How Budgets Shape Autocrats' Survival Strategies[*]

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Abstract

How do budgets affect autocrats' incentives to share or consolidate power? We estimate a dynamic model of autocrats who include or purge rivals from their coalitions to maintain power and maximize rents amid fluctuating budgets. Even for unconstrained autocrats, we find that purging is costly as it reduces their office benefits and, when budgets are tight, their survival prospects. Despite these upfront costs, purging has overwhelming dynamic benefits during periods of austerity: by removing rivals, autocrats reduce fiscally unsustainable patronage obligations, increasing their future survival chances and share of spoils. While austerity encourages purging, budget upswings have lasting positive effects on power sharing. Our counterfactuals indicate that budget shocks comparable to those generated by recent commodity booms increase the probability of inclusive coalitions by 10 percentage points over 20 years. Case studies of Sudan and Liberia indicate that our results describe the tradeoffs and survival strategies facing recent autocrats.

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1. Introduction

Survival is expensive for autocrats. Patronage and repression, common methods of commanding loyalty, demand resources. Social scientists have thus focused their attention on the budgets that autocrats disburse to hold their grip on power. de Waal (2015, 25), for example, writes, "the health of the political budget is the indicator of whether a political entrepreneur will thrive or fail, whether a political CEO will sustain his empire, or be plunged into crisis." Past research describes how large flows of unearned income from natural resources or foreign aid provide ample political budgets, allowing autocrats to survive longer in office (e.g., Smith 2004; Morrison 2009; Andersen and Ross 2013; Wright, Frantz and Geddes 2013).

The relationship between budgets and autocrats' incentives to use different survival strategies is not always clear, however. Ambiguities arise because survival strategies not only affect autocrats' rents from office today, but also their likelihood of survival and thus their ability to consume rents tomorrow. For example, suppose we observe autocrats purging rivals from their coalitions following budget downturns. Is this because purging strengthens autocrats' grip on power amid austerity, or because autocrats can, after removing their rivals, consume a larger portion of the smaller pie? Or some combination of the two incentives? Suppose instead that autocrats incorporate rivals in their coalitions when budgets increase and financial constraints loosen. Is this because power sharing promotes autocrats' survival, or because it becomes less imperative to monopolize consumption with added revenue. Without additional theory, we cannot infer autocrats' incentives in either instance.

These ambiguities compound when autocrats are far-sighted and consider how today's decisions can constrain their future choices. In that case, the survival strategies that autocrats adopt will not only reflect today's budget, but also their expectations about future budgets. Picking up on the second example, suppose the budget increases. If autocrats expect this upswing to endure, then expanding their coteries of ministers is fiscally sustainable. Yet, if they anticipate short-lived budget increases, autocrats may want to avoid cutting in coalition members that they will struggle to later pay off when the budget reverts. Instead they may pocket the rents and maximize their current consumption. Different expectations about budget trajectories could lead to divergent survival strategies even with similar budgets.

To elucidate autocrats' incentives, we adopt the structural approach. We write down and estimate a model of autocratic survival in which an autocrat repeatedly decides whether or not to share power with an opposition. The model incorporates three essentials features of autocratic decision making. First, including rivals or purging them from government not only affects the autocrat's office benefits today but also his likelihood of survival and the evolution of tomorrow's budget. Second, the autocrat makes these decisions to maximize long-term expected utility, endeavoring to retain power and maximize rents in the long run. Third, decisions to include the opposition are persistent: an inclusive government remains the status quo until the autocrat purges, a potentially costly action. These components generate a dynamic tension where the autocrat may want to adopt specific power-sharing arrangements today given the current budget but worries that fiscal resources may change tomorrow, making the arrangements untenable.

We fit the model to data that describes the tenures, budgetary resources, and power-sharing decisions of autocrats in the post-WWII era. Following Rust (1994), we proceed in two steps. First, we estimate the effects of budget levels and power-sharing arrangements on the likelihood of autocratic survival and budget fluctuations. Second, given the effects isolated in step one, we estimate autocrats' office benefits and their costs associated with sharing power and purging rivals. Thus, our structural approach allows us to identify how autocrats balance the effects of power-sharing arrangements on their political survival and office benefits. In doing so, we make three primary contributions.

First, although purging allows autocrats to consume more office rents in the future, it entails substantial upfront expense. We estimate that the cost of purging is an order of magnitude larger than the cost of power sharing. This implies that power sharing cannot be cheaply undone and thus constitutes a meaningful commitment even in contexts where autocrats exercise unconstrained authority. This result confirms a common but untested assertion that cabinet posts represent "credible" promises of future patronage (e.g., Arriola 2009; Paine 2018*b*; Roessler 2016). Furthermore, the cost of purging varies in expected ways. Institutionally unconstrained autocrats, those with a military pedigree, and those in oil exporting countries pay a smaller, albeit still substantial, price for purging.

Second, we find that large budgets are necessary for autocrats to share power and maintain inclusive political institutions. By contrast, when fiscal resources are tight, autocrats purge with substantial probability and then maintain exclusive governments. Our analysis uncovers leaders' dynamic incentives to purge with more meager budgets. Autocrats with low budget levels and inclusive coalitions face a dilemma: purging members of the opposition from a weak financial position increases leaders' chances of being immediately ousted by around 30 percentage points. Yet, maintaining their inclusive cabinets amid austerity also leaves them vulnerable; leaders with tight budgets have larger probabilities of removal with inclusive cabinets than with exclusive cabinets, a difference of roughly 5 percentage points. When autocrats expect lean times to persist, they risk purging and paying the upfront costs.

Should they survive the tumult that follows, they will have reduced their patronage obligations, increasing their share of the office spoils and likelihood of weathering subsequent low-budget periods. These predictions do not describe some unrecognizable sovereign; our in-sample predictions match de Waal's (2015) case study of Sudanese politics and help to explain the downfall of Samuel Doe in Liberia.

Third, we analyze the evolution of power-sharing institutions in response to budget shocks and find that budgetary expansions on the scale of recent commodity booms in Africa generate lasting changes in the likelihood that rulers include opposition groups in their ruling coalitions. After twenty years (and despite intervening budget volatility), the autocrat that starts from the more auspicious fiscal position is ten percentage points more likely to include other groups in their cabinet. This difference shrinks with time but remains of similar magnitudes even after fifty years.[1] These findings have implications for how we expect autocrats to respond to sanctions or aid conditionality — the economic sticks and carrots of foreign policy. Denying autocrats aid until they liberalize could be counter-productive, because leaders have little incentive to incorporate rivals without first having a flow of funds to buy their loyalty.

Our theoretical framework is essential for these conclusions. With a one-shot interaction, there would be few incentives for autocrats with tight fiscal constraints to purge, as purging under these conditions merely increases the autocrats per-period chances of removal and carries substantial cost. Thus, a dynamic model is necessary to explain the incidence of purging with smaller budgets given the upfront cost. In addition, our counterfactuals contrast with more recent work which, in pursuit of credible causal identification, focuses on short-term responses to as-if random budget fluctuations (e.g., Bazzi and Blattman 2014; Caselli and Tesei 2016). Our analysis, in fact, suggests that random and fleeting blips in the budget may not have a large impact on power sharing if autocrats do not expect these shocks to generate a persistent change in their fiscal resources (see Ross 2015, for a related discussion).

Our unified theoretical and empirical model distinguishes this paper from other political economy research analyzing the effects of budgets on leaders' decision-making (Robinson, Torvik and Verdier 2014; Paine 2018*a*; Dunning 2005; Bueno de Mesquita and Smith 2017). Our model is most similar to Caselli and Tesei (2016), and besides the structural approach, we build upon their work in two directions. Theoretically, we incorporate a novel

[1] While a recent literature in political economy documents the long-run effects of endowments or institutions (see Nunn 2009, for a review), these papers sometimes struggle to explain why differences persist or whether we should expect the initial variation to be amplified or erode in the intervening centuries or decades.

dynamic tension where power-sharing is persistent unless the autocrat purges, a potentially costly action. Empirically, we more directly measure leaders' survival tactics using the inclusion of rival groups rather than relying on Polity scores that aggregate decisions and institutions outside of leaders' purview. Using this more direct measure, we find that leaders undertake costly actions to purge expansive coalitions in response to budget shortfalls.

We also contribute to a literature that describes how leaders dole out patronage and cabinet positions to their ethnic kin and elites from other groups to maintain power (Bratton and van de Walle 1994; Fearon, Kasara and Laitin 2007; Arriola 2009; Roessler 2011).[2] Most notably, Francois, Rainer and Trebbi (2015) also undertake a structural exercise to explain cabinets' ethnic composition in African countries. Like these papers, we study whether or not a leader accommodates or excludes potential rivals when constituting a ruling coalition. Unlike past work, we illustrate how budget projections shape those decisions. Specifically, we conceive of budget levels as a state variable in a dynamic model that determines the effectiveness of different tactics on the leader's survival. As such, our contribution is to study leaders' forward-looking survival strategies — how decisions to payoff or purge elites today reflects the leader's expectations and uncertainty about their future survival and budget.

2. Model Rationale

2.1 Goals

"Survival is the primary objective of political leaders" (Bueno de Mesquita and Smith 2010, 936). "Leaders," according to De Mesquita and Smith (2015, 708), "overwhelmingly act as if they want to hold on to power as long as they possibly can."[3] This is true of both democrats and autocrats; yet, the latter face fewer constrains in how they dole out punishment and patronage to maintain their grip on power (Gehlbach, Sonin and Svolik 2015).

Autocrats also share an interest in maximizing rents — the economic perks from holding office. This is commonly assumed in models of authoritarian decision-making, even those which acknowledge that autocrats may also have policy preferences (e.g., Gandhi and Przeworski 2006; Bueno de Mesquita et al. 2005). In a succinct but exemplary statement, Magaloni (2008, 717) writes "In my account, all dictators are presumed to be motivated by the same goal — survive in office while maximizing rents."

[2] Relatedly, other scholars study how legislatures in autocracies help leaders maintain power by overcoming informational problems and incredible commitments (Gandhi and Przeworski 2007; Wright 2008; Boix and Svolik 2013; Blaydes 2010).

[3] Geddes (2003, 49) argues that military officers may sometimes "return voluntarily to the barracks" to maintain the cohesiveness of the armed forces.

An autocrat's survival and access to these rents are most immediately challenged by rival elites that also aspire to lead. Svolik (2009) shows that among 303 dictators from 1945 to 2002, over two thirds (205) were removed by government insiders. Although autocrats are also threatened by agitation by the masses (as in Acemoglu and Robinson 2006), only 10 percent lost power in a popular uprising during the post-WWII era. The most immediate challenge facing far-sighted autocrats is how to manage elite rivals. Roessler (2011, 308) writes, "the imminence, proximity, and the secrecy of the threat, coupled with its incredibly high costs, have forced rulers to be on the defensive at all times and adopt a set of 'coup proofing' techniques."

2.2 Survival Strategies

Past work focuses on one of two strategies autocrats employ: repression or patronage (Wintrobe 1990, 854). Both strategies affect the leader's office benefits and survival prospects. First, leaders can use coercion to reduce the opposition's capacity or to extract a larger share of government revenue. Repression of elities usually takes the form of purging potential rivals from government, e.g., Stalin's gutting of the Communist Party.[4] Although purges allow the leader to extract larger rents, they can have positive and negative consequences for survival. In seminal work, Skocpol (1979) argues that governments with effective security forces can fend off challenges. Examining the Middle East and North Africa, Bellin (2004, 143) observes "Democratic transitions can be carried out successfully only when the state's coercive apparatus lacks the will or capacity to crush it." However, purging is not without costs or risks. Maintaining a cohesive security apparatus is costly (Wright, Frantz and Geddes 2013). Moreover, obvious attempts to exclude rivals could invite countercoups (Sudduth 2017).

