prevent and/or mitigate the threats of popular mobilization as well as those emerging from actors within the incumbent coalition. In this article we explore one particular strategy, state-sponsored repression, the choice to imprison, execute or make political rivals disappear, both in the society at large as well as within the ruling body.

General theories of the incentives and constraints faced by dictators have a long tradition in political science and economics. This tradition goes back to Tullock (1987), who made the still uncontested claim that dictators primarily seek to remain in office, and often face a high risk of being deposed. Many subsequent contributions have studied the strategies rulers use to stay in power, ranging from loyalty and repression (Wintrobe, 1998), divide-and-rule strategies (e.g., Verdier *et al.* , 2004; De Luca *et al.* , 2014), power sharing and bargaining (e.g., Lizzeri & Persico, 2004; Morelli & Rohner, 2014), or even optimal succession rules (Konrad and Skaperdas, 2007; 2015). When describing who, exactly, threatens dictators, the elite, or "selectorate" (De Mesquita *et al.* , 2005), is the most commonly invoked challenger. The elite that brought the ruler into office can in principle depose him[1] for three main reasons. First, economic or political changes

[1]We use him/his here consistently instead of gender neutral language as dictators invariably tend to be men.

may make democracy more profitable for the elites.[2] Second, elites may support democracy as a compromise to avoid costly revolutions (Robinson & Acemoglu, 2006). Third, elites may have incentives in contesting the dictator in the hope of occupying power themselves (Acemoglu *et al.* , 2010; Konrad & Skaperdas, 2007, 2015), or of obtaining more favours under another dictator (Sekeris, 2011).

Elites control the fates of the dictator, and statistically most dictators were overthrown by members of their inner circle rather than popular uprisings; by one estimate (i.e., Svolik, 2009), out of 303 authoritarian rulers, 205 (68 percent) were deposed by a coup between 1945 and 2002. However, the recent political upheavals in Tunisia (2011), Ukraine (2014), or Hong Kong (2014) indicate that vertical accountability, or dictators' responsiveness to the broader population, also plays an important role. This is becoming more important as social media enables citizens to overcome the coordination problem often cited in the formal literature as a major hurdle for revolutions (Acemoglu & Robinson, 2001; Ellis & Fender, 2010).

Much of the existing formal literature sees dictators' behavior as determined by one opposition actor alone and disregards the potential role played by other actors. Some studies tend to emphasize the threat posed by the elites (De Mesquita *et al.* , 2005; Egorov & Sonin, 2011), while other consider the risk of popular revolutions (Gandhi & Przeworski, 2006). Theoretical models on dictatorships that bear resemblance to reality should allow for a double threat to the dictator's survival: the elites and the citizens. Even if the latter do not select rulers, they can determine their survival prospects through organized and potentially violent opposition. To this end, we develop a contest model of political survival with three sets of players, extending the conventional two-party model: a ruler, the elite and the opposition.

Theoretical models of conflicts and empirical studies tend to be weakly linked, and Blattman and Miguel (2010) lament how few empirical findings forge links between theory and data. We integrate these three actors into a *unified framework*,

[2]This is because democracy, among other advantages, improves property rights protection (Gradstein, 2007), enhances human capital accumulation (Bourguignon & Verdier, 2000), or entails greater provision of public services to a fraction of the elites (Lizzeri & Persico, 2004). These papers also give references to a fast-growing field of research, only part of which can be referred to here.

both from a theoretical and an empirical point of view. To this end, we directly bring to the data two theoretical hypotheses on the interaction between rulers, elites and the masses.

Of the two classical instruments of authoritarian control - repression and co-optation - we focus on repression, though our theory could be extended to include the use of co-optation. Abstracting from the repression *vs* co-optation trade-off that Desai *et al.* (2009) has termed the "authoritarian bargain", we can better analyse the degree of *horizontal* repression of the elites *versus* the *vertical* repression of the population to prevent the risk of coups and popular uprisings. In our model, elites ought to be compensated by the dictator, thus making it costly to maintain a large body of inner supporters. On the other hand, elites are useful to the ruler since they increase the grip of the ruler on the population, and therefore enhance his coercive ability. The dictator is thus facing a trade-off between purging the elites and thereby reducing their co-optation costs by having a smaller group of supporters on the one hand, and enhancing his coercive capacity on the population, on the other hand. Our theoretical model shows that the wealth under the control of a dictator affects his choice of repressing the elite as well as the population. Yet, while more resources increase vertical repression, i.e. against the citizens, they are shown to lower the level of horizontal repression, i.e. against the members of the elite. The first result is consistent with recent empirical studies on repression (see Acemoglu & Robinson, 2005; Smith, 2008; DeMeritt & Young, 2013; Al-Ubaydli, 2012; Conrad & DeMeritt, 2013, among others), although the theoretical mechanism underpinning our result is substantially different from that typically mentioned in the literature.

While in the latter the ruler wants to contain the level of repression to avoid dissatisfying the population too much and to preserve the capacity to tax the population at large, in our model more wealth translates into increased incentives for the population to mount a revolution to appropriate the riches. By reducing the horizontal repression of the elites, the dictator improves his vertical coercive capacity, thus improving the odds of retaining the extra riches. Interestingly, in our model revolutions are the result of a deliberate choice of the dictator not to repress the population beyond some "deterrent threshold". Revolutions do not therefore result from the regime's inability to repress dissent. Dictators may in-

deed find it profitable to sustain a (possibly low) risk of successful revolution if this is achieved a smaller body of supporting elites, thus implying large economies in terms of co-optation rents not paid to the elites.

We then use a global dataset on natural resources, human right violations and purges, and find empirical support for these hypotheses. We focus on the archetypal natural resource, oil, and use two measures of wealth from newly released datasets on oil discoveries, in addition to classical measures of oil production, to overcome the issue of reverse causality which has so far undermined the robustness of empirical findings on the nexus between oil and human right violations. The remaining of the article is organized as follows: Section 2 reviews existing studies on the logic of state-sponsored repression in autocratic regimes. Section 3 explicitly models vertical and horizontal repression, and in Section 4 we conduct comparative statics on the amount of resources in the economy. Section 5 describes the data used to test our hypotheses, in particular our exogenous measures of natural resource boom, and our empirical strategy. Section 6 presents our results while Section 7 provides concluding remarks.

2 Why autocracies repress

A large strand of the recent literature on authoritarian regimes explores how dictators use strategies of co-optation and repression to stay in office. From a political exchange perspective dictators usually try to buy-off the support of interests groups, especially the elite (North *et al.* , 2009; Egorov & Sonin, 2011; Sekeris, 2011), who play a key role in the regime's stability, but also broader sectors of the population (Acemoglu & Robinson, 2010). At the same time, when they believe they are unable to rule exclusively on the basis of co-optation, they make use of repression (Wintrobe, 2007). Repression is typically defined as one-sided use of violence by the incumbent government to increase the likelihood of remaining in office. Its main benefit is to contain threats and repress latent insurgencies by the population. This tactic aims at increasing the cost of mobilising against the regime and at limiting the extent to which citizens can effectively mobilize or disclose their true preferences. This in turn deters rebellion and mass mobilization (e.g. Moore, 1998; Davenport, 2007; Albertus & Menaldo, 2012).

However, repression has a number of drawbacks and can even prove counter-productive. Taken alone, it does not address the causes of unrest, when these arise from social inequalities and popular grievances. Research on the effect of mobilization shows that repression can also raise the level of hostility and strengthen the opposition (e.g., Francisco, 1995). Repression is also expensive since it requires security forces, troops and effective weaponry: raising the costs of political dissent thus drains available resources. Moreover, repression can trigger sanctions and international isolation, which can in turn destabilize authoritarian regimes (Escribà-Folch & Wright, 2010). It affects the wealth generated by the society through the loss of life and the destruction of assets (Acemoglu & Robinson, 2006), and it poses a moral hazard problem to the extent that the repressive agent - the state security apparatus - can be a threat to the regime itself (Acemoglu *et al.* , 2010; Svolik, 2013).

Given the above drawbacks, it is important to understand when and how repression is actually being used. Scholars seem to unanimously suggest that democratic institutions encourage governments to refrain from violations of human, civil and political rights, and therefore democracies repress less than autocracies (Davenport & Armstrong, 2004; Poe & Tate, 1994). Nevertheless, not all dictatorships resort to coercion to the same degree, and one witnesses considerable variations in the level of tortures, disappearances, extra-judicial killings among various autocratic regimes, thus calling for further research on the subject. Research on state-sponsored repression in autocracies suggests that repression is more likely when dictators face an overt challenge to the status quo, implying that repression is mainly a reaction against dissent and political instability (e.g., Keith & Poe, 2004; Davenport, 2007; Vreeland, 2008). Even elections - when they are perceived as a threat by the incumbent - are associated with an increased use of repression (Levitsky & Way, 2010). However, a recent theory put forward by Koga (2015) challenges some of the above findings and suggests that a dictator is more likely to eliminate rivals when the elites are temporarily less likely to successfully coordinate to oust him. Moreover, when campaigns of violent dissent stop, popular suffrage and a free press are shown to mitigate the use of torture (Conrad & Moore, 2010). A recent study by Frantz & Kendall-Taylor (2014) shows that the existence of parties and legislatures makes it easier for the ruler to monitor the opponents,

which leads to a decrease in repressive measures. Previous studies have also suggested that external factors, in particular economic globalization in the form of trade and investment, may increase the protection of human rights, although the quantitative evidence on this relation is not clear-cut (e.g., Hafner-Burton, 2005).

In what follows, we focus on the economic incentives of authoritarian governments to repress. A growing number of studies provide quantitative evidence that abundant natural resources, in particular oil, promote state repression of human rights (Smith, 2008; Caselli & Cunningham, 2009; DeMeritt & Young, 2013) and improve the survival odds of non-democratic regimes (Andersen & Ross, 2014; Cuaresma *et al.* , 2011; Andersen & Aslaksen, 2013). The theoretical mechanism underpinning this finding suggests that unearned revenues, unlike tax revenues, decreases the state's reliance on citizens for income (De Mesquita & Smith, 2009). Thus, when a state does not need to tax productive citizens to extract revenue because it can rely on natural resources, it is more likely to use repression to remain in power (Tilly 1985, 1992). A recent work by Al-Ubaydli (2012) shows how natural resources affect the optimal solution to the tradeoff between development and authoritarianism: "when natural resources are plentiful, dictators have a guaranteed income and can afford to hamstring the economy to maintain their grip on power. Conversely, when natural resources are limited, the cost of repressing associational freedom is high and so dictators have to balance their desire for longevity with their desire for wealth" (Al-Ubaydli, 2012, p.138).

Interestingly, Conrad & DeMeritt (2013) and Andersen & Aslaksen (2013) find that this relation is mediated by the extent to which a government is a democracy: "even states with unearned revenues avoid repression if they face ballot constraints that make them unwilling to incur the cost of repression" (Conrad & DeMeritt, 2013, p.116).[3] Three key points distinguish our efforts from theirs. First, as we describe in more detail in the theory section of this article, we provide a novel formal model on the relation between economic wealth and state repression, and put forward a substantially different theoretical mechanism linking repression to wealth. Second, we distinguish between vertical and horizontal repression, which they do not, and show how natural resources can affect in sub-

[3]Similarly, Moene et al. (2006) demonstrate that natural resources constitute a curse in countries with weak institutions alone.

stantially different ways the repression against the elite vis-a-vis the population. Third, we deal with the issue of endogeneity by using a newly released dataset on exogenous oil shocks.

3 The Model

3.1 The setting

We consider a setting featuring three actors, the ruler, the elites, and the masses. However, only the ruler and the masses are genuine actors who act strategically. In our setup, the ruler may face a revolutionary attempt by the masses. If a revolution is attempted, the people's efficiency in opposing the government's forces depends on their cooperation capacity, which is itself influenced by the support given by the elites to the rebellion.

The ruler who is in power manages the country's wealth, Y assumed to be exogenous. This wealth can be used (i) to enhance vertical coercion by increasing the state's repressive forces through military spending r, (ii) to enhance horizontal coercion of the elites by purging a portion p of them, thus reducing the cost of elite co-optation, and (iii) to enrich the ruler by retaining the residual wealth, $(Y - r - (1 - p)w)$, where w designates the (exogenous) per-capita bribe paid by the ruler to the elites whose total number is normalised to 1. If a revolution is attempted by the masses, they decide their revolutionary effort, x, which maps into effective strength $l(1 - p)x$. The function $l(1 - p)$ therefore describes the effectiveness of a nominal amount of revolutionary effort, which depends on the capacity of the masses to organize collectively toward the purpose of contesting the regime. This mobilization capacity is an inverse function of the support of the elites to the ruler: the wider the ruler's inner circle of supporters (i.e. the lower p), the less efficient will the masses be in opposing the regime. By purging the elites, the ruler saves on co-optation costs, but at the same time he reduces his grip on the masses. We are thus assuming that the collective action capacity of the masses, $l(1 - p)$, is a decreasing function of the total number of coopted elites $(1 - p)$. Moreover, we assume that the marginal effect of a larger body of elites is decreasingly small. We therefore have: $l'(.) < 0$ and $l''(.) > 0$.

In order to make the problem analytically tractable, we need to impose an additional restriction that bears upon the shape of the relationship expressing l as a function of $(1-p)$:

Assumption 1. $\epsilon_{l',1-p} > \epsilon_{l,1-p}$

We thus assume that the elasticity of the marginal efficiency of the opposition with respect to elite size, $(1-p)$, is larger than the direct elasticity of this efficiency with respect to the size of elites. This implies that the mobilisation capacity of the masses is a decreasing and sufficiently convex function of the size of the elite group. In other words, the dampening effect of the regime's horizontal support on the people's ability to revolt must be sufficiently strong at the margin.

Lastly, we denote by ϕ the economy's resilience to violence so that a share $(1-\phi)$ of the economy's wealth gets destroyed if a revolution is attempted.

If no revolution is attempted, the utility of the ruler is given by the following expression:

$$U = Y - (1-p)w - r \tag{1}$$

And the utility of the people then equals:

$$u = -x \tag{2}$$

Under a revolutionary attempt, the utility of the ruler and the utility of the people read, respectively, as:

$$V = \frac{r}{r + l(1-p)x}\phi\left(Y - (1-p)w - r\right) \tag{3}$$

$$v = \frac{l(1-p)x}{r + l(1-p)x}\phi\left(Y - (1-p)w - r\right) - x \tag{4}$$

The timing of the game is sequential. The autocrat first decides the levels of horizontal and vertical repression, p and r, respectively, and then the people decide whether or not to revolt, and how much effort to invest in the revolution. We solve for the game's subgame perfect Nash equilibria.

We first treat the simplified version in which p, and hence $l(1-p)$, are assumed

exogenous so that p is not a decision variable in the hands of the ruler. This will help us to lay the ground for the resolution of the complete problem in which p is endogenized.

3.2 Exogenous collective capacity l

In the game's last stage, the people maximize (4) w.r.t. x subject to $v(x) \geq 0$, which yields:

$$\frac{lr}{(r+lx)^2}\phi(Y-(1-p)w-r)=1$$

The people's reaction function is therefore given by:

$$x(r)=\begin{cases}\left(\frac{r\phi(Y-(1-p)w-r)}{l}\right)^{1/2}-r/l & \text{if } \frac{l\phi}{1+l\phi}(Y-(1-p)w)>r \Leftrightarrow v(x(r))>0\\ 0 & \text{otherwise}\end{cases} \tag{5}$$

Replacing (5) in (4), simplifying and collecting terms, we deduce that the people's utility of fighting is given by:

$$v(r)=\begin{cases}\phi\left[\phi\left(Y-(1-p)w-r\right)^{1/2}-\left(\frac{r}{l}\right)^{1/2}\right]^2 & \text{if } r<\frac{l\phi}{1+l\phi}(Y-(1-p)w)\\ =0 & \text{otherwise}\end{cases} \tag{6}$$

In the first stage of the game, the autocrat decides the amount of vertical repression, given the following two potential strategies:

1. *The deterrence strategy,* which consists in repressing the revolutionary attempts by deploying a sufficiently large force so that the people will not find it optimal to contest the autocracy. We denote the corresponding deterrence effort by r^d.

2. *The confrontation strategy* which consists in opting for violent confrontation, where power may be lost with a positive probability. We denote the corresponding repression effort by r^c.

The deterrence level is set in such a way that people are indifferent between contesting the autocrat, and taking their exit option which in our basic framework is equivalent to receiving zero income or utility. We thus have that r^d should set (6) to zero, and this is verified when r equals:

$$r^d = \frac{l\phi}{1+l\phi}(Y-(1-p)w) \tag{7}$$

Bearing (1) in mind, the utility obtained by the leader under *deterrence* therefore equals:

$$U^* = \frac{Y-(1-p)w}{1+l\phi} \tag{8}$$

Using (3) and (5), the utility of the ruler under *confrontation* comes out as:

$$V = \left(\frac{r\phi(Y-(1-p)w-r)}{l}\right)^{1/2} \quad \text{if } r < \frac{l\phi}{1+l\phi}(Y-(1-p)w) \tag{9}$$

$$= (Y-(1-p)w-r) \quad \text{otherwise} \tag{10}$$

The second possibility depicted by (10) corresponds to the *deterrence strategy* since, to put the people at their reservation utility (=0), the ruler sets the repression effort, r^d, at the minimum level compatible with $v(.) = 0$, which is identical to the solution depicted by (7).

Bearing the above in mind, optimizing under the *confrontation strategy* yields:

$$r^c = \frac{Y-(1-p)w}{2} \tag{11}$$

and the survival probability of the current autocrat at equilibrium, denoted by π, therefore equals:

$$\pi = (l\phi)^{-\frac{1}{2}} \tag{12}$$

The associated condition can now be written as $l\phi > 1$, instead of $r < \frac{l\phi}{1+l\phi}(Y-(1-p)w)$.

It is noticeable that the equilibrium level of repressive forces under the *confrontation strategy*, as given by (11) is independent of both l and φ, a property that

will prove very helpful when we analyze the more complex case discussed in the next subsection. It is easy to show that this property follows from the specification of the ruler's probability of success (the standard contest success function) combined with our particular setting.

We are now able to write the autocrat's indirect utility as follows:

$$V^* = \frac{1}{2}\left(\frac{\phi}{l}\right)^{1/2}(Y - (1-p)w) \tag{13}$$

Since we know that, when $l\phi \leq 1$, the optimal strategy for the autocrat is always the *deterrence strategy*, it remains to verify whether the alternative *confrontation strategy* can be optimal when $l\phi > 1$. To answer that question, we must compare V^* with U^* when $l\phi > 1$. The deterrence strategy remains preferable if:

$$U^* \geq V^* \Leftrightarrow 2\left(\frac{l}{\phi}\right)^{1/2} \geq 1 + l\phi \tag{14}$$

Some basic algebra shows that Inequality (14) is verified for $l \in [\underline{l}(\phi); \bar{l}(\phi)]$, where $\underline{l}(\phi) = \frac{\left(1-(1-\phi)^{1/2}\right)}{\phi^{3/2}}$, and $\bar{l}(\phi) = \frac{\left(1+(1-\phi)^{1/2}\right)}{\phi^{3/2}}$. Because $\phi^{3/2}$ is smaller than 1 by the definition of ϕ, it is evident that $\bar{l}(\phi) > 1$. It is immediate to establish that for $\phi < 1$, $\bar{l}(\phi) > \frac{1}{\phi}$, so that when $l\phi > 1$, the threshold value for determining the autocrat's optimal strategy is $\bar{l}(\phi)$. Indeed, in the case where $l\phi > 1$, which implies $l > 1$, two possibilities arise: either $l < \bar{l}(\phi)$ and the *deterrence strategy* is optimal, or $l > \bar{l}(\phi)$ and it is the *confrontation strategy* that is optimal. On the other hand, it is easy to check that $\underline{l}(\phi)\phi < 1$ for any value of ϕ, which implies that the *deterrence strategy* is always optimal when l is smaller than the lower bound of the interval $[\underline{l}(\phi); \bar{l}(\phi)]$.

The following proposition summarizes these findings:

Proposition 1. *When the collective capacity of the masses is exogenous, the deterrence strategy is the preferred option of the ruler whenever* $l\phi \leq 1$. *When* $l\phi > 1$, *the alternative confrontation strategy is optimal but only if* $l > \frac{1+(1-\phi)^{1/2}}{\phi^{3/2}}$.