Second, leaders can also buy off potential challengers with concessions. Gandhi and Przeworski (2007, 1281-2) note that "the use of force is costly and may not always be effective ... The instruments by which nondemocratic rulers solicit cooperation and thwart rebellion include policy concessions and distribution of spoils." Inclusion in the ruling coalition represents an important type of patronage. Arriola (2009, 1340-1) argues that "leaders use high-level government appointments to make credible their promises to distribute patronage among political elites and the constituencies whom they represent." Likewise, Kramon

[4] We focus on elite interactions. Others illustrate the tactics leaders use to diffuse revolutionary threats (see Gehlbach, Sonin and Svolik 2015, for a review). Selectorate theory, for example, considers how leaders allocate public goods to appease the masses (De Mesquita and Smith 2010). Egorov, Guriev and Sonin (2009) argue that dictators deploy censorship to avoid mass mobilization, and Blaydes (2010) suggests that autocrats encourage vote buying in legislative elections to purchase public support.

and Posner (2016, 27) contend that "the implicit understanding is that holders of these cabinet seats will enrich themselves, distribute resources to their clients, and support the incumbent from whom their benefits flow. The common use of elite inclusion indicates its perceived efficacy. More systematically, Arriola (2009, 1355) estimates that "each additional cabinet minister lowers the coup hazard by 23 to 25 percent."[5] The costs associated with this approach are obvious: resources expended on patronage cannot be consumed by the leader. In addition, larger ruling coalitions increase the number of insiders that might mount a coup (Roessler 2011), and they make it more difficult for leaders to use particularistic transfers to secure power (Bueno de Mesquita and Smith 2010).

2.3 Budget constraints

A number of studies in political science find that leaders more often succeed in retaining power when they control large flows of unearned income, such as royalties from natural resources or foreign aid (Smith 2004; Morrison 2009; Bueno de Mesquita and Smith 2010). Even studies focused on regime type (rather than survival) often argue that states with abundant natural resources (particularly oil) tend to be less democratic, because resource-rich autocrats endure while resource-poor leaders give way to democratic pressures (see Ahmadov (2014) for a meta-analysis; Ross (2015), for a broader review).[6]

Leaders flush with resource revenues survive longer because they can afford to deploy repression and dole out patronage.[7] For purging, coercive capacity is essential, and Cotet and Tsui (2013) and Wright, Frantz and Geddes (2013) find that oil discoveries and wealth, respectively, increase military expenditure in autocracies. Reno (1999) traces the downfall of Liberia's Samuel Doe back to his attempts to consolidate power and sideline Americo-Liberian elites during a period of depressed government revenue. In terms of patronage, Jensen and Wantchekon (2004, 820) relay stories about bloated roles of public employees in mineral-rich Botswana and Guinea; Clark (2002) estimates that oil-rich Congo-Brazzaville had the most civil servants per capita in Africa in the early 1990s. On the flip side, resource-starved leaders lack the funds required to buy elites' continued loyalty. "Reform and economic austerity can be imposed on the general population," observes van de Walle (1993,

[5] Although their focus is on institutional concessions, Gandhi and Przeworski (2007, 16) find that the average tenure of autocrats is three years longer when one or more parties are allowed to influence policy.

[6] Caselli and Tesei (2016) find that the survival strategies of autocratic rulers are particularly sensitive to budget shocks relative to their democratic counterparts.

[7] Some authors (e.g., Gandhi and Przeworski 2007; Bueno de Mesquita and Smith 2010; Besley and Persson 2011) have argued that resource-rich leaders not only have more income at their disposal, but also that this income does not depend on encouraging private investment through investments in public goods.

398) in his study of Cameroon. "It is the state elite that will not tolerate the end of a system of prerogatives and privilege that is the glue that keeps the system together."[8]

3. Model

We model autocratic survival as a Markov decision process that builds off features emphasized by prior research. A farsighted and potentially long-lived autocrat repeatedly decides whether or not to share power by including the opposition in government. These decisions (potentially) affect the consumption, survival prospects, and future budget levels of the autocrat. Autocrats make decisions optimally to maximize their discounted expected utility. Finally, estimation of the model is our end goal, so we include unobserved action-specific shocks and allow the leader's payoffs and survival chances to also depend on observed covariates that can vary across leaders.

3.1 Primitives

We consider autocrats $\{1, \ldots, L\}$, where l denotes the model parameterized for a specific leader. Autocrat l struggles to maintain power in each of a countably infinite number of periods $t \in \{1, 2, \ldots\}$. If l is in power in period t, then he first observes two state variables s_l^t and ε_l^t. The variable $s_l^t = (B_l^t, C_l^t) \in \mathcal{S}$ is two dimensional and is observed by the analyst. The first dimension, $B_l^t \in \mathcal{B}$, denotes the leader's budget in period t, where $\mathcal{B} = \{b_1, \ldots, b_J\}$ is the set of budget levels. The second variable, $C_l^t \in \{0, 1\}$, indicates whether the opposition is included in the government ($C_l^t = 1$) or not ($C_l^t = 0$) at the beginning of the period. The remaining state variable, $\varepsilon_l^t \in \mathbb{R}^2$, represents action-specific payoff shocks and is unobserved by the analyst.

After observing s_l^t and ε_l^t, the leader then chooses whether or not to exclude the opposition from the government. If $C_l^t = 0$, then period begins with an excluded opposition, and the leader decides whether or not to include them. If $C_l^t = 1$, then the period begins with an inclusive government, and the leader decides whether or not to purge the opposition. Formally, l chooses an action $a_l^t \in A(C_l^t)$, where

$$A(C_l^t) = \begin{cases} \{\varnothing, i\} & \text{if } C_l^t = 0 \\ \{\varnothing, p\} & \text{if } C_l^t = 1, \end{cases} \tag{1}$$

[8] While we focus here on how leaders manage coerce or co-opt other elites, a large strand of this literature argues that leaders also use resource revenues to assuage the masses by providing social services without demanding tax payments in return (Mahdavy 1970; Shambayati 1994; Anderson 1995; Ross 2001; McGuirk 2011; Paler 2013).

$a_l^t = i$ denotes including the opposition, $a_l^t = p$ purging, and $a_l^t = \varnothing$ maintaining the status quo.

After the leader chooses action a_l^t in states s_l^t and ε_l^t, he accrues payoffs, which take the form

$$u_l(a_l^t, s_l^t; \theta) + \varepsilon_l^t(a_l^t). \tag{2}$$

The function $u_l(a^t, s^t; \theta)$ captures the deterministic component of the leader's utility and is parameterized by the to-be-estimated vector θ. The value $\varepsilon^t(a^t)$ captures the unobservable, stochastic component.

We endow u_l with the following form:

$$u_l(a_l^t, s_l^t; \theta) = \underbrace{B_l^t}_{\text{Budget benefits}} + \overbrace{x_l \cdot \beta}^{\text{Office benefits/costs}} + \underbrace{\rho \cdot \mathbf{I}(a_l^t, C_l^t)}_{\text{Costs of inclusion}} + \underbrace{\mathbf{P}(a_l^t) x_l \cdot \kappa}_{\text{Cost of purging}} \tag{3}$$

where $\theta = (\beta, \kappa, \rho)$, $\mathbf{P}(a_l^t)$ is an indicator function denoting whether or not the leader purged, and $\mathbf{I}(a_l^t, C_l^t)$ is an indicator function denoting whether or not the opposition is included in the government given (a_l^t, s_l^t).[9] The payoffs in Equation 3 have an intuitive interpretation. First, the leader receives the government revenue B_l^t, and this revenue is offset by an additional cost or benefit $x_l \cdot \beta$. The adjustment $x_l \cdot \beta$ could be positive if governing entails additional benefits beyond observed revenue, and it could be negative if the leader cannot consume the entire government budget. These additional office benefits or costs could vary with observables.[10] Second, the coefficient ρ captures the degree to which including the opposition diminishes or increases the autocrat's office benefit. Thus, ρ includes both the monetary resources extracted by the opposition *and* any ideological or policy payoffs that autocrat may receive by including the opposition. Finally, the value $x_l \cdot \kappa$ represents the cost of purging the opposition from government. These payoffs from of inclusion or purging are separate from the effects that these actions have on the leader's survival probability, which we explicitly model below. If the autocrat can easily eliminate an opposition, then $\kappa \approx 0$, a case which is subsumed by the model.

[9] Specifically, $\mathbf{I}(a_l^t, C_l^t) = 1$ if and only if $(a_l^t, C_l^t) \in \{(i, 0), (\varnothing, 1)\}$.

[10] The covariates x_l are not indexed by t, i.e., they do not vary over time. If they did, then they would need to be incorporated into additional dimensions of the state space, $\mathcal{S}$, and doing so would introduce two complexities: (a) exponentially increasing the size of the state space and the resources needed to solve the autocrat's optimal decision and (b) introducing uncertainty as their law of motion would be need be estimated. Because budget levels and power-sharing rules are our main variables of interest, we adopt the more parsimonious specification and discuss robustness checks below.

After the leader accrues payoffs, he may lose power either due to death or forcible removal. This occurs with probability $1 - g_l(a_l^t, s_l^t, \gamma)$, where g_l is a function parameterized by γ that explicitly depends on the current state and endogenous actions chosen by the leader. This framework allows the leader's actions to affect his probability of being overthrown and the future budget level: power sharing affects not only l's payoffs from holding office but also l's likelihood of maintaining a grip on power.[11] For example leaders who purge may face a relatively larger probability of removal than those that maintain power-sharing arrangements.

If the leader exits office, then his decision process ends, and his payoff in all future periods is 0.[12] If the leader remains in office, then he enters period $t+1$, in which case, the state variables s_l^t and ε_l^t evolve as follows. First, ε_l^{t+1} is drawn from a type one extreme value distribution and is independent across states, actions, and time periods, a standard assumption in these types of models. Second, the power-sharing variable is fully endogenous. If the opposition is included in the government at the end of period t, then the next period begins with inclusion, i.e., $C_l^{t+1} = \mathbf{I}(a_l^t, C_l^t)$. Third, the budget evolves according to a Markov process conditional on observed actions and states. That is, $f_l(B_l^{t+1}; a_l^t, s_l^t, \phi)$ is a probability function, parameterized by ϕ, denoting the probability that B_l^{t+1} is next period's budget given actions a_l^t and the current state $s_l^t = (B_l^t, C_l^t)$. We calibrate g_l and f_l to match the empirical analyses common in the autocratic survival literature, an exercise described in greater detail below.

The leader chooses optimally to maximize the expected sum of his discounted utility. Given a sequence of actions, states, and shocks, $\{(a^t, s^t, \varepsilon^t)\}_{t=1}^T$, these payoffs take the form

$$\sum_{t=1}^{T} \delta^{t-1} \left[u_l(a_l^t, s_l^t; \theta) + \varepsilon^t(a_l^t) \right], \tag{4}$$

where $T \in \mathbb{N} \cup \{\infty\}$ and $\delta \in (0,1)$.[13] As is standard in dynamic optimization, the leader's optimal choice is Markovian and unique. In Section A.1, we characterize the leader's optimal choice as a vector of continuation values via the Bellman Equation. Specifically, Equation 9 characterizes the probability with which the leader purges and includes rivals which we use to fit the model to data via maximum likelihood estimation.

[11]Without further assumptions, the model is agnostic to the size and direction of power-sharing's effect on the autocrat's survival probability.

[12]In our data, leaders rarely exit and then return to office, an event that occurs in only 2% of leaders (6 out of 303). When this occurs, we treat them as separate autocrats.

[13]Note that that δ is not a parameter to be estimated which is standard in the structural literature as it can be difficult to identify with finite samples. Throughout estimation, we fix $\delta = 0.9$.

Before proceeding, it is important to acknowledge a modeling choice that deviates from other formal work on autocratic survival: the autocrat is the only strategic actor in our model. While potential challengers play an important role, their machinations are captured in the survival function g_l. This function describes how the leader's prospects of remaining in office change as a consequence of their budget, survival strategies, and other covariates identified in the empirical literature on authoritarian survival. Our forward-looking autocrat thus "responds" to would-be challengers by taking decisions that incorporate the empirical associations — estimated here and explored in previous literature — between today's state and actions and tomorrow's survival.

This modeling choice is particularly appropriate in our sample of autocracies, where, beyond survival threats, leaders face few (institutional) constraints. It also allows us to avoid imposing additional modeling assumptions on the interaction between autocrats and potential challengers. It also enables us to make empirical progress as we do not require information on would-be challengers' characteristics, which affect their returns to seizing power and holding office.[14]

3.2 Numerical Example

We present a numerical example to illustrate how the model captures important trade-offs. We consider two budget levels, large and small, where $\mathcal{B} = \{0, 5\}$. In addition, we parameterize the leader's payoffs using Equation 3 with modest office-holding benefits, $x_l = 1$ and $\beta = 1$, and more substantial costs of inclusion and purging, $\rho = -2$ and $\kappa = -2.5$. For the state transitions, we specify the probability of leader survival as

$$\begin{aligned} g_l(a_l, s_l) = 0.85 - 0.05\ \mathbf{I}(a_l, C_l) - 0.2\ \mathbf{P}(a_l) - 0.03 B_l + \\ 0.06\ \mathbf{I}(a_l, C_l) \times B_l + 0.05\ \mathbf{P}(a_l) \times B_l, \end{aligned} \tag{5}$$

which is an equivalent to the representation in Table 1. Notice that the functional form of g_l explicitly models the effects of purging and inclusion as a function of the current budget level, and both actions are more detrimental to the leader's survival in low budget periods. As for fiscal resources, the budget in period t remains the budget in period $t+1$ with probability $\phi \in (0, 1)$, where we set $\phi = 0.75$ as the persistence of the budget in the example.