Proposition 1 states that the autocrat is more likely to suppress potential dissent when people face large collective action problems and when the economy is less resilient to violence. Figure 1 helps visualizing the meaning of the proposition. On the x-axis we measure the economy's resilience to violence, while on the

y-axis we represent the collective action ability of the masses in case of a revolutionary attempt. The downward sloping curve $\bar{l}(\phi)$ divides the parameter space in two regions, with repression being the outcome below the curve, and revolution above. The rectangular hyperbola $l\phi = 1$ is another downward sloping curve shown in the figure, and we know that the *deterrence strategy* is always obtained below it while the *confrontation strategy may* occur above it. For low levels of resilience, deterring the masses from attempting a revolution is cheap since, irrespective of the revolution's outcome, much of the contested wealth will be destroyed. Moreover, destruction of wealth reduces the incentives for the autocrat to confront the dissenters, thus further inducing it to choose repression. Increasing the economy's resilience therefore has the double revolution-promoting effect of making the *deterrence strategy* strategy costlier, and increasing the payoff from revolution for both the ruler and the masses.

On the other hand, when the masses are ill-organized and face serious collective action problems, while repression is cheap, the odds of quelling the revolutionary attempt are high, therefore making both options attractive. When the collective action capacity is sufficiently low ($l \leq 1/\phi$), if a revolution is attempted the small security forces deployed by the autocrat under the *deterrence strategy* will be sufficient to prompt the dissenters to reduce their revolutionary effort to nothing. As a consequence, they are effectively deterred or suppressed as an opposition movement. For higher collective action abilities, the cost of deterrence becomes proportionally higher than the optimal expenditures required to face a revolutionary attempt. Hence, while the probability that the autocrat remains in control of political power gradually declines as l becomes higher, putting his political survival at risk is preferred to spending a significant part of the budget in order to deter revolutionaries. The following corollary summarizes the findings regarding the equilibrium survival probability of the regime.

Corollary 1. *For any $\tilde{\phi}$, there exists a unique $\tilde{l}$ such that for any $(\phi, l) < \left(\tilde{\phi}, \tilde{l}\right)$, $\pi = 1$, otherwise $\pi = (l\phi)^{-1/2}$.*

The proof of this Corollary follows directly from Proposition 1 which reveals the existence of threshold values of ϕ and l below which the *deterrence strategy* is the equlibrium strategy, that is, the regime is fully secure. More resilient

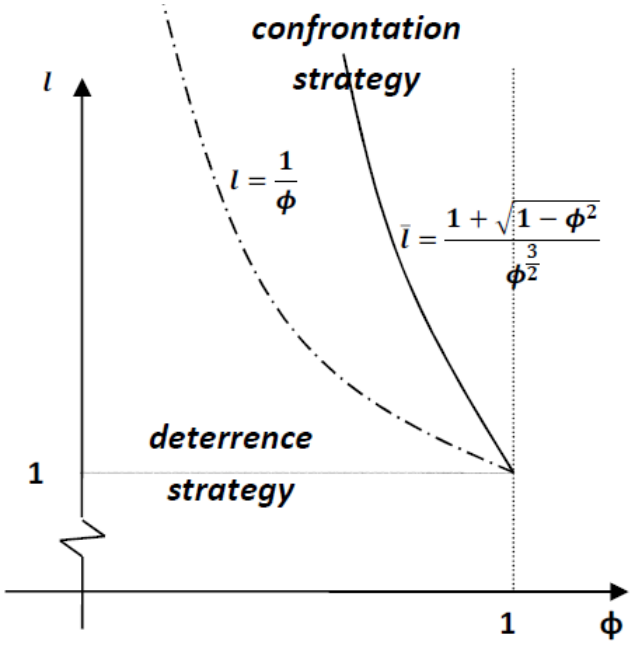

Figure 1: Equilibrium outcomes with exogenous l

economies (higher values of ϕ) and/or more efficient revolutionary movements (higher values of l) induce the autocrat to implement the *confrontation strategy*, in which case the survival probability of the regime monotonically decreases in both ϕ and l. The logic behind the effect of a change in l on π is immediate: more efficient revolutionary movements have better chances of ousting the ruler from power. As for the rationale underlying the effect of a change in ϕ, it is as follows. On the one hand, as damages inflicted on the economy are smaller in more resilient economies, revolutionaries are willing to invest more effort in their struggle against the regime. On the other hand, the optimal confrontation effort of the ruler is unaffected by ϕ because the economy's resilience affects both the marginal benefit and the marginal cost of confrontation in a proportional manner. We can then deduce that, in more resilient polities that are less vulnerable to revolutionary attempts, the probability of winning is unambiguously higher for the masses.

3.3 Endogenous collective capacity $l(1-p)$

We now allow that the people's collective action ability varies with the size of the elite group, $(1-p)$. Throughout we will use the short notation $l(p)$ to describe the collective action of the opposition.

Under the *confrontation strategy*, the optimal level of purges is denoted by P^*. This level of purges is obtained by optimizing the ruler's utility, given by (9), with respect to p, conditional on $l(P^*) > \bar{l}(\phi)$ (otherwise the outcome of the game is deterrence). The unconstrained optimization yields:

$$\frac{w\phi^{1/2}}{2l^{1/2}}\left(\frac{l'(p)(Y-(1-p)w)}{2l(p)}+1\right)=0 \tag{15}$$

In Appendix A.1, we verify that the problem is quasi-concave in p when Assumption 1 is satisfied. As a consequence, the optimal level of purges under the *confrontation strategy*, P^*, is such that:

$$P^*: -\frac{l'(P^*)(Y-(1-P^*)w)}{2l(P^*)}=1 \qquad \text{if} \qquad l(P^*)>\bar{l}(\phi) \tag{16}$$

$$P^*: l(P^*)=\bar{l}(\phi) \qquad \text{otherwise} \tag{17}$$

To distinguish between the optimal purges under the *confrontation strategy*, and the corner solution of the problem, we denote by $\hat{P}$ the level of purges satisfying (16) when disregarding the constraint. A useful lemma regarding this variable needs to be stated here:

Lemma 1. *$\hat{P}$ (and therefore $l(\hat{P})$) is independent of ϕ.*

This follows from the fact that under the *confrontation strategy*, r is independent of φ and l. This property ensures that when ϕ is higher the cost decreases for both the ruler and the revolutionaries. To be more specific, $V(r,x,p;\phi)$, as given by (3), can be expressed as $\pi(r,x,p;\phi)\phi(Y-(1-p)w-r)$. Using previously derived values, we have that $r+lx=\varphi^{1/2}\left[rl\left(Y-(1-p)w-r\right)\right]^{1/2}$, which means that the aggregate strength involved in rebellion is a multiplicative expression of ϕ. It follows that ϕ also enters in a multiplicative manner in $V(r,x,p;\phi)$, since $V=\left[\frac{r(Y-(1-p)w-r)}{l}\right]^{1/2}\varphi^{1/2}$. Using the short notation $\nu(r(x),p)$ to designate all the

elements that are independent from ϕ, we write $V(r(x), p; \phi) = \nu(r(x), p) \cdot \phi^{1/2}$, which implies that ϕ bears upon the utility level of the agents but not upon the optimal values of either r or p.

Under deterrence by the autocrat, differentiating U^* w.r.t. p yields the following expression:

$$\frac{w}{(1 + l(p)\phi)^2} \Big((Y - (1 - p)w) l'(p)\phi + 1 + l(p)\phi \Big) \tag{18}$$

This problem admits an interior optimum. In Appendix A.1, we show, indeed, that the function is quasi concave in p, so that when (18) is satisfied with equality, the second-order derivative is negative.

Because of the additional constraint that $l(p^*) \leq \bar{l}$, the optimal level of purges under the *deterrence strategy*, p^*, should satisfy:

$$p^* : -\frac{(Y - (1 - p^*)w) l'(p^*)\phi}{1 + l(p^*)\phi} = 1 \qquad \text{if} \qquad l(p^*) < \bar{l}(\phi) \tag{19}$$

$$p^* : l(p^*) = \bar{l}(\phi) \qquad \text{otherwise} \tag{20}$$

As above, we designate by $\hat{P}$ the unconstrained solution to (19).

To determine the equilibrium outcome of the game, in Appendix A.3, we consider two different scenarios according to the values which $l(\hat{P})$ may take: $l(\hat{P}) \leq 1$, or $l(\hat{P}) > 1$.

When the parameter configuration is such that $l(\hat{P}) \leq 1$, the unique equilibrium outcome for any parameter configuration compatible with this condition is repression. When the parameter configuration is such that $l(\hat{P}) > 1$, then for low levels of resilience, the outcome is deterrence, while for higher levels of resilience the outcome is confrontation. For some parameter configurations, there may exist an intermediate range of ϕ values such that the autocrat is indifferent between the two strategies.

We can therefore state the following proposition:

Proposition 2. *If an economy is not very resilient to violence (ϕ is low), revolutionary movements are always suppressed (deterrence strategy). In resilient economies (ϕ is high), the autocrat may choose to use the confrontation strategy.*

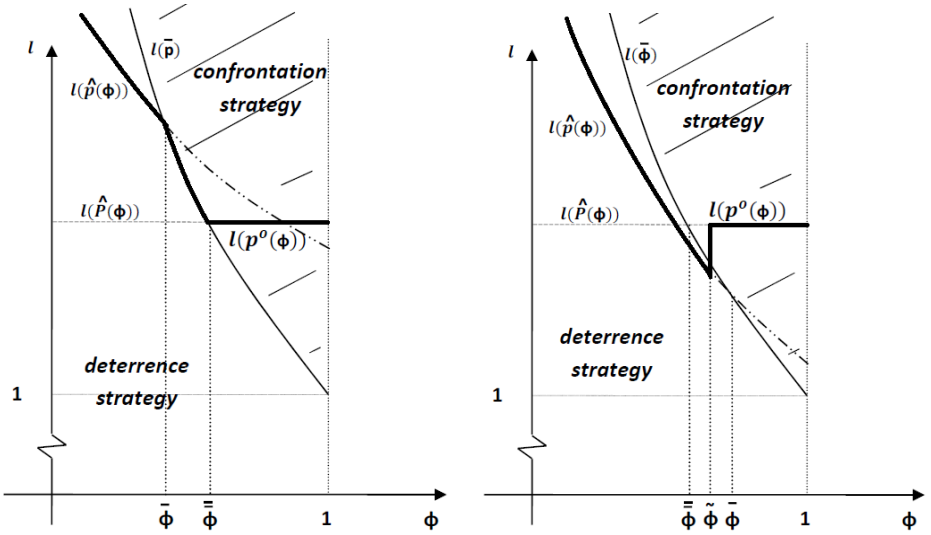

Figure 2: Equilibrium outcomes with endogenous l: $l(P^*) > 1$.

In Figures 2a and 2b, we revisit Figure 1 by allowing the level of purges to be endogenous, and by assuming that $l(P^*) > 1$. Three curves are represented: $l(\hat{p})$, $l(\hat{P})$, and $\bar{l}(\phi)$. Remember that the latter corresponds to the frontier between the domains of repression and revolution, whereas the former two curves describe how the masses' collective action capacity evolves when the optimal level of purges is chosen by the autocrat under the *deterrence strategy* and the *confrontation strategy*, respectively.

Following Lemma 1, $l(\hat{P})$ is a horizontal line. Two intersection points matter for the analysis: one corresponding to the crossing of $l(\hat{p})$ and $\bar{l}(\phi)$, and the other to the crossing of $l(\hat{P})$ and $\bar{l}(\phi)$. The former intersection defines a first threshold, $\bar{\phi}$, and the latter a second threshold, $\bar{\bar{\phi}}$. As explained below, these elements allow us to depict the equilibrium locus $l(p^o(\phi))$ which indicates how the masses' collective action capacity changes as we vary parameter ϕ, via the effect of the optimal level of purges p^o. This function is represented by the bold kinked curve.

In Figure 2a, we have $\bar{\phi} < \bar{\bar{\phi}}$, as a consequence of which the outcome is deterrence for low levels of resilience to violence, while the outcome is confrontation for very resilient economies (see Appendix A.3 for the proof). The intuition behind this result is rather straightforward: incentives to mount a revolution are

contained when the level of destruction is high, and this implies that the ruler can deter such movements at reduced cost. On the other hand, when revolutions do not affect the country's wealth much, the support of the elites becomes less essential, hence opening the way for more purges (i.e. $l(P(1)) \geq 1$). Lastly, there is an intermediate range of values of the parameter ϕ for which the optimal level of purges under the *confrontation strategy* would deter the revolution from occurring, while the level of purges under the *deterrence strategy* would be too low to yield such an effect. As a consequence, the level of purges of the elites is such that the autocrat is exactly indifferent between deterring a revolution and not deterring it.

In Figure 2b, we have the same pattern of deterrence for non resilient economies and non deterrence for resilient economies. Unlike in Figure 2a, however, we now have $\bar{\phi} > \bar{\bar{\phi}}$, which implies the disappearance of a ϕ-parameter region where both deterrence and confrontation are possible. The above strategy of choosing a level of purges that would leave the autocrat indifferent between the two outcomes of the game is therefore ruled out, and there will be a switching level of resilience $\tilde{\phi}$ below (above) which the outcome is deterrence (confrontation) for the same reasons as those previously described. As is evident from the two figures, the optimal degree of purges decreases (and, therefore, the masses' collective capacity also decreases) as the economy's resilience, ϕ, increases, up to a point above which the optimal degree of purges becomes constant (Fig. 2a), or experiences a downward jump and then remains constant (Fig. 2b).

A second corollary can now be stated concerning the equilibrium survival probability of the ruler in the full fleged model.

Corollary 2. *The equilibrium survival probability of the ruler is monotonically decreasing in the economy's resilience to violence.*

The proof of this Corollary follows directly from a combination of Proposition 2 and Equation (12). For the same reasons as for Corollary 1, more resilient economies tend to increase the revolutionaries' incentives to combat the central regime, eventually improving their odds of ousting the ruler. Alternatively, economies that heavily rely on activities easily and deeply disrupted by violent conflict will tend to create more stable authoritarian regimes.

4 Modifying the wealth of the economy

We now explore the effect of modifying the country's wealth on the game's equilibrium.

Changing the wealth level has no influence on the locus separating the opposition confrontation region from the opposition suppression region (bear in mind that $\bar{l}$ is independent of Y). Indeed, if the prize at stake, $Y - (1 - p)w$, experiences an exogenous change, the incentives to deter or to confront dissenters remain unchanged because in both cases the ruler's equilibrium utility is linear in the prize. On the other hand, the optimal degree of purges under both regimes is affected by a change in Y. Rearranging (16) and applying the implicit function theorem yields:

$$\frac{\partial \hat{P}}{\partial Y} = -\frac{l'}{l''(Y - (1 - p)w) + l'} > 0 \tag{21}$$

The sign follows from the denominator of the expression being positive, as proven in Appendix A.1.

Proceeding likewise with (19) gives:

$$\frac{\partial \hat{p}}{\partial Y} = -\frac{l'\phi}{l''(Y - (1 - \bar{P})w)\phi + l'\phi} > 0 \tag{22}$$

The sign follows from the denominator of the expression being positive, as proven in Appendix A.2.

We can therefore deduce that $\partial l(\hat{P})/\partial Y < 0$, and $\partial l(\hat{p})/\partial Y < 0$. These two results imply, respectively, that $\partial \bar{\bar{\phi}}/\partial Y > 0$ and $\partial \bar{\phi}/\partial Y > 0$. In Figure 2a, this means that an increase in Y is reflected in a downward shift of the curves $l(\hat{p}(\phi))$ and $l(\hat{P}(\phi))$. The locus of equilibria $l(p^o(\phi))$ is thus affected in such a way that the deterrence region is enlarged (see Appendix A.4 for a treatment of the case where $\bar{\phi} > \bar{\bar{\phi}}$). We can therefore write the following proposition:

Proposition 3. *In wealthier economies, the autocrat is more likely to opt for deterrence than for confrontation. If his power remains contested even though the economy has become wealthier, he is more likely to survive in power.*

The first part of Proposition 3 is proven in Appendix A.4. As for the second

part, it is directly inferred from combining (21) and (22) with the fact that $l_p < 0$, and $\pi_l < 0$ as deduced from (12).

The intuition behind this result is of particular interest since it sheds new light on an old debate about the wealth-conflict nexus. When the country's wealth, Y, is more important, in accordance to the *greed* theory (Collier and Hoeffler, 2004) the incentives of the dissenters to mount a revolution increase, implying a greater willingness to invest in revolutionary efforts. Under both deterrence and confrontation, the autocrat will respond to the emboldened rebels by increasing vertical coercion. Moreover, as the opposition has become emboldened, the marginal return to military investment has become lower than the marginal return to cutting back on the purges, hence incentivizing the ruler to be more lenient towards the elites whose support has now become more essential. The combination of these two reactions on behalf of the ruler eventually implies that under the confrontation strategy the survival probability of the regime is now higher. Nevertheless, the *deterrence strategy* becomes comparatively more attractive. When the value of the prize is larger, the additional forces deployed by the autocrat are increasingly smaller because of the increasing reliance on a larger body of elites (i.e. the level of purges diminishes) and because of the decreasing marginal returns of the rebels' efforts in terms of the probability to win the war. The same reasoning applies to the scenario where a revolutionary attempt is being faced. Yet, although the same mechanism applies under both scenarios, a crucial distinction is that while in the former scenario the ruler retains control over the whole prize increase, in the latter this is true only in a probabilistic sense. Therefore, even though the marginal cost of the two moves is identical, the marginal benefit of deterrence outmatches the marginal benefit of confrontation.

This is an important point because it invites us to revisit the resources-conflict nexus. The initial view that has been made popular through the empirical results of (Collier & Hoeffler, 2004) is that the presence of a larger booty induces more conflict, a finding in line with the theoretical findings that larger stakes incentivize players to fight more fiercely over the prize (see Garfinkel and Skaperdas' (2007) literature review). These empirical findings have been contested, however, since natural resources have been shown to have a pacifying effect through their positive effect on a country's state capacity (Fearon & Laitin, 2003; Besley

& Persson, 2011a). Using more contemporaneous econometric techniques, Tsui (2011) presents evidence that oil discoveries make countries more authoritarian, and Cotet & Tsui (2013) demonstrate that when country fixed effects are included in cross-country analyses, oil discoveries increase military spendings - hence possibly coercion - in non-democratic regimes, without however increasing the risk of civil war.

Our setup provides some theoretical foundations combining the above seemingly contradictory findings. Indeed, our analysis shows that whether a revolution is attempted or not may hinge on something else than a static conception of state capacity: the ruler may be able to quell rebellions yet be unwilling to do so. Wealthier autocrats, on the other hand, may not have incentives in letting the country plunge into civil war, especially in contexts of economies that are not very resilient to violent conflict. The latter point brings support to Cotet and Tsui's (2013) findings. We now turn to the empirical analysis to test our hypothesised relation between economic wealth and vertical and horizontal repression.

5 Data and Empirical Model

Dependent variables

To empirically test our predictions regarding vertical and horizontal repression, we first need to quantify two substantially different dependent variables. To measure vertical repression, one of our key dependent variables, we use the Political Terror Scale (PTS), the "most commonly used indicator of state violations of citizens' physical integrity rights" (Wood & Gibney, 2010, p.32). The PTS uses a five level coding scheme, assessed along three dimensions: scope i.e., the type of violence being carried out by the state such as imprisonment, torture, killing; intensity, i.e. the frequency with which the state employs a given type of abuse; and the range, i.e. the portion of the population targeted for abuse.

To capture horizontal repression, we use the number of purges taken from the Arthur Banks Cross-National Times Series (CNTS) Data Archive. The Banks CNTS dataset provides count data on purges and is based upon information from the New York Times. Purges are defined as "any systematic elimination by jailing or execution of political opposition within the ranks of the regime or the opposi-

tion" (Banks, 2008). True, this indicator also includes violence against opposition outside the incumbent coalition. Yet, as far as we are aware, Banks' data is the only available measure of repression against the members of the incumbent regime and it is therefore the best proxy at hand to capture rulers' coercion against the internal elite opposition. This measure has been extensively used in recent studies on conflict, democratization and development (e.g., Collier & Rohner, 2008; Besley & Persson, 2011b; Burke, 2012; Bank *et al.* , 2013).