[14] An additional concern arises because the leader's optimal choices may not be unique if the model incorporates a strategic challenger as multiple equilibria may exist. Following the procedure in Crisman-Cox and Gibilisco (2018), we would need to estimate an additional $4 \cdot L \cdot \#\mathcal{S}$ parameters in order to pin down correct equilibrium choice probabilities if we were to add a strategic challenger.

Table 1: Example of leader's survival transition probabilities.

State (s_l)			
Budget (B_l)	Cabinet (C_l)	Action (a_l)	Survival Prob. (g_l)
Low (0)	Exclusive (0)	Status Quo ($\varnothing$)	**0.85**
Low (0)	Exclusive (0)	Inclusion (i)	0.80
High (5)	Exclusive (0)	Status Quo ($\varnothing$)	0.70
High (5)	Exclusive (0)	Inclusion (i)	0.95
Low (0)	Inclusive (1)	Status Quo ($\varnothing$)	**0.80**
Low (0)	Inclusive (1)	Purge (p)	**0.65**
High (5)	Inclusive (1)	Status Quo ($\varnothing$)	0.95
High (5)	Inclusive (1)	Purge (p)	0.75

We choose this specification because it matches several patterns in the data and reveals real tradeoffs. Excluding the opposition in high budget periods imperils the leader's survival as maintaining an exclusive cabinet with a high budget reduces the survival probability by 25 percentage points. This is consistent with comparative politics research on neopatrimonial regimes, which argues that opposition elites may be inclined to depose the leader if denied some share of the spoils (Kramon and Posner 2016, 27). Yet inclusion is not always recommended, and not just because it is costly to dole out patronage. If the budget falls, then the leader, with an inclusive cabinet, faces a dilemma: if he maintains the status quo, his survival probability is 0.80, and if he purges his survival probability is 0.65. Both of these are smaller than the survival probability in a low budget state in an exclusive cabinet of 0.85. Thus, even though purging reduces his survival probability by 15 points, the leader may be better off excluding his opponents if he expects the lean times to persist. Our leader's dilemma — not wanting to alienate the opposition during a recession, all the while recognizing that their inclusion is unsustainable amid ongoing scarcity — is a tradeoff apparent in this example and one that emerges in the data.

Table 2: Optimal choice quantities.

State $s_l = (B_l, C_l)$	Continuation Value $V_l(s_l)$	Pr(Changing Status Quo) $\Pr(a_l \neq \varnothing; s_l, V_l)$
$(0, 0)$	11.45	0.01
$(0, 1)$	7.12	0.61
$(5, 0)$	17.24	0.51
$(5, 1)$	16.72	0.14

Given this parameterization, Table 2 reports the quantities describing the leader's optimal choice and associated expected payoffs. The first column lists the four states in this example, i.e, all possible (B_l, C_l) pairs, and the second column provides the associated continuation values, where the leader has larger expected utilities in large budget states. The third column reveals how our hypothetical leader's survival strategies change across different states of the world. When budgets are tight, the leader wants to maintain an exclusive cabinet. He almost never adopts inclusive governments when the opposition is currently excluded. If necessary, he's inclined (with probability 0.61) to purge the opposition to consolidate power. Though it initially reduces his survival prospects, he prefers to purge given the persistence of the current, low budget. In high-budget periods, the leader generally maintains inclusive cabinets. He purges the opposition when the government currently shares power only with probability 0.14. In addition, with probability 0.51 he opts to adopt inclusive power sharing structures when the opposition is currently excluded. On the one hand, adopting an inclusive cabinet in this state guarantees the leader a large likelihood of remaining in power tomorrow (with probability 0.95), but on the other hand, it also entails substantial costs ($\rho = -2$).

Thus, large budgets encourage power sharing, and small budgets encourage exclusivity in this example (and in the data below). This relationship may seem surprising at first, because large budgets are often conflated with political power, and why would powerful leaders share power? Yet, having enough resources to buy loyalty (a large budget) is not the same as commanding deference under any circumstances (raw power). A key feature of the example and our data is that most leaders do not have enough raw power to guarantee their survival. If they did and they were powerful enough to survive in every period regardless of their actions — $g_l(a_l, s_l) = 1$ for all (a_l, s_l) — then there would, of course, be little incentive to share power. In this example, the probability of inclusion given a large budget would drop to 0.04 compared to 0.61 in Table 2. But survival is almost never assured even when budgets are large, so forward-looking, rich leaders opt for inclusion, trading off consumption for improved survival prospects.

3.3 Transitions

Our model is flexible enough to incorporate a variety of transition probabilities that capture the effects of the leader's actions on his survival or the evolution of the budget, g_l and f_l. A benefit of this approach is that we can specify these probabilities to match the empirical analyses common in the comparative politics literature,[15] subject to a specification

[15] For examples, see Bueno de Mesquita and Smith (2010), Gandhi and Przeworski (2007), and Wright, Frantz and Geddes (2013).

that preserves the model's stationarity. Following existing work allows the model to better illustrate how leaders optimally expand and purge their cabinets given the effects highlighted in the empirical literature on leader survival.[16]

Section C details the statistical models that relate the action a_l^t chosen in state s_l^t and period t to (a) leader l's survival probability at the end of period t and (b) the future budget B^{t+1}. Throughout we maintain three goals. First, the effects of inclusion or purging on the leader's survival (or tomorrow's budget) depend on the current budget level — as in Equation 5 from the numerical example. It could be the case that, in large budget periods, adopting an inclusive cabinet successfully deters coups, but not in low budget periods as the autocrat has less resources to redistribute. Likewise, a higher budget may enhance the ability of an autocrat to successfully purge members of the ruling coalition, but purges could result in countercoups in leaner times. Second, there could be other factors that determine leader survival or future budget levels, so we include additional leader-specific information z_l such as his start age, military background, whether his administration produces oil, etc. Finally, we include country-specific fixed effects to alleviate concerns about omitted variable bias that arise from time-invariant characteristics of states (e.g., geography, colonial origin).

4. Data

4.1 Sample

We restrict attention to autocratic regimes that impose few or no constraints on leaders, settings where, as in our model, leaders' survival tactics are not limited by other political actors. Our sample constitutes administrations that score five or below on the Polity scale; are classified as non-democracies; and have, at most, limited constraints on executive authority, as measured by Polity.[17] As our measurement of leaders' actions (discussed below) relies on the inclusion or exclusion of different ethnic or racial groups, we drop all countries with a single group in the Ethnic Power Relations (EPR) data. This leaves us an unbalanced panel of 303 administrations from 88 countries over 54 years. In Table A.2, we show how listwise deletion due to missing covariates affects our sample of unconstrained autocrats.[18]

[16] Without data constraints, we could pursue a nonparametric approach. For example, if we observed enough data from autocrat l over time, then we could estimate these transitions using frequency estimators. In the data, however, the median length of autocratic tenure is six years, making the approach infeasible.

[17] Our theory focuses on the actions of unchecked autocrats; hence, these sample restrictions. As a robustness check, we relax these sample filters and estimate g_l on the expanded sample. Our coefficient estimates remain consistent (see Figure A.1).

[18] While we find no evidence that region, oil production, or the number of EPR groups affect sample inclusion, our estimation sample scores slightly lower on the polity scale and is less likely to include administrations that begin after 2010.

We measure explanatory variables at the time the leader assumes power, thereby ensuring that sample selection is not an outcome of leaders' decisions in office.

4.2 Budget

We compile data on government budgets from the Penn World Tables (PWT), Cross-National Time-Series Archive (CNTS), and International Centre for Tax and Development (ICTD) (Feenstra, Inklaar and Timmer 2015; Banks and Wilson 2014; ICTD/UNU-WIDER N.d.). While the sources employ different definitions of government revenue, the pairwise correlations across the series (see Table A.1) are very high (above 0.9). Given this correlation, we use the PWT in our analysis because it provides better coverage. Among the unconstrained autocracies in our sample, the PWT covers 90 percent of country-years. By contrast, the CNTS covers 65 percent of this sample; the ICTD, less than half.

In more democratic settings, one might worry that government expenditure includes allocations beyond the leader's control (e.g., debt servicing). Thus, our measure could overstate the resources at these leaders' disposal. This is less of a concern in our sample, which is limited to autocrats that face few or no constraints on their authority. In unconstrained autocracies, we can more safely assume expenditure is discretionary and line items are a reflection of the leaders' priorities, not their constraints. Furthermore, our model reflects the possibility that autocrats cannot control the every penny of the government budget. The office adjustment, $x_l \cdot \beta$, could be negative, indicating that (certain) leaders' utilities are less than what government consumption implies.

4.3 Leader's Actions

We use the EPR data to code whether leaders include or exclude rival groups (Cederman, Min and Wimmer 2012). The EPR "identifies all politically relevant ethnic groups and their access to state power in every country of the world from 1946 to 2013." Ethnicity here is defined broadly, incorporating groups defined by a common language, race, or religion. The EPR considers a group to be "politically relevant if *either* at least one significant political actor claims to represent the interests of that group in the national political arena *or* if group members are systematically discriminated against in the domain of public policies."

An administration starts as exclusive ($C_l^t = 0$) if it is initially dominated by a single group and inclusive otherwise. We then define inclusion ($a_l^t = i$) as adding another group as a junior or senior partner in government. This addition would change the subsequent state to inclusive ($C_l^t = 1$). If an administration is in an inclusive state, it can purge by reducing the number of groups in government ($a_l^t = p$), changing the state in the next year to exclusive. While very rare, adding groups from an already inclusive state or subtracting groups from an exclusive state are considered as maintenance of the status-quo ($a_l^t = 0$).[19]

This operationalization implies that the leader views elites from other politically relevant ethnic, linguistic, or religious groups as potential rivals — an assumption consistent with past research. Roessler (2011, 324), for example, finds that "two-thirds of groups involved in successful coups [in Africa] are different from the ruler's ethnic group." His analysis also suggests that the ruler's co-ethnics are less likely to stage a rebellion. More broadly, the literature on neopatrimonialism views the inclusion of elites from other ethnic, linguistic, or religious groups as an effort to buy their otherwise wavering loyalty (Bratton and van de Walle 1994; Kramon and Posner 2016). Our use of the EPR data and coding scheme capture a common way of identifying autocrats that do and do not permit power sharing (Francois, Rainer and Trebbi 2015).[20]

4.4 Survival Data

The Archigos data record the tenure of primary rulers for every independent state until 2015 (Goemans, Gleditsch and Chiozza 2009). This enables us to code when an administration starts and ends. Archigos also includes information on how each leader lost power. Of particular interest for us is when leaders die or are removed through "irregular means" — "when the leader was removed in contravention of explicit rules and established conventions." The Archigos codebook notes, "Most Irregular removals from office are done by domestic forces. Irregular removal from office is overwhelmingly the result of the threat or use of force as exemplified in coups, (popular) revolts and assassinations" (3). While multiple administrations can pass in a single country-year, our other variables are measured at the country-year level. We collapse Archigos to the country-year level by retaining the leader that serves the most months in a given year. We include country fixed effects and additional covariates when estimating the transition probabilities — see Section C for a longer description of these data.

[19] In Section B.3, we consider two alternative codings. The first measure permits failed purges if reducing the number of partners in government does not concentrate power to a single group. The second uses changes in whether or not there is a dominant group in government to code both the action and the state variable. In Tables A.6 and A.7, we show our first-stage results for these different codings; in Table A.11, we show that our estimates of the leader's payoffs are largely unchanged.

[20] We recognize that other forms of power sharing exist, e.g., granting monopolies or decentralization. We focus here on inclusion in the ruling coalition, as this has been a focus of past research and panel data exist that enables our empirical analysis.

4.5 Payoff Covariates

We specify covariates in x_l that are common in studies of autocratic politics, focusing on those that affect leaders' office benefits and costs of purging. Using Polity's executive constraints measure, we code an indicator for whether or not the autocrat has unlimited authority. Leaders who are not accountable to other branches of government will have an easier time exacting office benefits or purging rivals. We also add an indicator for whether or not the leader has a military background (Ellis, Horowitz and Stam 2015), as military leaders are thought to generate less rents (Besley, Montalvo and Reynal-Querol 2011; Yu and Jong-A-Pin 2016). Because oil-flushed dictators may find it easier to suppress opposition members without harming economic performance (Wright, Frantz and Geddes 2013; Bueno de Mesquita and Smith 2010), we add an indicator for oil producing countries using data from (Ross and Mahdavi 2015). Following Collier et al. (2003), we include the cumulative number of civil wars — defined by the Correlates of War — in the leader's country. Finally, because trade may mitigate the incentives leaders have for using repression (Gandhi and Przeworski 2007), we have exports as a percent of GDP from PWT. As described above, all covariates are measured during the year the leader takes office. In addition, we standardize the continuous covariates to have a zero mean and a standard deviation of one.

5. Results

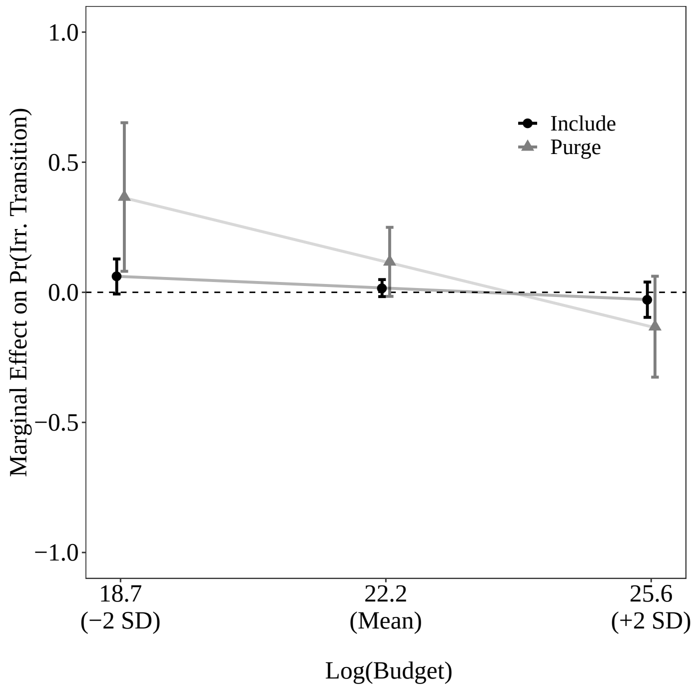
5.1 Transition Probabilities

Our model implies stationary and Markovian transition probabilities that are functions of the budget, the leader's actions, and leader-specific covariates. (See Section C for more information.) To do this, we estimate

$$Y_{lc,t+1} = \alpha_c + \gamma_1 \mathbf{I}_{lct} + \gamma_2 \mathbf{P}_{lct} + \gamma_3 B_{lct} + \gamma_4 \mathbf{I}_{lct} \times B_{lct} + \gamma_5 \mathbf{P}_{lct} \times B_{lct} + \omega \mathbf{Z}_{lc} + \varepsilon_{lc,t+1} \tag{6}$$

for three outcomes of interest: irregular leadership transition, natural death, and government consumption. In Equation 6, l indexes administrations; c, countries; and t, years. Our right-hand-side variables lag our outcome measures by one year, and our budget variable B_{lct} is in logs. Notice we include interaction terms between the current budget level (B_{lct}) and the decisions of the leader to purge or include their rivals (P_{lct} and I_{lct}). We also include country fixed effects (α_c) and leader-specific covariates $\mathbf{Z}_{lc}$. We present the full regression results when the dependent variable is irregular transitions in Table A.3. Our coefficients

Figure 1: Marginal effect of leader's actions on Pr(irregular transition)



Marginal effects (and confidence intervals for $\alpha = 0.1$) of including an excluded group or purging an included group on the probability of an irregular leadership transition when the budget (logged) is at its mean or ± 2 pooled standard deviations. These predictions use estimates from model 5 in Table A.3.

remain consistent in magnitude across specifications; the inclusion of additional covariates improves precision. In all models, we cluster our standard errors on administration.

To aid in interpretation, we present the marginal effects of inclusion or purging when the budget is two (pooled) standard deviations above and below its mean in Figure 1. This plot is based on estimates from Model 5 in Table A.3, which includes all of our leader-specific covariates. The figure clearly demonstrates one aspect of the tradeoff leaders face. When budgets are tight, changing the composition of government increases the likelihood of an irregular transition. Yet, when times are good, leaders can increase their survival prospects by purging or, to a lesser extent, including rival groups. Similarly, the marginal effect of the budget on irregular removal is positive with exclusive coalitions, but the effect is essentially zero when the leader adopts inclusive coalitions. Overall, the survival strategies of purging and inclusion become more effective as the budget increases.

To keep our formal model tractable, we restrict the state space to the budget and cabinet composition. As a consequence, Equation 6 does not include other covariates that change over a leader's term.[21] As a robustness check, we relax this assumption and permit $\mathbf{Z}$ to vary within administrations over time. In these models, we also include year or continent-by-year fixed effects to account for global or continent-specific trends. The marginal effects of purging or inclusion at different budget levels are qualitatively unchanged (see Table A.8). This should alleviate concern that our estimation of g_l — the autocrat's survival function — depends on a particular empirical specification.

To further validate these results, we leverage exogenous variation in government budgets using the timing of giant oilfield discoveries as in Lei and Michaels (2014).[22] We use their identification strategy and replication data but restrict attention to the administrations that overlap with our sample. Such giant oilfield discoveries increase budgets by 15 to 20 percent—see Table A.9. Furthermore, we estimate the reduced-form relationship between giant oilfield discoveries and irregular leadership transition by re-estimating Equation 6 but substituting an indicator for recent discoveries for our budget measure B. In Figure A.2, we reproduce Figure 1 (left) and then show the marginal effects of purging and inclusion for leaders who do and do not enjoy a recent giant oilfield discovery (right). We again find that purging and inclusion detract from the leader's survival absent the windfall; however, inclusion weakly and, to a far greater extent, purging actually improve the leader's survival prospects following a giant oilfield discovery.

The appendix contains our other results describing leader death and the transition of the budget. Table A.4 reports models of leader death. Reassuringly, we find that young leaders or those who began their tenure more recently are less likely to die from natural causes while in office. Table A.5 reports models of the budget transitions. We find evidence of strong budget persistence as the coefficient associated with a lagged budget level is roughly 0.94. In addition, we reject the the null hypothesis that the autoregressive process has a unit root at the $\alpha < 0.001$ level in all specifications. Finally, purging does not relate to tomorrow's budget levels; however, we find suggestive evidence that inclusion, particularly at higher budget levels, is associated with budget increases in the next year.

5.2 Leader's Payoff Parameters

Table 3 presents our estimates of leaders' payoff parameters — how the benefits of holding office or payoffs from purging vary across leaders with different characteristics. We restrict the coefficient on the budget (B_l^t) to one, lending the other estimates a straightforward

[21]That is, $\mathbf{Z}$ is not indexed by t. For any covariate in $\mathbf{Z}$, we use the first value that it takes in the administration's term to avoid endogeneity issues.

[22]Giant oilfields encompass 500 million barrels of ultimate recoverable reserves, and Lei and Michaels (2014) demonstrate that their timing is plausibly exogenous in the short and medium term.

interpretation: these marginal effects are relative to a one log point increase in the budget. Notice that we report two coefficient estimates for each variable, one describing how the variable affects the leader's office benefits, β, and one describing how it affects costs of purging, κ.[23] These would be aggregated in a standard reduced-form regressions. Table 3 also includes two sets of standard errors, a conventional estimate based on the outer-product of gradients and a second computed by a jackknife procedure that re-estimates both the transition probabilities and payoff parameters excluding one country at a time. The jackknife generates larger standard errors as it also incorporates uncertainty in our estimates of the transition probabilities.

Table 3: Estimates of leaders' payoff parameters.

Leader's Utility:	$u_l(a_l^t, s_l^t; \theta) = B_l^t + x_l \cdot \beta + \rho \boldsymbol{I}(a_l^t, C_l^t) + \boldsymbol{P}(a_l^t) x_l \cdot \kappa$			
		Point Estimate	Outer Product	Jackknife Countries
Office Benefits (β)	Constant	-3.61	(0.03)***	(0.32)***
	Unconstrained	0.45	(0.05)***	(0.41)
	Military Leader	-1.64	(0.05)***	(0.36)***
	Oil Producer	-0.85	(0.05)***	(0.56)
	Cum. Civil Wars	-0.77	(0.02)***	(0.09)***
	Exports	-0.07	(0.02)***	(0.16)
Inclusion Cost (ρ)		-1.15	(0.00)***	(0.05)***
Purging Payoff (κ)	Constant	-11.23	(0.26)***	(0.48)***
	Unconstrained	1.54	(0.28)***	(0.30)***
	Military Leader	0.59	(0.28)**	(0.23)**
	Oil Producer	0.66	(0.20)***	(0.26)**
	Cum. Civil Wars	-0.01	(0.09)	(0.09)
	Exports	-0.16	(0.13)	(0.10)
	Log Likelihood	209.74		
	Administrations	303		

Note: *p<0.1; **p<0.05; ***p<0.01

Starting with our office-benefit estimates, leaders with a military pedigree or ruling states with a history of civil wars gain less from holding executive office. This aligns with seminal work on autocracies, which argues that military leaders often assume power reluctantly, staging a coup only to maintain order or the cohesiveness of the military (Geddes

[23] Section D.2 describes the moments in the data used to separately estimate these different coefficients.

2003). We also find, unsurprisingly, that a history of repeated civil wars reduces the benefits from holding office. Conflict can destroy the tax base, deter investment, and force leaders to divert revenues to fighting rebellion. The remaining variables have estimates that are not significant at conventional levels when using our more conservative standard errors.

Recall that the parameter ρ captures the payoff a leader receives from including another ethnic group in their government. Our negative estimate suggests this action is costly for rulers. While some ministers may hold peripheral portfolios (e.g., over sports or vocational training), rulers pay a cost to increasing the number of groups represented in their cabinets. This finding is consistent with our earlier argument and the literature on power sharing through cabinet appointments. The magnitude indicates that inclusive governments cost the leader roughly one logged unit of government revenue. If autocrats could be assured of their continued rule, they would prefer an administration composed of their own ruling group. Yet, as we described above, adopting inclusive cabinets allow leaders to extend their expected tenure in office.

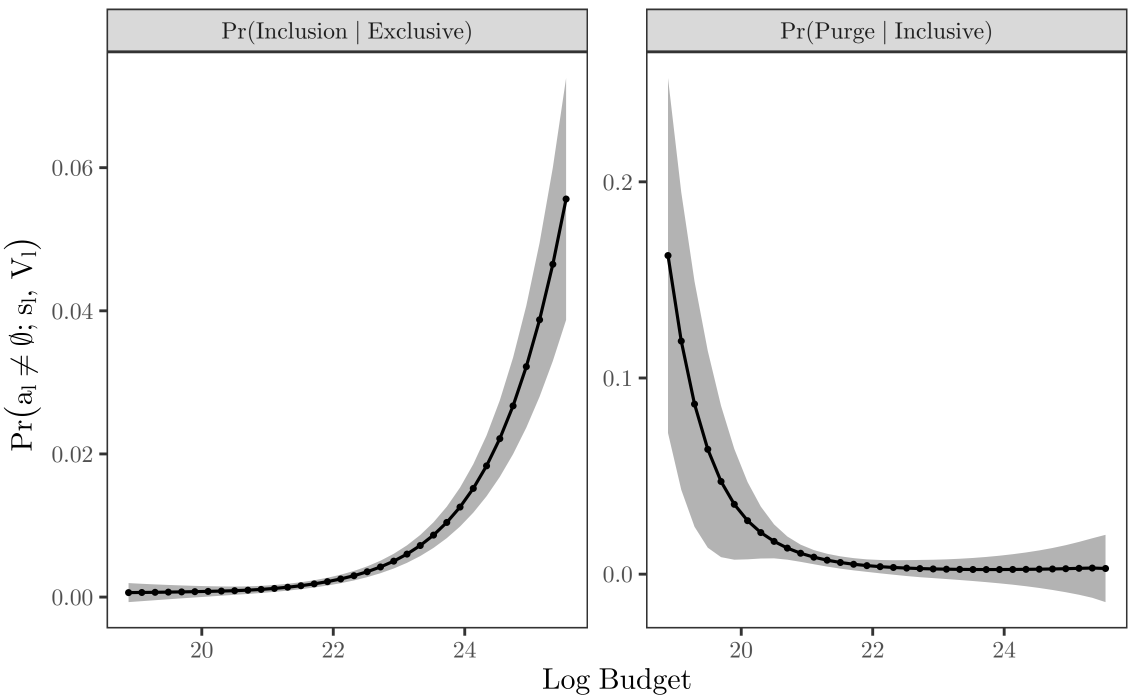
Finally, we estimate the payoff to repression among different types of leaders (κ). In these rows of Table 3, negative values indicate variables that move the leader's payoffs toward $-\infty$, i.e., increase the overall costs of repression. First, we note that the constant is large and negative, implying that purging is costly absent other information. This estimate provides a rationale for Arriola's (2009) claim that cabinet positions represent a credible promise of future spoils: the cost autocrats pay to purge provides their ministers with some assurance that they will not be sacked on a whim. Some leaders take a smaller hit for purging their opposition. The costs are roughly ten percent lower for unconstrained executives or leaders with a military background. While we do not know of past work that estimates leaders' costs of purging, these findings are easy to rationalize using folk theories of autocracy. Leaders who are not accountable to citizens or other branches of government should find it less costly to purge. Those with prior ties to the security forces likely find it easier to threaten or deploy coercive force to remove a rival.