Key explanatory variables

Our main regressor of interest is an indicator of the amount of resource wealth of the economy. As a baseline, following previous research on the same topic, we use per capita measures of oil exports from Feenstra *et al.* (2005), converted in constant 2005 US dollar;[4] and information on the value of per capita rent from oil and gas (oil production less country-specific extraction costs) from Ross (2011). Although models using flow variables, i.e., fuel exports or production as a percentage of GDP, have been so far wildly used in empirical studies of repression (see De Mesquita & Smith, 2009; Conrad & DeMeritt, 2013), they are likely to be contaminated by endogeneity (Bulte & Brunnschweiler, 2009): a correlation between repression and oil flows can arise, for instance, from the extraction of resources not being exogenous (Cotet & Tsui (2013)) or from causality running both ways when repression affects the productivity of the economy (De Luca et al. 2015). This makes the direction of causality between repression and resource revenues difficult to ascertain. To circumvent this issue, we use stock variables, in particular indicators for the known amount of oil reserves per capita (million barrels per 1000 persons) from Cotet & Tsui (2013). Oil reserves depend on geological features and previous exploration efforts. As such, they should not be affected by the level of political violence in a country, and hence less vulnerable to endogeneity concerns than flow variables.

More interestingly, however, we use a number of indicators of discovery of oil fields in a given country in a given year. The timing of oilfield discoveries is plausibly exogenous, at least in the short-medium run, as prospecting for oil is

[4]Similarly to Lei & Michaels (2014), this is constructed as the sum of exports in SITC Revision 2 categories 33 (Petroleum, petroleum products and related materials) and 34 (Gas, natural and manufactured).

highly uncertain; moreover countries have little or no control over the size of such discoveries. Therefore we use information on the amount and value of new discoveries per capita from the Association for the Study of Peak Oil and Gas (ASPO), assembled by Cotet & Tsui (2013). The latter value is obtained by multiplying the amount of oil by the yearly crude oil price. To cross-check our results on oil discoveries, we use an alternative dataset on the discovery of (at least one) giant oil field by country and by year. Data are from Horn (2004) and have been employed in a recent study on the effect of giant oilfield discoveries on civil wars by Lei & Michaels (2014). Accordingly, a giant oilfield must contain at least 500 million barrels of oil equivalent. This is possibly a more exogenous source of variation in oil rent as finding a giant oilfield is unpredictable (see Lei & Michaels, 2014). We look at whether the size of a giant oilfield discovery (i.e., the estimated ultimate recoverable reserves) in a given country/year belongs to the first or second half of the distribution.

Other explanatory variables

We expect repression to be a negative function of the GDP, as wealthier countries are less likely to experience state-sponsored violence. Moreover, there is robust evidence that population size increases repression (e.g., Poe & Tate, 1994). We therefore include the GDP per capita, the GDP growth rate and the population size using figures from Gleditsch (2002). As discussed above, political instability is an important factor affecting the level of repression, so that we need to control for the presence of civil and international conflicts, using information from the Correlates of War project; we also control for the level of popular dissent, which is obtained by summing up the annual number of riots, anti-government protests and strikes drawn from Banks (2008).[5] Moreover, since relatively more democratic institutions are less repressive, we include the Polity IV scale (Polity, 2012). Because we are interested in how resources affects repression in dictatorships, we restrict our sample to countries with a Polity score < 7, as traditional

[5]General strikes are defined as any strike of 1,000 or more industrial or service workers that involves more than one employer and that is aimed at national government policies or authority. Antigovernment demonstrations account for any peaceful public gathering of at least 100 people for the primary purpose of displaying or voicing their opposition to government policies or authority, excluding demonstrations of a distinctly anti-foreign nature. Riots refer to any violent demonstration or clash of more than 100 citizens involving the use of physical force.

studies code transitions from an autocracy to a new democracy when there is a movement from < 6 to ≥ 6 in the Polity score (e.g., Gleditsch & Ward, 2006). Finally, we include country-specific time trends to capture idiosyncratic variations over time, and, following similar studies by Davenport (2007) and Conrad & DeMeritt (2013), a lagged dependent variable to uncover inertia in a country's use of violence and address additional temporal dynamics. We control for group-wise heteroscedasticity and serial correlation by reporting robust standard errors clustered on countries. Our dataset includes a maximum of 119 dictatorships over the period 1981-2003, depending on the model, and therefore the availably of control variables. All positive and continuous explanatory variables are log-transformed to scale down the variance and reduce the effect of outliers. Table A.1 contains the summary statistics for our sample.

As the dependent variables are categorical, we use ordered probit models with random effects in addition to classical linear models. Note that the random effects model yields consistent and efficient estimates under the assumption of exogeneity of the covariates with respect to the country intercept. Yet, many covariates could be correlated with the country intercept. To relax this assumption, and allow for the endogeneity of the covariates with respect to the time-invariant country intercept, we also estimate random effect models which include the country (cluster) mean of the covariates *a la* Mundlak (1978).[6] This model has many desirable features, as it obtains consistent estimates that are not influenced by the specification of the country intercept, while allowing for endogeneity of the covariates with respect to the time-invariant component of the error; moreover, it controls for all unobservable differences between countries, thus dealing with all country-specific characteristics that may affect repression and oil wealth at the same time; yet, as opposed to fixed effect models, it does not require us to exclude as non-informative all countries where we do not observe variation in the dependent variable (see Caballero, 2014, for a recent application and full discussion).

[6]The correlation between the random intercept α_i and the observed characteristics x_{it} is allowed by assuming a relationship of the form $\alpha_i = \bar{x}_i\prime a + \epsilon_i$ with α_i independent of $\bar{x}_i\prime$. The unobserved heterogeneity is divided into within and between components, which weakens the assumption that random effects must be uncorrelated with the covariates.

6 Results

We show our results in Tables 2-5. In Tables 2 and 3 the dependent variable is vertical repression, i.e., political terror, while in Tables 4 and 5 we use horizontal repression, i.e., purges. Moreover, while Tables 2 and 4 include flow variables and oil reserves, models in Tables 3 and 5 only incorporate measures of oilfield discoveries. We use throughout the tables linear models (OLS), ordered probit with random effect (Oprobit) and ordered probit with random effect *a la* Mundlak's (1978). Starting with vertical repression (Tables 2 and 3), the results with respect to country-specific variables are largely consistent with expectations and previous studies on government repression. The level of economic development and the annual economic performance, measured by the GDP per capita and its growth rate respectively, are negative and significant. The size of the population is positive. Similarly, the presence of conflicts and the level of popular mobilization against autocrats (dissent) are shown to positively increase the level of coercion against the population. Finally, the relative level of democracy of each country, captured by the polity score, is negative and significant as one would expect.

As can be seen in Table 2, our analysis supports our theoretical argument that autocratic repression against the population increases with the amount of oil and gas rent and with the amount of oil reserves per capita, which is less likely to be contaminated by endogeneity. Oil export is not significant. This result holds across three different model specifications, i.e., linear models, ordered probit with random effects and ordered probit with country-means of the time-variant control variables. This last specification should further mitigate the issue of endogeneity stemming from the omission of important co-determinants of repression and oil wealth.

In Table 3 we move to even more exogenous measures of oil wealth, and use oil discoveries and its value. Oil prices exhibit a notable fluctuation over time, and the intuition behind our theoretical framework is that the incentives to repress are shaped by the value of a country's reserves rather than the quantity, which motivates the use of the value of oil as a further test of our hypothesis. Both the amount of oil discoveries and its value are positive and significant at conventional levels. We also include the presence of giant oilfield discoveries, and divide it into

two groups by the size of the estimated recoverable reserves (whether it belongs to the first or second half of the distribution). As we can see, while the occurrence of giant oil discoveries do not seem to matter in determining the intensity of government repression against its citizens, the coefficient estimates for the size of oil discoveries and it value are in the hypothesized direction and significantly different from 0, regardless of the empirical specification. The other contextual variables all continue to add significantly to the fit of the model in the same direction. Note that the OLS models allow for direct reading of the coefficients and that our continuous explanatory variables are log-transformed. Therefore a 50% increase in oil reserves will increase the level of vertical repression by approximately 0.35 points. The substantive impact is overall quite important, if we take into account that the mean level of political terror is 2.8. While we do not rely exclusively upon the direction and statistical significance of a parameter estimate, the extent of evidence for the substantive impact of oil on repression clearly depends on model specification and data considerations.

Moving from vertical to horizontal repression, in Tables 4 and 5 the signs of our control variables are also those expected. Our estimates are very conservative, and the combination of a lagged level of purges, random effects, clusters at country level and country-specific time trends make some of the control variables, in particular the presence of wars and the polity score, insignificant at conventional levels. Interestingly, in Table 3 only oil export is negative and significant, while the other oil variables fail to achieve statistical significance. Establishing a close relationship between repression and oil wealth leaves open the question of whether “oil causes repression" or vice versa. Therefore, as we argued above, we are much less confident about flow variables such as production and exports - given the likely presence of reverse causality - than more exogenous measures of resource booms, in particular oil discoveries. Therefore in Table 5 we drop standard oil production variables in favor of the amount of new oil discoveries and their value; they are both shown to significantly lower the intensity of horizontal repression in autocratic regimes, as predicted by our formal model. We then concentrate on giant oilfield discoveries, which are overall a rare event, and look at possible differential effects of discoveries according to their size (below or above the median). We find that the effects are concentrated in the second half of the

distribution. Otherwise stated, small giant discoveries might not have as strong an effect as the very largest giant oilfield discoveries. Finally note that while some control variables fail to achieve statistical significance when we move to more conservative model specifications, our results remain unaffected.

To sum up, our empirical analysis seems to point clearly and consistently towards the conclusion that wealth, in particular oil, does indeed affect the level of state sponsored repression. Yet the effect of natural resource booms on state repression varies according to the type of target: the use of horizontal violence against elite actors decreases with the amount of oil revenue, while vertical repression, against the population, increases with the level of wealth.

7 Conclusions

The use of repression is widespread among authoritarian rulers around the world, as testified by recent events in the middle East, in Sub-Saharan Africa, or even Russia and China. To confront dissent, regimes strengthen their security (and repressive) apparatuses, making use of imprisonment, restricting freedom of expression and civil liberties. We argue that depending on their natural wealth, authoritarian regimes differ in their respective use of vertical and horizontal coercion and terror to prevent popular uprisings. This is important since different combinations of vertical and horizontal repression have different consequences for the organization and stability of dictatorships.