5.3 Optimal Choice of Power Sharing or Purging

The previous subsections demonstrate that purging and adopting inclusive governments affect both autocrats' survival prospects and office benefits. When budgets are small, reshuffling the ruling coalition — either including opponents or attempting to purge them — reduces the leader's likelihood of keeping office. When resources are ample, both tactics can enhance survival prospects. As for office benefits, we find that both purging and inclusion are costly, but the costs of purging are an order of magnitude larger. Given the tradeoffs implied by our structural estimates, when should leaders purge or share power?

To answer this question we consider a hypothetical autocrat who takes on median values of the observed covariates x_l and z_l. This leader is unconstrained, has a military background, and entered office in the mid-1970s at the age of 45. In addition, his country does not have oil and has had no civil wars.[24] Fixing the coefficient estimates to those in Table 3, we can compute the autocrat's optimal probabilities of purging and including using Equations 8 and 9.

Figure 2: Effect of budget levels of autocratic survival strategies.



Predicted probability that the leader chooses to include an excluded group in their cabinet (**left**) and of choosing to purge an included group (**right**). All variables, z_l and x_l, are held at their sample medians; the conditional volatility of the budget is set at the median, $\sigma_l = 0.117$. The shaded area denotes confidence intervals ($\alpha = 0.1$). Standard errors computed using a jackknifing procedure that drops each country in the sample.

Figure 2 presents the optimal choice probabilities. The left-hand panel graphs the probability that the leader includes the opposition ($a_l = i$) given that they are currently excluded ($C_l = 0$), and the right-hand graphs the probability that the leader purges ($a_l = p$ given $C = 1$). Two immediate patterns emerge. First, given an exclusive cabinet, the autocrat only broadens his coalition when the budget is large. At the average budget (logged) in the data ($B_l = 22.2$), the autocrat almost never includes other groups, but this probability in-

[24] We include country fixed effects in the transition models of leader survival, death, and budget evolution. We set these values to be the average over all countries in the data for the analysis below. We fix the conditional variance of the budget to $\sigma_l = 0.117$, the median in the sample.

creases to approximately seven percent at the upper end of the range ($B_l \approx 25$). This is consistent with Caselli and Tesei (2016) who find that resource booms encourage autocrats to engage in activities that promote their survival. Second, purges are most likely at small budget levels, occurring with over 15 percent probability in the extreme. Leaders almost never purge at higher budget levels.[25]

Figure 1 and Table A.5 indicate that, when budgets are high, inclusion can both improve an autocrat's survival prospects and their budget outlook. The latter finding — that inclusion can bolster future revenues — is consistent with past work arguing that autocrats can benefit economically by sharing power and, thus, mitigating the moral hazard problem (e.g., Gandhi and Przeworski 2006). Given the relatively high costs of purging, we see autocrats opting for power sharing at high budget levels.

However, Figure 1 also indicates that purging is a risky action when budgets are low. Why then do we see budget-starved autocrats opting to push out the opposition? First, they expect budgets to remain low because budget levels are relatively persistent (see Table A.5). And at low budget levels, the autocrats' survival probabilities are greatest when they can simply maintain an exclusive coalition without purging (i.e., $C_l = 0$, and $a_l = \varnothing$). Anticipating future lean periods, autocrats then risk purging to reach this preferred state. Should they survive the backlash, they then enjoy the full spoils of office and a higher likelihood of remaining in power in subsequent lean periods. Despite the short-run risks, there are substantial long-term benefits to purging inclusive governments given that autocrats expect budgets to remain low. To illustrate the size of these dynamic benefits, Figure A.3 graphs the difference in expected utilities between periods with exclusive and inclusive cabinets for a fixed budget, $V_l(B_l, C_l = 0) - V_l(B_l, C_l = 1)$. Because we estimate a relatively large cost to adopting an inclusive coalition, this difference is always positive. Yet the long-term benefits of purging depend on the current budget level: when budgets are tighter autocrats have a larger incentive to purge and switch from an inclusive to an exclusive coalition (or simply maintain the latter).

Overall, our findings echo de Waal's (2015, 70) account of power-sharing decisions in the Horn of Africa. He concludes:

> The essential precondition for a peace agreement is an expanding budget, with most of it under the ruler's discretionary control. The key to a workable peace deal is an allocation of resources to the adversary sufficient for him to join the government.

[25] This result differs from Caselli and Tesei (2016); we find that leaders do expend resources at low budget levels, but these are to purge the opposition, not create inclusive political institutions.

By contrast, when budgets are tight, any allocation to the opposition cuts into the leader's meager rents. Furthermore, if lean budgets persist, the leader jeopardizes their survival by inviting in opponents and creating unaffordable future obligations. Thus, they adopt and maintain more exclusive coalitions.

6. Budget Levels and Power Sharing

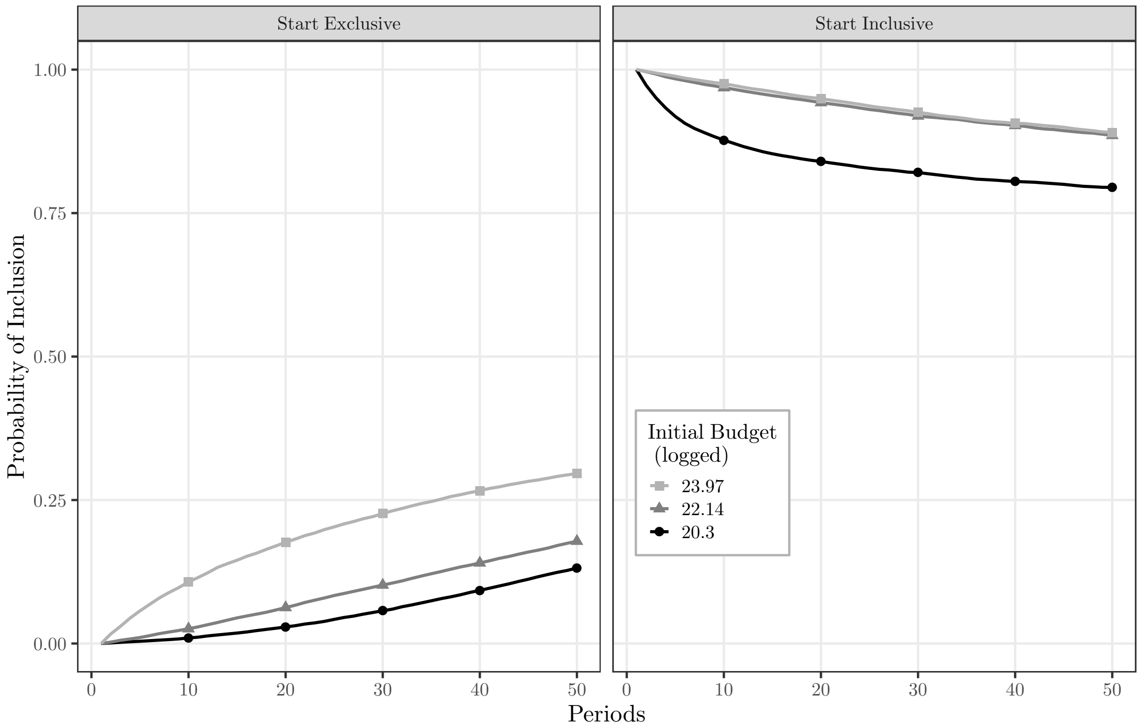
Figure 2 demonstrates that large budgets tend to increase the per-period probability of inclusion and decrease the probability of purges. The effects are significant at conventional levels and of plausible magnitudes: shifting from an inclusive to exclusive coalition (or vice-versa) is a major and infrequent reform, and these per-period (i.e., annual) predicted probabilities reflect that. However, our estimates indicate that budgets are relatively persistent and, thus, that autocrats at high or low budgets repeatedly face these hazards. To better demonstrate the medium- and long-run effects, we use the estimated model to predict the evolution of power sharing when the identical autocrat is endowed with different initial budgets. In Figure 3, we endow our hypothetical leader with different initial budgets, where 22.14 is the mean and 23.97 and 20.3 are plus and minus one pooled standard deviation, respectively. We then compute the probability that the leader includes the opposition in their coalition as years pass.

Consistent with the logic sketched above, larger budgets promote power sharing. Suppose the autocrats start with an exclusive cabinet (left panel). Initially, the autocrats are quite similar; after one year there is less than 1 percent probability that any autocrat has an inclusive government. The differences grow over time, however. After ten years, the probability of including the opposition is four times higher when the autocrat begins with the largest versus the middle budget level. They remain substantial over the long-term. Twenty years out, the probability of including the opposition is roughly 20 percent when the autocrat starts with the above average budget, but less than 7 percent when they start with the mean budget.[26]

If instead the autocrat starts with an inclusive coalition (right panel), he is least likely maintain the power-sharing arrangement when he starts at the smallest budget level rather than the others. After ten years, the probability of an inclusive cabinet is 10 percentage points greater when the autocrat starts with a budget at the mean rather than one standard deviation below the mean. This difference remains fairly large in the medium term even after 40 years.

[26] The model is stationary, however, so initial differences disappear over the very long term.

Figure 3: Budgets and the probability of inclusion over time.



Predicted probability that a leader has an inclusive coalition after starting in an exclusive (**left**) or inclusive state (**right**). Line colors represent the leader's initial budget level; chosen values correspond to the sample mean and ±1 pooled standard deviation. All variables, z_l and x_l, are held at their sample medians; the conditional volatility of the budget is set at the median , $\sigma_l = 0.117$.

6.1 Illustrative Cases

These counterfactuals illuminate the political consequences of large historical shocks to government budgets. To take a recent example, a dramatic increase in world commodity prices between 2000 and 2012 expanded government budgets across a number of mineral-rich countries in Africa (Humphreys 2015). Between 2000 and 2012, 14 mineral producing African countries saw budget increases of more than one log point; eight experienced increases of more than 1.8 log points, roughly a standard deviation in our data (see Figure A.4). These positive fiscal shocks ought, by our model, to have promoted power sharing. And over this same period, the probability of an inclusive cabinet in this sample increased by 12 percentage points from 0.75 to 0.87. While we do not regard this as a test of our model, it suggests that real leaders facing budget shocks respond in ways that resemble the hypothetical autocrat whose behavior is dictated by our structural estimates.