We theorize that horizontal support from the elites improves the regime's coercive capacity on the population at large. Such support being costly, autocrats have incentives in purging the elites to reduce the size of the regime's inner circle. We demonstrate that wealthier regimes have incentives to deploy a stronger security apparatus to quell possible popular dissent. To improve such vertical coercive capacity, autocrats will accordingly restrain the level of purges against the elites so as to have a larger body of influential supporters. There is thus a double wealth effect: when they can rely on more substantial resources to sustain them, autocrats spend more on both direct repression of dissent and co-optation of elites. Consistent with the bulk of the literature, we establish that wealthier regimes are more stable and rely increasingly on elites to control the population.

Our empirical findings strongly support the theory. By making use a global dataset on natural resources, human rights violations and purges, we find that oil discoveries, and more generally authoritarian regimes that are more wealthy in terms of oil resources, tend to contain the level of horizontal repression, while they simultaneously resort to vertical repression to a larger extent.

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Table 1: Vertical Repression: Oil production and reserves

	OLS	OLS	OLS	Oprobit	Oprobit	Oprobit	Mundlak	Mundlak	Mundlak
main									
L.Political Terror	0.646***	0.646***	0.628***	1.104***	1.125***	1.067***	1.070***	1.098***	1.029***
	(0.030)	(0.024)	(0.028)	(0.086)	(0.068)	(0.081)	(0.084)	(0.067)	(0.079)
GDP per capita (log)	-0.058*	-0.100***	-0.115***	-0.150*	-0.249***	-0.305***	-0.520***	-0.572***	-0.612***
	(0.032)	(0.020)	(0.023)	(0.082)	(0.053)	(0.065)	(0.179)	(0.115)	(0.179)
GDP growth rate	-0.003	-0.003*	-0.004*	-0.006	-0.006*	-0.008*	-0.006	-0.004	-0.007
	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)
Population (log)	0.042***	0.044***	0.029**	0.112***	0.122***	0.090**	-0.406	-0.709***	-0.991***
	(0.013)	(0.011)	(0.014)	(0.034)	(0.029)	(0.039)	(0.479)	(0.231)	(0.328)
War	0.522***	0.444***	0.498***	1.019***	0.856***	0.929***	1.032***	0.858***	0.929***
	(0.062)	(0.051)	(0.064)	(0.121)	(0.105)	(0.135)	(0.127)	(0.108)	(0.141)
Dissent	0.049***	0.056***	0.061***	0.094***	0.106***	0.114***	0.096***	0.109***	0.117***
	(0.013)	(0.010)	(0.014)	(0.023)	(0.018)	(0.026)	(0.023)	(0.018)	(0.025)
Polity	-0.009	-0.006*	-0.004	-0.025*	-0.016*	-0.011	-0.031*	-0.023**	-0.017
	(0.006)	(0.004)	(0.004)	(0.013)	(0.009)	(0.010)	(0.017)	(0.011)	(0.011)
Trend	0.009***	0.009***	0.011***	0.023***	0.022***	0.027***	0.039***	0.045***	0.056***
	(0.003)	(0.003)	(0.003)	(0.007)	(0.006)	(0.008)	(0.012)	(0.008)	(0.012)
Oil export (log)	0.003			-0.002			-0.006		
	(0.007)			(0.017)			(0.018)		
Oil & Gas rent		0.016**			0.034**			0.029*	
		(0.007)			(0.016)			(0.017)	
Oil reserves (log)			0.694***			1.549**			1.221**
			(0.230)			(0.625)			(0.581)
Observations	1092	1786	1261	1092	1786	1261	1092	1786	1261

$*p < 0.10, **p < 0.05, ***p < 0.01$

Mundlak's model is an ordered probit with country means of all time-variant covariates (not shown).

Standard errors are given in parentheses clustered by country

Table 2: Vertical Repression: Oil discoveries

	OLS	OLS	OLS	Oprobit	Oprobit	Oprobit	Mundlak	Mundlak	Mundlak
main									
L.Political Terror	0.636***	0.636***	0.650***	1.079***	1.079***	1.127***	1.032***	1.032***	1.097***
	(0.028)	(0.028)	(0.024)	(0.082)	(0.081)	(0.068)	(0.079)	(0.079)	(0.067)
GDP per capita (log)	-0.091***	-0.091***	-0.073***	-0.252***	-0.251***	-0.192***	-0.649***	-0.648***	-0.577***
	(0.021)	(0.021)	(0.017)	(0.057)	(0.057)	(0.046)	(0.176)	(0.176)	(0.116)
GDP growth rate	-0.005**	-0.005**	-0.003*	-0.009*	-0.009*	-0.006*	-0.008	-0.008	-0.004
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)	(0.003)
Population (log)	0.032**	0.032**	0.048***	0.100**	0.101**	0.133***	-0.974***	-0.974***	-0.672***
	(0.014)	(0.014)	(0.011)	(0.039)	(0.039)	(0.030)	(0.325)	(0.325)	(0.228)
War	0.498***	0.498***	0.443***	0.927***	0.927***	0.854***	0.932***	0.932***	0.859***
	(0.063)	(0.063)	(0.051)	(0.131)	(0.131)	(0.104)	(0.140)	(0.140)	(0.108)
Dissent	0.060***	0.060***	0.054***	0.112***	0.112***	0.103***	0.116***	0.116***	0.106***
	(0.014)	(0.014)	(0.010)	(0.026)	(0.026)	(0.018)	(0.025)	(0.025)	(0.018)
Polity	-0.007	-0.007	-0.008**	-0.017*	-0.017*	-0.020**	-0.018*	-0.018*	-0.024**
	(0.005)	(0.005)	(0.004)	(0.010)	(0.010)	(0.009)	(0.011)	(0.011)	(0.010)
Trend	0.012***	0.012***	0.009***	0.028***	0.028***	0.023***	0.057***	0.057***	0.045***
	(0.003)	(0.003)	(0.003)	(0.008)	(0.008)	(0.006)	(0.012)	(0.012)	(0.008)
Oil discoveries (log)	0.515**			1.021**			0.870*		
	(0.243)			(0.516)			(0.513)		
Value Oil disc. (log)		0.492**			0.969*			0.816*	
		(0.234)			(0.496)			(0.496)	
Giant discoveries 1H			0.029			-0.014			-0.004
			(0.063)			(0.120)			(0.117)
Giant discoveries 2H			0.054			0.022			0.011
			(0.066)			(0.117)			(0.133)
Observations	1261	1261	1786	1261	1261	1786	1261	1261	1786

$*p < 0.10, **p < 0.05, ***p < 0.01$

Mundlak's model is an ordered probit with country means of all time-variant covariates (not shown).

Standard errors are given in parentheses clustered by country

Table 3: Horizontal Repression: Oil production and reserves

	OLS	OLS	OLS	Oprobit	Oprobit	Oprobit	Mundlak	Mundlak	Mundlak
main									
L.Purges	0.059	0.061*	0.102**	0.114	0.132	0.196**	0.100	0.128	0.189*
	(0.044)	(0.038)	(0.046)	(0.138)	(0.085)	(0.092)	(0.141)	(0.084)	(0.105)
GDP per capita (log)	0.012	-0.005	-0.005	0.074	-0.145*	-0.189*	0.194	-0.118	0.182
	(0.011)	(0.005)	(0.007)	(0.132)	(0.078)	(0.113)	(0.338)	(0.343)	(0.515)
GDP growth rate	0.002	0.001	0.002	0.011	0.001	0.009	0.012	0.002	0.008
	(0.002)	(0.001)	(0.002)	(0.014)	(0.010)	(0.010)	(0.013)	(0.010)	(0.011)
Population (log)	0.022*	0.015*	0.013	0.203**	0.162**	0.107	-1.302	-0.919	-0.489
	(0.013)	(0.009)	(0.014)	(0.093)	(0.072)	(0.119)	(1.028)	(0.678)	(1.112)
War	0.003	0.020	0.033	0.094	0.170	0.281	0.062	0.147	0.293
	(0.016)	(0.021)	(0.028)	(0.191)	(0.171)	(0.231)	(0.194)	(0.176)	(0.255)
Dissent	0.000	0.002	-0.000	0.039	0.042	0.024	0.053	0.048*	0.030
	(0.005)	(0.004)	(0.003)	(0.033)	(0.029)	(0.036)	(0.033)	(0.029)	(0.034)
Polity	-0.002	-0.001	-0.001	0.022	0.008	0.005	0.040	0.017	0.011
	(0.002)	(0.001)	(0.002)	(0.026)	(0.018)	(0.026)	(0.028)	(0.022)	(0.029)
Trend	-0.002*	-0.002***	-0.001	-0.045***	-0.039***	-0.041**	-0.022	-0.019	-0.031
	(0.001)	(0.001)	(0.001)	(0.015)	(0.011)	(0.021)	(0.020)	(0.016)	(0.028)
Oil export (log)	-0.007**			-0.083***			-0.085**		
	(0.003)			(0.031)			(0.034)		
Oil & Gas rent		-0.001			-0.039			-0.048	
		(0.002)			(0.039)			(0.038)	
Oil reserves (log)			-0.011			-0.218			0.580
			(0.104)			(1.763)			(1.587)
Observations	1101	2013	1315	1101	2013	1315	1101	2013	1315

$*p < 0.10, **p < 0.05, ***p < 0.01$

Mundlak's model is an ordered probit with country means of all time-variant covariates (not shown).

Standard errors are given in parentheses clustered by country

Table 4: Horizontal Repression: Oil discoveries

	OLS	OLS	OLS	Oprobit	Oprobit	Oprobit	Mundlak	Mundlak	Mundlak
main									
L.Purges	0.100**	0.100**	0.061*	0.193**	0.191**	0.134	0.180*	0.179*	0.132
	(0.045)	(0.045)	(0.038)	(0.089)	(0.089)	(0.086)	(0.105)	(0.105)	(0.088)
GDP per capita (log)	-0.002	-0.002	-0.007*	-0.133	-0.134	-0.187***	0.229	0.225	-0.080
	(0.006)	(0.006)	(0.004)	(0.089)	(0.089)	(0.066)	(0.477)	(0.476)	(0.355)
GDP growth rate	0.002	0.002	0.001	0.009	0.009	0.001	0.008	0.008	0.001
	(0.002)	(0.002)	(0.001)	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)	(0.010)
Population (log)	0.016	0.016	0.015*	0.160	0.161	0.151**	-0.540	-0.534	-0.976
	(0.013)	(0.013)	(0.009)	(0.105)	(0.106)	(0.070)	(1.120)	(1.119)	(0.670)
War	0.033	0.033	0.020	0.276	0.275	0.166	0.290	0.290	0.149
	(0.027)	(0.027)	(0.021)	(0.222)	(0.222)	(0.171)	(0.245)	(0.246)	(0.179)
Dissent	-0.000	-0.000	0.002	0.024	0.023	0.044	0.031	0.030	0.049*
	(0.003)	(0.003)	(0.003)	(0.035)	(0.035)	(0.028)	(0.033)	(0.033)	(0.029)
Polity	-0.002	-0.002	-0.001	0.002	0.002	0.012	0.007	0.007	0.019
	(0.002)	(0.002)	(0.001)	(0.026)	(0.026)	(0.018)	(0.029)	(0.029)	(0.021)
Trend	-0.001	-0.001	-0.002***	-0.042**	-0.043**	-0.038***	-0.029	-0.030	-0.017
	(0.001)	(0.001)	(0.001)	(0.020)	(0.020)	(0.012)	(0.028)	(0.028)	(0.016)
Oil discoveries (log)	-0.144*			-2.625*			-2.765*		
	(0.086)			(1.594)			(1.664)		
Value Oil disc. (log)		-0.139*			-2.537*			-2.647*	
		(0.084)			(1.545)			(1.623)	
Giant discoveries 1H			0.013			-0.027			-0.007
			(0.020)			(0.168)			(0.158)
Giant discoveries 2H			-0.051**			-4.566***			-4.595***
			(0.021)			(0.195)			(0.277)
Observations	1315	1315	2013	1315	1315	2013	1315	1315	2013

$*p < 0.10, **p < 0.05, ***p < 0.01$

Mundlak's model is an ordered probit with country means of all time-variant covariates (not shown).

Standard errors are given in parentheses clustered by country

A Appendix

A.1 Second order condition under revolution

Differentiating (15) w.r.t. p yields:

$$-\frac{w^2\phi^{1/2}}{4l^{3/2}}\left(\frac{l'(p)(Y-(1-p)w)}{2l(p)}+1\right)-\frac{w^2\phi^{1/2}}{2l^{1/2}}\frac{(l''(Y-(1-p)w)-l')l-l'l'(Y-(1-p)w)}{l^2}$$

The first term of this expression equals zero when the FOC is satisfied, thus implying that the objective function is quasi-concave in p if:

$$\frac{(l''(Y-(1-p)w)-l')l-l'l'(Y-(1-p)w)}{2l^2}>0 \tag{23}$$

Using the fact that the bracketed term in expression (15) is equal to zero, and substituting in (23) enables us to re-write the condition as:

$$l''(Y-(1-p)w)+l'>0$$

Yet, if the FOC is satisfied, the above condition becomes:

$$2l''l>l'l'$$

And this last condition is verified because of Assumption 1.

A.2 Second order condition under deterrence

Differentiating (18) w.r.t. p yields:

$$\begin{aligned}&-\frac{2w^2l'(p)\phi}{(1+l(p)\phi)^3}\left((Y-(1-p)w)l'(p)\phi+1+l(p)\phi\right)\\&-\frac{w^2}{(1+l(p)\phi)^2}\left(l'(p)\phi-l'(p)\phi+l''(p)\phi(Y-(1-p)w)\right)\end{aligned} \tag{24}$$

Whenever (18) equals zero, the first term of (24) equals zero as well, thus

implying that (24) is negative if the last expression between brackets is positive. This is necessarily true since by Assumption 1 we must have $l^{'}(p) > 0$.

A.3 Optimal degree of purges

Case 1**:** $l(\hat{P}) \leq 1$ **in** $\varphi = 1$

We proceed in three steps. We first show that, over the whole range of admissible ϕ values, the optimal level of purges under the *confrontation strategy* is such that $l(P^*) = \bar{l}(\phi)$. We next show that, in the same parameter space, the optimal level of purges under the *deterrence strategy* is strictly larger than P^*, and this allows us to conclude that given $p^* \geq P^*$, and since P^* is feasible under the *deterrence strategy*, it is necessarily the case that $U(p^*) > V(P^*)$.

For the first step, from (18) we know that the interior value $\hat{P}$ is independent of ϕ. Since $\bar{l}(\phi) \geq 1$, $\forall\phi \in [0, 1]$, with strict equality in $\phi = 1$, and since $l(\hat{P}) \leq 1$ by assumption, it follows that the condition in (16) is violated so that P^* is given by (17).

For the second step, we demonstrate using lemmatas 2 to 4 that (*i*) if $\phi = 1$, then $l(\hat{P}) \leq 1 \Rightarrow l(\hat{P}) \leq l(\hat{p}(1)) \leq 1$, (*ii*) if $\phi = 0$, $\bar{l}(0) > l(\hat{p}(0))$, and (*iii*) there exists a single crossing point between $l(\hat{p}(\phi))$ and $\bar{l}(\phi)$. Combining these elements enables us to conclude that for $\phi \in [0, 1]$, $l(\hat{p}(\phi)) \leq \bar{l}(\phi)$ with equality in $\phi = 1$ and $l(\hat{P}) = 1$.

Lemma 2. $l(\hat{P}(1)) \gtreqless 1 \Rightarrow l(\hat{P}(1)) \gtreqless l(\hat{p}(1)) \gtreqless 1 \Leftrightarrow \hat{p}(1) \gtreqless \hat{P}(1)$

Proof. If we set $\phi = 1$ in (19) and drop the ϕ arguments to save on notation, the expression becomes:

$$-l^{'}(\hat{p})(Y - (1 - \hat{p})w) = 1 + l(\hat{p}) \tag{25}$$

Re-arranging (16) we obtain:

$$-l^{'}(\hat{P})(Y - (1 - \hat{P})w) = 2l(\hat{P}) \tag{26}$$

As the shape of the expression (25) will be used in what follows, we rewrite the expression as $\Xi(\hat{p}) = -l^{'}(\hat{p})(Y - (1 - \hat{p})w) - (1 + l(\hat{p}))$, and making use of (18)

and the problem's concavity, we therefore know that $\Xi(\hat{p})_{\hat{p}\hat{p}} \leq 0$, with $\Xi(0)_{\hat{p}} > 0$ if an interior solution exists.

Take first the case where $l(\hat{P}) = 1$, so that the RHS of (26) is equal to 2. By comparing (25) and (26), it is immediate that if we substitute $\hat{p}$ by $\hat{P}$ in (25), (25) holds true. We therefore have that if $l(\hat{P}) = 1$, $\hat{p} = \hat{P}$ is the unique solution to the problem, since $\hat{p}$ is unique.

Consider next the purges $\hat{P}$ such that $l(\hat{P}) < 1$. Replacing $\hat{P}$ in (25), the RHS of (25) is necessarily larger than the RHS of (26), thus implying that $\Xi(\hat{P})_{\hat{p}} < 0$. Because of the problem's concavity, we deduce that $\hat{p} < \hat{P} \Rightarrow l(\hat{p}) > l(\hat{P})$. Lastly, to show that $1 > l(\hat{p}) > l(\hat{P})$, we proceed by contradiction. We know that $l(\hat{p}) \neq 1$, otherwise we would have $l(\hat{p}) = l(\hat{P}) = 1$. Assume that $l(\hat{p}) > 1 > l(\hat{P})$. Substituting the value of $\hat{p}$ into (26) would make the RHS of the expression larger than the LHS. Applying the same reasoning as above, this would eventually imply that $\hat{P} < \hat{p}$, hence $l(\hat{P}) > l(\hat{p})$, which constitutes a contradiction.

Proceeding likewise, we can show that $l(\hat{P}) > 1 \Rightarrow 1 < l(\hat{p}) < l(\hat{P}) \Leftrightarrow \hat{p} > \hat{P}$.

□

Lemma 3. $\bar{l}(0) > l(\hat{p}(0))$

Proof. This result follows directly from the assumption that $l(0)$ is finite, while $\lim_{\phi \to 0} \bar{l}(\phi) = \infty$. □

Lemma 4. *There exists at most one ϕ such that $l(\hat{p}(\phi)) = \bar{l}(\phi)$*

Proof. To establish Lemma (4), it is sufficient to show that, whenever $l(\hat{p}) = \bar{l}$, the slope of $\bar{l}$ is smaller (i.e. more negative) than the slope of $l(\hat{p})$. This implies that at the crossing point, the difference between the slope of $\bar{l}$ and the slope of $l(\hat{p})$ is negative. Since the functions are continuous on the interval $\phi \in [0, 1]$, this is a sufficient condition for proving that there can be at most one crossing between the two functions. Dropping the ϕ arguments to save on notation, we therefore begin by re-writing the difference between $\bar{l}$ and $l(p)$ at the crossing point as:

$$\frac{\overbrace{\left(1 + (1 - \phi)^{1/2}\right)}^{\bar{l}}}{\phi^{3/2}} - l(\hat{p}) = 0$$

$$\Leftrightarrow \left(1 + (1-\phi)^{1/2}\right) - l(\hat{p})\phi^{3/2} = 0$$

$$\Leftrightarrow (1-\phi) = \left[l(\hat{p})\phi^{3/2} - 1\right]^2 \tag{27}$$

$$\Leftrightarrow -\phi\left(1 + \phi^2 l(\hat{p})^2 - 2\phi^{1/2} l(\hat{p})\right) = 0 \tag{28}$$

Differentiating w.r.t. ϕ gives:

$$\frac{\partial\left[-\phi\left(1 + \phi^2 l(\hat{p})^2 - 2\phi^{1/2} l(\hat{p})\right)\right]}{\partial\phi}$$

$$= -\underbrace{\left(1 + \phi^2 l(\hat{p})^2 - 2\phi^{1/2} l(\hat{p})\right)}_{=0} - \phi\left(2\phi l(\hat{p})^2 + 2\phi^2 l(\hat{p}) l'(\hat{p})\hat{p}'(\phi) - l/\phi^{1/2} - 2\phi^{1/2} l' \hat{p}'(\phi)\right) < 0$$