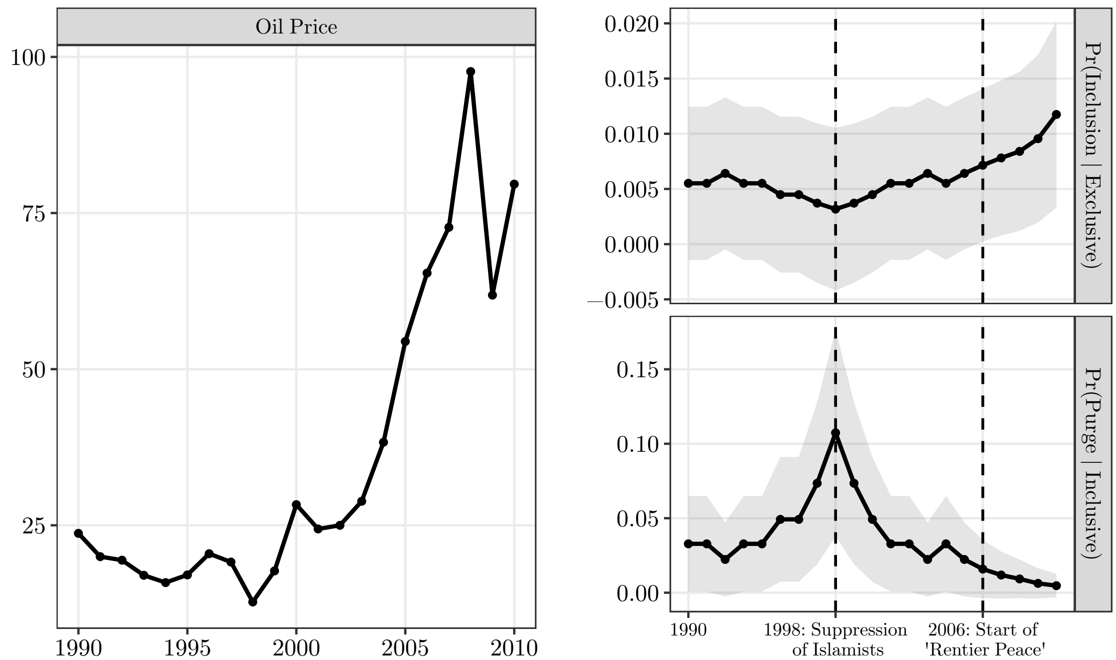
Sudan was among the states that saw a major windfall during this period due to rising oil prices (see left panel of Figure 4). Before the boom, in the mid 1990s, Sudan became the largest debtor to the World Bank and International Monetary Fund, resulting in the suspensions of ongoing loans and financial aid. Amid this austerity, Sudan's president Omar al-Bashir declared a state of emergency and jailed Hassan al-Tarubi who was the speaker of the National Assembly and leader of the Islamist faction, the government's main opposition. As oil production and prices rose between 1999 and 2008, government spending increased by an order of magnitude. de Waal (2015, 82-4) argues that this budgetary expansion facilitated power-sharing agreements — a "rentier peace." The timing of peace agreements between the northern government in Khartoum and the South coincided with a major upswing in government revenue, because the 2005 Comprehensive Peace Agreement (CPA) was primarily a rent allocation formula meant to buy the loyalty of elites from both regions. "The arithmetic," de Waal (2015, 84) argues, "was possible because the fast-expanding budget meant that Khartoum's ruling cartel could offer a generous incentive without hardship to itself."

To use the terminology of our model, at smaller budget levels in the mid to late 1990s, the leader had incentives to purge rivals from the government. As the budget increased, the leader could afford to cut in rivals without sacrificing his own survival or stream of rents. Figure 4 presents our in-sample predictions for Sudan. Consistent with de Waal's (2015) narrative, as oil prices rise the likelihood of inclusion increases (top right panel) — heightened oil prices permit a "rentier peace" — and the probability of purging falls (bottom right panel).

Budget shortfalls have proven fatal for other autocrats.[27] Liberia's Samuel Doe faced the dilemma formalized earlier: "How was Doe to manage the urgent task of asserting his political authority over strongmen (not to mention satisfying his expensive person tastes)?" (Reno 1999, 87). Doe's survival strategies during his tenure illustrate our findings. Upon assuming power and prior to the country's economic collapse, Doe opted for inclusion. While he publicly executed top officials from the overthrown Tolbert government, he also appointed many as ministers: "Doe's first cabinet included four ministers from Tolbert's era, and others from that era were promoted into the top ranks of the civil service. Of twenty-two cabinet ministers listed in 1985, at least half had held bureaucratic positions in pre-Doe governments" (Reno 1999, 82). Charles Taylor, who would later mount a rebellion against Doe's government, returned to Liberia in 1980 to serve in Doe's cabinet. According to Reno (1999, 85), Doe "found that any long-term strategy for consolidating power included buying off his opposition."

[27] de Waal (2015, 74-5) argues that Colonel Jaafar Nimeiri's dictatorship in Sudan collapsed amid austerity.

Figure 4: In-sample predictions for Sudan.



Global price of Brent Crude in USD/barrel from the St. Louis Federal Reserve (**left**). Predicted probability (**right**) that a leader chooses to include an excluded group (top) or purge an included group (bottom). All variables, x_l and z_l, are set using values from Sudan from 1990 to 2010. The shaded area denotes the confidence intervals ($\alpha = 0.1$).

Yet, this strategy proved untenable amid austerity. After years of economic decline and the loss of US and international aid in the late 1980s, Doe was left "manag[ing] a burdensome patron-client network on an empty treasury." A declassified assessment from the US Central Intelligence Agency concludes that "Doe has no better than an even chance of coping with Liberia's problems for the next several years" (Directorate of Intelligence 1983, iii). "Doe's vulnerability lay in his incapacity to wield resources to counterbalance those controlled by Liberian strongmen or to finance patronage obligations to Liberia's state bureaucrats" (Reno 1999, 88). Per our model, he looked to consolidate power amid contraction but feared he could not weather the backlash that would follow a purge. Doe lost power and was executed in 1990 as Liberia descended into civil war.

7. Discussion

In addition to illuminating the consequences of natural resource booms and busts, our findings help to reconcile claims about the effects of economic sanctions on authoritarian breakdowns and consolidation. International relations scholars have found that sanctions often fail to improve governance and may even be counterproductive. Wood (2008) finds that US economic sanctions are associated with greater state-sponsored repression, arguing "repression results from incumbent efforts to prevent the defection of core supporters and to stifle dissent in the face of declining economic conditions" (509). Peksen (2010) similarly finds that economic sanctions are associated with reductions in press freedom. This research contributes to a prevailing view that sanctions do not encourage political liberalization. Krasner and Weinstein (2014, 129) summarize that "the conventional wisdom on sanctions . . . was that sections are ineffective."

Marinov (2005, 564), however, questions this pessimism, showing "economic sanctions work in at least one respect: they destabilize the leaders they target." Folch and Wright (2010) also find that sanctions imperil the survival of personalist dictators and monarchs. "If sanctions are to be effective at destabilizing dictators," the authors conclude, "they should strike at revenue sources the dictator needs to stay in power" (355).

While some view these results as at odds, both consequences of sanctions — increased repression and instability — are implied by our results. If sanctions reduce an autocrat's budget, this pushes them to purge, excluding the opposition from government, which often takes the form of repressing elite rivals. This is a risky gambit because, reconfiguring their coalition amid financial distress, the autocrat increases their risk of an irregular transition (see Figure 1).[28] These empirical results are not contradictory but rather fully consistent with an autocrat attempting to concentrate power from a weak financial position.[29]

For policymakers inclined to use carrots rather than sticks, our results speak to the use of positive democratic conditionality when disbursing foreign aid, e.g., rewarding autocrats with assistance if they permit greater voice to the opposition. We are not the first to question the effectiveness of such conditionality; others have noted that conditions are inadequate or unequally enforced (see Carnegie and Marinov 2017, for a more optimistic take). Our point is that the sequencing may be backwards: asking autocrats to invite in their rivals without first having the funds to purchase their loyalty runs contrary to autocrats' strong instincts for self-preservation.

These policy implications also raise additional questions and extensions of our work. First, future work could extend our model to incorporate additional survival strategies. For

[28] Even if the autocrat does not purge, he still faces diminished survival prospects, as it is difficult to maintain an inclusive and obedient cabinet on a tighter budget.

[29] Folch and Wright (2010, 336) write, "although personalist rulers can and do increase repression in response to sanctions, this is a risky and potentially counterproductive strategy that can further destabilize the regime."

example, scholars and policy practitioners are not only concerned about power sharing among elites but also about treatment of the masses in terms of repression, free press, or human rights abuses. These types of survival strategies are currently absent from our model due to the focus on elite inclusion and purges. Second, future work could also examine more nuanced counterfactuals that better mimic conditions on international aid or sanctions. Our counterfactuals examine how leader's immediate and long-term policies change according to different budget levels or shocks. While aid and sanctions affect an autocrat's fiscal resources in this manner, their conditions are complicated, potentially affecting the autocrat's expectations about future budgets in more nuanced ways.

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Supporting Information

How Budgets Shape Autocrats' Survival Strategies

Following text to be published online.

Contents

A. Model

A.1 Leader's Optimal Solution

Recall that the endogenous state is two dimensional where $s_l = (B_l, C_l)$, $B_l \in \mathcal{B}$ denotes a budget level, and C_l denotes whether or not the autocrat is currently sharing power. Let $V_l(s_l)$ denote the leaders expected continuation value in state s_l, and let $V_l = (V_l(s_l))_{s_l \in \mathcal{S}}$. For housekeeping, let $F_l(s_l^{t+1}; a_l^t, s_l^t, \phi)$ denote the transition probabilities over the state space $\mathcal{S}$ implied by f_l and $C^{t+1} = \mathbf{I}(a_l^t, C_l^t)$. Following Rust (1994), we can write

$$\begin{aligned} V_l(s_l) &= \int_{\varepsilon_l'} \max_{a_l \in A(C_l)} \left\{ u_l(a_l, s_l; \theta) + \varepsilon_l'(a_l) + g_l(a_l, s_l; \gamma)\delta \sum_{s_l' \in \mathcal{S}} V(s_l') F_l\left(s_l'; a_l, s_l, \phi\right) \right\} d\varepsilon_l' \\ &= \log\left(\sum_{a_l \in A(C_l)} \exp\left\{ u_l(a_l, s_l; \theta) + g_l(a_l, s_l.\gamma)\delta \sum_{s_l' \in \mathcal{S}} V(s_l') F_l\left(s_l'; a_l, s_l, \phi\right) \right\} \right) + C \\ &\equiv \Upsilon_l(s_l, V_l; \theta, \gamma, \phi), \end{aligned} \tag{7}$$

where C is Euler's constant. Above, the first equality follows because ε_l' and s_l' are independent. The second follows from McFadden (1978, Corollary p. 82) because ε_l' is T1EV. Thus, for any parameter values (θ, γ, ϕ), leader l's optimal decision can be described by a vector V_l such that

$$\Upsilon_l(V_l; \theta, \gamma, \phi) - V_l = 0, \tag{8}$$

where $\Upsilon_l(V_l; \theta, \gamma, \phi) = \times_{s_l \in \mathcal{S}} \Upsilon_l(s_l, V_l; \theta, \gamma, \phi)$. Because ε_l is T1EV, if leader l is in state s_l, then he chooses $a_l \in A(C_l)$ with probability:

$$P\left(a_l; s_l, V_l\right) = \frac{\exp\left\{ u_l(a_l, s_l; \theta) + g_l(a_l, s_l, \gamma)\delta \sum_{s_l' \in \mathcal{S}} V(s_l') F_l\left(s_l'; a_l, s_l, \phi\right) \right\}}{\sum_{a_l' \in A(C_l)} \exp\left\{ u_l(a_l', s_l; \theta) + g_l(a_l', s_l, \gamma)\delta \sum_{s_l' \in \mathcal{S}} V(s_l') F_l\left(s_l'; a_l', s_l, \phi\right) \right\}}, \tag{9}$$

where V_l solves Equation 8. Given a vector of parameters (θ, γ, ϕ), Equation 9 defines the likelihood of observing action a_l in state s_l, which we use to fit the model to data via maximum likelihood estimation.

B. Data and Sample

B.1 Budget Data

Table A.1: Correlation across budget series (logged).

	PWT	CNTS	ICTD
PWT	1	0.913	0.949
CNTS	0.913	1	0.949
ICTD	0.949	0.949	1

PWT: Penn World Tables, Govt. Consumption
CNTS: Cross-National Time-Series, Govt. Revenue
ICTD: Intl. Centre for Tax and Dev., Tax Revenue

B.2 Sample

Table A.2: Missingness due to listwise deletion.

	Included in Sample			
	Model 1	Model 2	Model 3	Model 4
Americas	-0.089			-0.128
	(0.122)			(0.115)
Asia	-0.092			-0.103
	(0.060)			(0.078)
Europe	-0.074			-0.120
	(0.111)			(0.121)
Year		-0.004***		-0.004***
		(0.001)		(0.001)
Polity 2			-0.010	-0.007
			(0.007)	(0.006)
EPR Groups				-0.001
				(0.004)
Oil Producer				0.025
				(0.068)
Constant	0.919***	7.964***	0.812***	8.766***
	(0.032)	(2.723)	(0.057)	(2.707)
N	3,168	3,168	3,168	3,168

Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.3 Alternative Codings of Leader's Actions and States

Failed Purges For states, $C_l^t = 0$ if and only if we observe that leader l's country in year t has a dominant group in government as recorded in the EPR data. For actions, $a_l^t = p$ if the previous year has an inclusive state ($C_l^{t-1} = 1$) and the number of groups in power decreases in year t. Likewise, $a_l^t = i$ if the previous year has an exclusive state ($C_l^{t-1} = 0$) and the number of groups in power increase in year t. In all other cases, $a_l^t = \varnothing$.

Note that this coding permits failed purges because the number of groups in government may decrease in period t, i.e., there is a purge, but there may still not be a dominant group in period $t + 1$ so $C_l^{t+1} = 1$. Using this coding, seven out of 35 purges fail.

Dominant For $t = 1$, $C_l^1 = 0$ if and only if we observe that leader l's country in year t has a dominant group government as recorded in the EPR data. If there is no dominant group, then $C_l^1 = 1$. For $t > 1$, $a_l^t = \varnothing$ if there is no change in the country's dominant group status, i.e., there was a (no) dominant group in both t and $t - 1$. For purges, $a_l^t = p$ if there was a switch from no dominant group to a dominant group between t and $t - 1$. For inclusion, $a_l^t = i$ if there was a switch from dominant group to no dominant group between t and $t - 1$. The remaining states are coded following $C_l^{t+1} = \mathbf{I}(a_l^t, C_l^t)$.

C. Transition Probabilities

We model the means of the transition probabilities, g_l and f_l. First, suppose leader l chooses action a_l in state s_l, and consider the probability that he retains power, avoiding death or being deposed. For the latter case, we model this as a probit function with mean $\mu_l^r[a_l, s_l; \gamma^r]$, which takes the form:

$$\mu_l^r[a_l, s_l; \gamma^r] = \gamma_1^r \mathbf{I}(a_l, C_l) + \gamma_2^r \mathbf{P}(a_l) + \gamma_3^r B_l + \gamma_4^r \mathbf{I}(a_l, C_l) \times B_l + \gamma_5^r \mathbf{P}(a_l) \times B_l + \gamma_6^r z_l. \quad (10)$$

Then $\Phi(\mu_l^r[a_l, s_l; \gamma^r])$ is the probability that l is not forcibly removed from office after choosing action a_l in state s_l. This setup has several useful properties due to its flexibility and ease of interpretation. First, the effect of cabinet inclusion and purging depends on the current budget level. For example, it could be the case that, in large budget periods, adopting an inclusive cabinet successfully deters coups, but not in low budget periods. Likewise, a higher budget may enhance the ability of an autocrat to successfully purge members of the ruling coalition. The vector z_l contains pertinent information about the leader such has his start age, military background, whether his administration produces oil, and country-specific dummies. Thus, our model and data alleviates some concerns about omitted variable bias that arise from time-invariant characteristics of states (e.g., geography, colonial origin) by accommodating country fixed effects in the transitions. In a similar manner, we define $\Phi(\mu_l^d[a_l, s_l; \gamma^d])$ as the probability that the leader does not die in office, and $\mu_l^d[a_l, s_l; \gamma^d]$ takes an identical form as μ_l^r in Equation 10 which includes country-specific fixed-effects. Letting $\gamma = (\gamma^r, \gamma^d)$, we define $g_l(a_l, s_l, \gamma) = \Phi(\mu_l^r[a_l, s_l; \gamma^r])\Phi(\mu_l^d[a_l, s_l; \gamma^d])$, where γ is a vector of to-be-estimated parameters.

For the transition probabilities governing the evolution of the budget, we pursue a similar approach, but we account for multiple discrete budget levels following Tauchen's (1986) model of a discrete AR-1 process. Let $\mathcal{B} = \{b_1, \ldots, b_J\}$ denote a set of equally spaced budget levels such that $i > j$ if and only if $b_i > b_j$. Let $\mu_l^b[a_l, s_l; \phi]$ and σ_l^2 denote the mean and *conditional* variance of tomorrow's budget (what we subsequently refer to as volatility) given the action and state pair (a_l, s_l).[30] We parameterize μ_l^b in a manner identical to Equation 10, which includes country-specific fixed effects. For $j = 2, \ldots, J-1$, budget level $b_j \in \mathcal{B}$ arises tomorrow with probability

$$f_l(b_j; a_l, s_l, \phi) = \Phi\left(\frac{b_j + d - \mu_l^b[a_l, s_l; \phi]}{\sigma_l}\right) - \Phi\left(\frac{b_j - d - \mu_l^b[a_l, s_l; \phi]}{\sigma_l}\right) \quad (11)$$

[30] In a simple autoregressive model, $y_t = \phi y_{t-1} + \varepsilon_t$, and ε_t is distributed i.i.d. according to normal distribution with mean zero and standard deviation σ. Conditional on y_{t-1}, the variance of y_t is σ^2. The unconditional variance is $\frac{\sigma^2}{(1-\phi^2)}$.

where $2d$ describes the distance between the equally spaced budget levels. Equation 11 is straightforwardly modified to account the smallest and largest budget levels, b_1 and b_J, respectively. Not only does the specification in Equation 11 permit the same flexibility and identification strategy as those above, it can also be estimated consistently from standard autoregressive models, as long as the number of budget levels is not too small. In our results below, we set $J = 50$ and estimate σ_l at the country level. In words, if leaders are from the same country, then they face the same budget volatility, i.e., the same conditional variance of tomorrow's budget. Preliminary Monte Carlo evidence indicates that we can uncover the model's true parameters relatively accurately if $J = 50$.

C.1 Covariates

We include additional covariates when estimating the transition probabilities (Equation 6). These reduce confounding by conditioning on time-varying features that affect leaders' actions, the budget, and their survival. (Country fixed effects absorb any static differences across countries.) The Archigos data enable us to code the leader's age at the start of their administration, as well as the first year of their tenure. Older leaders might have reduced survival probabilities. Stationarity in our model excludes measures that vary over time within administrations. Yet, we capture changes over time that affect survival (e.g., in medical technologies) by including each leader's first year in office. Using data from Ellis, Horowitz and Stam (2015), we code whether the leader has a military background, as this might enable the leader to more effectively wield coercive power and repress rivals.[31] As our coding of leaders' actions depends on their decisions to include or exclude other ethnic groups from their ruling coalitions, we condition on the number of ethnic groups. Finally, a large literature on the resource curse relates oil wealth to authoritarian survival Ross (see 2015, for a recent review). We use data from Ross and Mahdavi (2015) to determine if a country is an oil producer during a leader's time in office.

[31] Alternatively, military leaders might be inclined to "return to the barracks," wanting merely to secure order rather than extend their tenure (Geddes 2003).

C.2 First-stage Results

Table A.3: Irregular leader transition.

	Irregular Leader Transition				
	Model 1	Model 2	Model 3	Model 4	Model 5
Log(Budget) (B)	0.015	0.019	0.020*	0.020*	0.022**
	(0.010)	(0.013)	(0.011)	(0.011)	(0.010)
Included (I)	0.255	0.268	0.287	0.305	0.301
	(0.192)	(0.189)	(0.206)	(0.218)	(0.230)
Purged (P)	1.569**	1.504*	1.797**	1.802**	1.708**
	(0.753)	(0.792)	(0.808)	(0.809)	(0.831)
I × B	-0.011	-0.012	-0.013	-0.014	-0.013
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
P × B	-0.066**	-0.063*	-0.076**	-0.076**	-0.072**
	(0.033)	(0.035)	(0.035)	(0.035)	(0.036)
First Year in Office	-0.001***	-0.001	-0.002***	-0.001***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Military Pedigree			-0.045***	-0.045***	-0.033**
			(0.015)	(0.015)	(0.015)
EPR Groups				-0.006	-0.001
				(0.011)	(0.013)
Start Age					0.004***
					(0.001)
Oil Producer					-0.004
					(0.034)
Country	87	87	87	87	87
Year		54			
N	2,782	2,782	2,674	2,674	2,674

Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Leader death.

	Leader Death				
	Model 1	Model 2	Model 3	Model 4	Model 5
Log(Budget) (B)	-0.001	-0.016***	0.002	0.002	0.002
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Included (I)	-0.076	-0.139	-0.064	-0.066	-0.071
	(0.115)	(0.115)	(0.124)	(0.125)	(0.123)
Purged (P)	-0.059	-0.200	-0.042	-0.043	-0.065
	(0.125)	(0.134)	(0.131)	(0.132)	(0.141)
I $\times$ B	0.003	0.006	0.003	0.003	0.003
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
P $\times$ B	0.002	0.008	0.001	0.001	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
First Year in Office	-0.001**	-0.002***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Military Pedigree			-0.007	-0.007	-0.004
			(0.006)	(0.006)	(0.006)
EPR Groups				0.001	0.002
				(0.007)	(0.007)
Start Age					0.001**
					(0.000)
Oil Producer					-0.008
					(0.017)
Country	87	87	87	87	87
Year		54			
N	2,782	2,782	2,674	2,674	2,674

Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Budget.

	Budget				
	Model 1	Model 2	Model 3	Model 4	Model 5
Log(Budget) (B)	0.941***	0.934***	0.938***	0.938***	0.938***
	(0.013)	(0.017)	(0.014)	(0.014)	(0.014)
Included (I)	-0.478*	-0.401	-0.501*	-0.456	-0.463
	(0.277)	(0.265)	(0.299)	(0.294)	(0.295)
Purged (P)	-0.204	-0.186	-0.184	-0.170	-0.168
	(0.441)	(0.409)	(0.459)	(0.461)	(0.464)
I $\times$ B	0.024*	0.020	0.025*	0.023*	0.024*
	(0.013)	(0.012)	(0.014)	(0.014)	(0.014)
P $\times$ B	0.008	0.008	0.008	0.007	0.007
	(0.021)	(0.019)	(0.022)	(0.022)	(0.022)
First Year in Office	0.001**	-0.000	0.001**	0.001***	0.001***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Military Pedigree			-0.003	-0.003	-0.004
			(0.010)	(0.010)	(0.010)
EPR Groups				-0.016	-0.015
				(0.012)	(0.013)
Start Age					-0.000
					(0.001)
Oil Producer					-0.024
					(0.020)
Country	88	88	88	88	87
Year		54			
N	2,807	2,807	2,699	2,699	2,674

Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.3 Robustness: Coding that Permits Failed Purges

Table A.6: Irregular leader transition.

	Irregular Leader Transition				
	Model 1	Model 2	Model 3	Model 4	Model 5
Log(Budget) (B)	0.017*	0.021*	0.021**	0.021**	0.025***
	(0.010)	(0.012)	(0.010)	(0.010)	(0.010)
Included (I)	0.287	0.301*	0.327*	0.366*	0.386*
	(0.186)	(0.183)	(0.198)	(0.206)	(0.210)
Purged (P)	2.257***	2.223***	2.490***	2.530***	2.523***
	(0.831)	(0.853)	(0.858)	(0.863)	(0.889)
I × B	-0.012	-0.013	-0.014	-0.016*	-0.016*
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
P × B	-0.097***	-0.096**	-0.107***	-0.109***	-0.108***
	(0.037)	(0.038)	(0.038)	(0.038)	(0.039)
First Year in Office	-0.001***	-0.001	-0.002***	-0.001***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Military Pedigree			-0.045***	-0.045***	-0.034**
			(0.015)	(0.015)	(0.014)
EPR Groups				-0.011	-0.006
				(0.009)	(0.012)
Start Age					0.004***
					(0.001)
Oil Producer					-0.000
					(0.033)
Country	87	87	87	87	87
Year		54			
N	2,782	2,782	2,674	2,674	2,674

Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.4 Robustness: Coding based on Existence of Dominant Group

Table A.7: Irregular leader transition.

	Irregular Leader Transition				
	Model 1	Model 2	Model 3	Model 4	Model 5
Log(Budget) (B)	0.018*	0.021*	0.022**	0.022**	0.026***
	(0.010)	(0.012)	(0.010)	(0.010)	(0.010)
Included (I)	0.378*	0.395**	0.434**	0.470**	0.495**
	(0.203)	(0.199)	(0.216)	(0.215)	(0.210)
Purged (P)	0.803	0.529	0.880	0.896	0.739
	(0.805)	(0.799)	(0.812)	(0.815)	(0.817)
I × B	-0.016*	-0.017*	-0.019*	-0.021**	-0.021**
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)
P × B	-0.032	-0.019	-0.035	-0.036	-0.029
	(0.035)	(0.035)	(0.036)	(0.036)	(0.036)
First Year in Office	-0.001***	-0.001	-0.002***	-0.001***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Military Pedigree			-0.044***	-0.044***	-0.032**
			(0.015)	(0.015)	(0.015)
EPR Groups				-0.010	-0.006
				(0.011)	(0.013)
Start Age					0.004***
					(0.001)
Oil Producer					0.002
					(0.033)
Country	87	87	87	87	87
Year		54			
N	2,782	2,782	2,674	2,674	2,674

Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.5 Robustness: Including Time-Varying Covariates

Table A.8: Irregular leader transitions with time-varying covariates.