The first term of the above expression is equal to zero because condition (28) must be satisfied when $\bar{l}$ and $l(\hat{p})$ cross. We therefore need to show that:

$$2\phi l(\hat{p})^2 + 2\phi^2 l(\hat{p}) l'(\hat{p})\hat{p}'(\phi) - l/\phi^{1/2} - 2\phi^{1/2} l' \hat{p}'(\phi) > 0$$

Factoring this expression out, we get:

$$2\phi^{1/2} l'(\hat{p})\hat{p}'(\phi)(\phi^{3/2} l(\hat{p}) - 1) + \frac{l(\hat{p})}{\phi^{1/2}}(2l(\hat{p})\phi^{3/2} - 1) > 0$$

By equation (27) we know that $l(\hat{p})\phi^{3/2} - 1 = (1-\phi)^{1/2} > 0$. As a consequence, the above inequality holds if the following inequality is satisfied:

$$\left(l(\hat{p})\phi^{1/2} - 1\right)\left(2l(\hat{p})/\phi^{1/2} + 2\phi^{1/2} l'(\hat{p})\hat{p}'(\phi)\right) + l/\phi^{1/2} > 0$$

Because of $\phi \in [0,1]$ it follows that $l(\hat{p})\phi^{1/2} > l(\hat{p})\phi > 1$, and the above condition will therefore necessarily hold if

$$2l(\hat{p})/\phi^{1/2} + 2\phi^{1/2} l'(\hat{p})\hat{p}'(\phi) > 0$$

$$\Leftrightarrow \frac{2}{\phi^{1/2}}\left(l(\hat{p}) + \phi l^{'}(\hat{p})\hat{p}^{'}(\phi)\right) > 0$$

It is therefore sufficient to have:

$$l(\hat{p}) > -\phi l^{'}(\hat{p})\hat{p}^{'}(\phi) \tag{29}$$

Computing $\hat{p}^{'}(\phi)$ by applying the IFT on (19) yields:

$$\frac{\partial p^*}{\partial \phi} = -\frac{(Y-(1-p^*)w)l^{'}(p^*) + l(p^*)}{(Y-(1-p^*)w)l^{''}(p^*)\phi} \tag{30}$$

Substituting in (29) gives us:

$$l(\hat{p}) > \frac{l^{'}(\hat{p})\phi\left(l^{'}(\hat{p})(Y-(1-\hat{p})w) + l(\hat{p})\right)}{(Y-(1-\hat{p})w)l^{''}(\hat{p})}$$

Using the implicit definition of $\hat{p}$ as given by (12) so that the term between brackets in the numerator of the RHS is equal to $-1/\phi$, the condition can be written thus:

$$l(\hat{p}) > -\frac{l^{'}(\hat{p})}{(Y-(1-\hat{p})w)l^{''}(\hat{p})}$$

Using the fact that $(Y-(1-\hat{p})w) = -\frac{(1+l(\hat{p})\phi)}{l^{'}(\hat{p})\phi}$, the above inequality is satisfied if:

$$l(\hat{p})^2\phi + l(\hat{p})l^{''}(\hat{p}) > (l^{'}(\hat{p}))^2\phi$$

Since, $l(\hat{p})^2\phi > 0$, and $\phi \leq 1$, this inequality is necessarily satisfied if:

$$l(\hat{p})l^{''}(\hat{p}) > (l^{'}(\hat{p}))^2$$

a condition which has been assumed in Assumption 1. □

Combining Lemmatas 2 to 4 implies that, for $\phi \in [0, 1[$, there can be no crossing between $\bar{l}(\phi)$ and $l(\hat{p}(\phi))$, while in $\phi = 1$, $\bar{l}(\phi) \geq l(\hat{p}(\phi))$ with strict equality for $l(\bar{p}) = 1$. We therefore have that $l(\hat{p}(\phi))$ lies beneath $\bar{l}(\phi)$ over the whole interval $\phi \in [0, 1]$. As a consequence, $p^o = \hat{p}$ and $l(\hat{p}) \leq l(P^*)$, hence $\hat{p} \geq P^*$. Since, how-

ever, P^* is feasible under the *deterrence strategy* (while $\hat{p}$ is not feasible under the *confrontation strategy*), it must be the case that $U(\hat{p}) > V(P^*)$, and that $p^o = p^*$. The *deterrence strategy* is thus always preferred when $l(\hat{p}) \leq 1$.

Case 2**:** $l(\hat{P}) > 1$ **in** $\phi = 1$

By Lemma 3, the fact that $l(\hat{P}) > 1 = \bar{l}(1)$, and $\partial\hat{P}(\phi)/\partial\phi = 0$, there exists a unique $\bar{\bar{\phi}}$ such that $l(P^*) = \bar{l}$ for $\phi \leq \bar{\bar{\phi}}$, and $l(P^*) = l(\hat{P})$ for $\phi > \bar{\bar{\phi}}$.

By Lemma 2, we know that $l(\hat{P}(1)) > l(\hat{p}(1)) > 1$. Combining this with Lemmatas 3 and 4 implies that there exists a unique $\bar{\phi}$ such that $p^* = \hat{p}$ for $\phi < \bar{\phi}$, and $p^* = \bar{l}(p(\phi))^{-1}$ for $\phi \geq \bar{\phi}$.

Combining these findings, we conclude that if $\bar{\phi} < \bar{\bar{\phi}}$, then for $\phi < \bar{\phi}$, $p^o = p^* = \hat{p}$, for $\phi \in [\bar{\phi}, \bar{\bar{\phi}}[$, $p^o = \bar{l}(p(\phi))^{-1}$, and if $\phi \in [\bar{\bar{\phi}}, 1]$, $p^o = P^* = \hat{P}$.

If, however, $\bar{\phi} > \bar{\bar{\phi}}$, then there exists a $\tilde{\phi} \in]\bar{\phi}, \bar{\bar{\phi}}[$ such that for $\phi < \tilde{\phi}$, $p^o = p^* = \hat{p}$, while for $\phi > \tilde{\phi}$, $p^o = P^* = \hat{P}$.

A.4 Proof of Proposition 3

Proof. The proof of Proposition 3 is decomposed in two parts.

a) If $\bar{\phi} < \bar{\bar{\phi}}$, from a simple look at Figure 2a it is evident that (*i*) the range of ϕ parameters for which OSS is used is enlarged when Y increases, and the curves $l(\hat{p})$ and $l(\hat{P})$ shift downwards as a consequence, and that (*ii*) the range of ϕ parameters for which a revolutionary attempt is not deterred is correspondingly narrowing.

b) If $\bar{\phi} > \bar{\bar{\phi}}$, we need to show that the threshold value $\tilde{\phi}$ is monotonically increasing in Y. To that end, it is sufficient to show that in $\phi = \tilde{\phi}$, $\partial\tilde{\phi}/\partial Y > 0$, which will necessarily be true if in that point $\partial(U(\hat{p}) - V(\hat{P}))/\partial Y > 0$. The difference in utilities in $\tilde{\phi}$ is, by definition, equal to zero and, therefore, is given by:

$$\frac{Y - (1 - \hat{p})w}{1 + l(\hat{p})\phi} - \frac{\phi^{1/2}(Y - (1 - \hat{P})w)}{2l(\hat{P})^{1/2}} = 0 \tag{31}$$

Rearranging, we get:

$$(Y - (1 - \hat{p})w)\, 2l(\hat{P})^{1/2} - \phi^{1/2}(Y - (1 - \hat{P})w)\,(1 + l(\hat{p})\phi) = 0 \tag{32}$$

Differentiating w.r.t. Y yields the required condition

$$2l(\hat{P}) - \partial\hat{p}/\partial Y\left[2l(\hat{p})^{1/2} + l'(\hat{p})\phi^{3/2}(Y-(1-\hat{P})w)\right] - \phi^{1/2}(1+l(\hat{p})\phi) \\ +\partial\hat{P}/\partial Y\left[\frac{l'\hat{P}}{l(\hat{p})^{1/2}}(Y-(1-\hat{p})w) + \phi^{1/2}\,(1+l(\hat{p})\phi)\right]$$

Replacing (32) in the two squared-bracketed terms allows us to re-write the above condition as:

$$2l(\hat{P}) - \partial\hat{p}/\partial Y\frac{(Y-(1-\hat{P})w))\phi^{1/2}}{Y-(1-\hat{p})w}\underbrace{\left[1+l(\hat{p})\phi + l'(\hat{p})\phi(Y-(1-p)w)\right]}_{=0} - \phi^{1/2}(1+l(\hat{p})\phi)$$

$$+\partial\hat{P}/\partial Y\frac{(Y-(1-\hat{p})w)}{l(\hat{P})^{1/2}(Y-(1-\hat{P})w)}\underbrace{\left[l'\hat{P}(Y-(1-\bar{P})w) + 2l(\hat{P})\right]}_{=0}$$

in which the two terms set equal to zero are, respectively, (19) and (16).

What remains to be shown therefore:

$$2l(\hat{P}) - \phi^{1/2}(1+l(\hat{p})\phi) > 0 \tag{33}$$

Since $\bar{\phi} > \bar{\bar{\phi}}$, it is necessary that in $\phi = \tilde{\phi}$, $\hat{p} < \hat{P}$, which implies that $Y-(1-\hat{p})w < Y-(1-\hat{P})w$. Combining this last inequality with (32) enables us to infer that (33) is satisfied. □

Table A.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Political Terror	2.8	1.1	1	5	2346
Purges	0.2	0.9	0	34	4636
Oil export (log)	2.2	3.9	-8.8	10.9	2441
Oil and Gas rent	2	2.8	0	11.3	4270
Oil reserves (log)	-0.1	0.1	-0.2	0.1	3319
Oil discoveries (log)	-0.2	0.1	-0.2	0.1	3319
Value Oil disc. (log)	-0.1	0.1	-0.2	0.1	3319
Giant discoveries 1H	0	0.2	0	1	5487
Giant discoveries 2H	0	0.1	0	1	5487
GDP per capita (log)	8	1	5	11.5	4335
GDP growth rate	2	8.9	-65	131.2	4254
Population (log)	8.9	1.5	4.8	14.1	4768
War	0.1	0.4	0	1	2492
Dissent	0.9	2.3	0	41	4636
Polity	-4.3	4.9	-10	6	5487
Trend	34.4	17.1	1	64	5487