	Irregular Leader Transition					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Log(Budget) (B)	0.022**	0.023*	0.017	0.012	0.016	0.011
	(0.010)	(0.012)	(0.013)	(0.015)	(0.015)	(0.017)
Included (I)	0.301	0.253	0.266	0.189	0.215	0.123
	(0.230)	(0.251)	(0.230)	(0.256)	(0.252)	(0.275)
Purged (P)	1.708**	1.631*	1.571*	1.471	1.584*	1.493*
	(0.831)	(0.885)	(0.862)	(0.925)	(0.845)	(0.899)
I × B	-0.013	-0.010	-0.011	-0.007	-0.009	-0.004
	(0.010)	(0.011)	(0.010)	(0.012)	(0.011)	(0.013)
P × B	-0.072**	-0.067*	-0.066*	-0.060	-0.066*	-0.061
	(0.036)	(0.039)	(0.038)	(0.041)	(0.037)	(0.040)
First Year in Office	-0.003***	-0.002***	-0.003***	-0.003***	-0.003***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Military Pedigree	-0.033**	-0.037**	-0.038**	-0.043***	-0.037**	-0.042***
	(0.015)	(0.016)	(0.015)	(0.016)	(0.015)	(0.016)
EPR Groups	-0.001	0.001	-0.001	-0.001	0.004	0.003
	(0.013)	(0.012)	(0.013)	(0.012)	(0.014)	(0.013)
Start Age	0.004***	0.004***	0.004***	0.004***	0.004***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Oil Producer	-0.004	-0.023	-0.008	-0.035	-0.008	-0.035
	(0.034)	(0.022)	(0.033)	(0.023)	(0.031)	(0.024)
Country	87	87	87	87	87	87
Year			54	45		
Continent-Year					196	169
Time-varying Covariates		✓		✓		✓
N	2,674	2,459	2,674	2,459	2,674	2,459

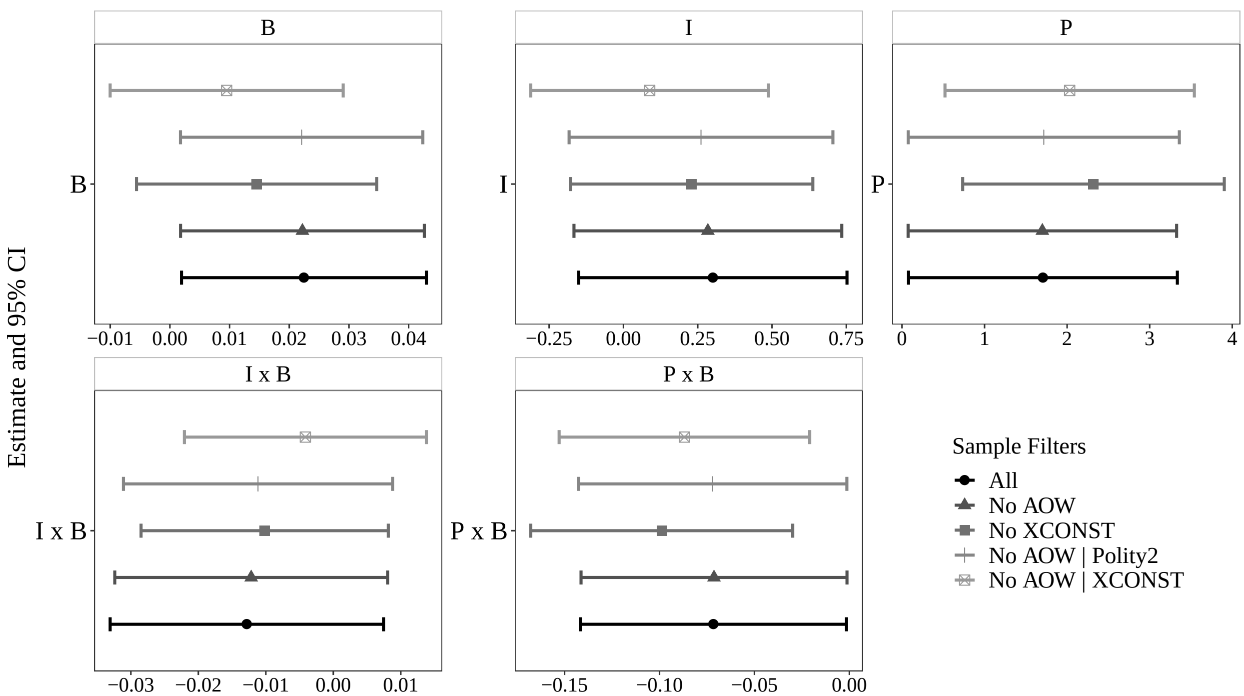
Notes: Standard errors clustered on administration. Even numbered models allow all covariates to vary year-to-year. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.6 Robustness: Sample Filters

To focus attention on unchecked autocrats, we use three criteria: (1) an administration must start with a Polity 2 score less than 6; (2) an executive constraints score below 4 (or missing for transitional regimes); and (3) be classified by the Autocracies of the World dataset as not a democracy.

In Figure A.1, we show how the coefficients of interest from Table A.3 change when we drop these sample filters. The dot and bar are our estimate and 95% confidence interval when all filters are applied. We then drop the Autocracies of the World (AOW) filter; the executive constraints filter; the AOW and Polity 2 filters; and the AOW executive constraints filter. We always impose some filter on regime or executive constraints, as our interest is in the decision-making of unchecked leaders.

Figure A.1: Consistency of first-stage results for different sample filters.



C.7 Robustness: Using Giant Oilfield Discoveries as an Instrument for Budget Shocks

Lei and Michaels (2014) argue that the discovery of giant oilfields (encompassing 500 million barrels of ultimate recoverable reserves) generates a major resource windfall. Moreover, they show that "the timing of giant oilfield discoveries is plausibly exogenous, at least in the short-medium run" after conditioning on country and year fixed effects (140). Using this exogenous variation, Lei and Michaels estimate the causal effects of these giant oilfield discoveries, finding that oil production increases by 35-50 percentage points in the 4-10 years after discovery; oil exports increase 20-50 percent within 6-10 years; and government spending increases by 4-6 percent over the subsequent decade.

While Lei and Michaels focus on the reduced form relationship between giant oilfield discoveries and internal conflict (their main dependent variable), both their formal model and empirical strategy indicate that they view such discoveries as an instrument for government resource revenue: "giant oilfield discoveries increase oil revenues, generating windfall income for the incumbent" (139). We are similarly interested in identifying the effect of government budget shocks, though our focus is on how this interacts with leaders' actions to determine their probabilities of surviving in power.

Table A.9: Effects of giant oilfield discoveries on oil production and budgets.

	Log(Oil and Gas Production)			Log(Budget)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Discovery in $t-4$	0.210**			0.153**		
	(0.106)			(0.070)		
Discovery from $t-2$ to $t-6$		0.260*			0.151**	
		(0.145)			(0.061)	
Discovery from $t-4$ to $t-6$			0.242**			0.208***
			(0.122)			(0.073)
Country	52	52	52	87	87	87
Year	48	48	48	48	49	49
N	1,222	1,233	1,222	2,521	2,559	2,546

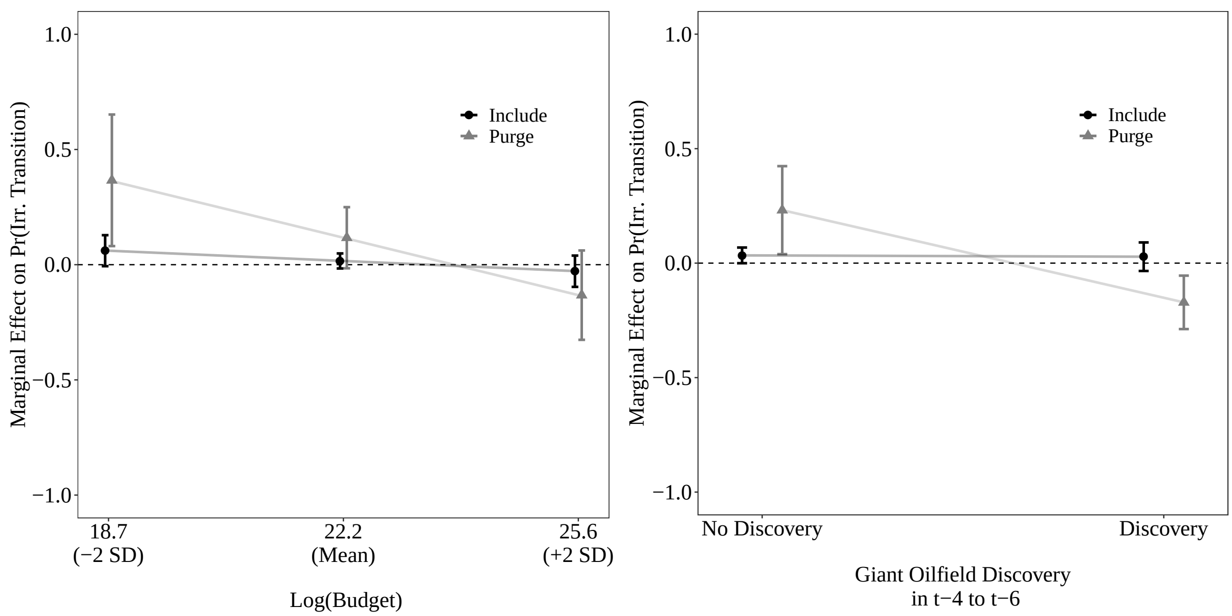
Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We use Lei and Michaels's (2014) replication data but restrict attention to the administrations that overlap with our sample. Employing the authors' preferred specification, we first estimate in

Table A.9 the effect of giant oilfield discoveries on oil and gas production per capita (logged) and our measure of government budgets (logged). Looking at columns 4-6, we find that recent oil discoveries increase our measure of governments' budgets by 15 to 20 percent.

Like Lei and Michaels (2014), we next estimate the reduced form relationship. We focus on the relationship between giant oilfield discoveries and irregular leadership transitions, re-estimating equation 6, but substituting an indicator for past oil discoveries for our budget measure B. In Figure A.2, we reproduce Figure 1 (left) and then show the marginal effects of purging and inclusion for leaders who do and do not enjoy a recent giant oilfield discovery (right).

Figure A.2: Marginal effect of leader's actions on Pr(irregular transition).



(a) Log(Budget) **(b)** Giant Oilfield Discoveries

The marginal effects follow the same pattern. While giant oilfield discoveries generate substantial budget increases, they do not generate a two-standard-deviation budget increase. Hence, the more modest magnitudes using this alternative empirical strategy.

D. Estimation of Leader's Payoffs

D.1 Point Estimates

We consider L leaders, where $l \in \{1, \ldots, L\}$ indexes an arbitrary leader. Our data consists of a list comprising three arrays: $\{Y, X, Z\}$. Here, $Y = \{Y_l\}_{l=1}^{L}$ is an array of time series matrices, where $Y_l = \{(a_l^t, s_l^t)\}_{t=1}^{T_l}$ records the observed action-state pairs for each leader, and we observe $T_l \geq 1$ observations for leader l. The matrix $X = (x_l)_{l=1}^{L}$ collects the leader-specific covariates that affect the per-period payoffs of leaders, i.e., the covariates entering Equation 3. Finally, the matrix Z collects the leader-specific covariates that affect the transition probability, i.e., those entering the function $\mu_l^e[a_l, s_l; \gamma]$, for $e = r, d, b$, which is explicitly defined in Equation 10. The goal is to estimate parameters (θ, γ, ϕ). Recall, θ is a vector of coefficients associated with the leaders' per-period payoff and variables x_l, and γ and ϕ are vectors of coefficients associated with the leaders' transition probabilities and variables z_l. We estimate these parameters in following steps.

(A) Estimate $\gamma = (\gamma^r, \gamma^d)$, i.e., $\mu_l^r[a_l, s_l; \gamma^r]$ and $\mu_l^d[a_l, s_l; \gamma^d]$, using linear probability models with country fixed effects. Here the dependent variables are indicators for leader death and leader removal and the independent variables follow the left-hand-side of Equation 10.

(B) Estimate ϕ, i.e., $\mu_l^b[a_l, s_l; \phi]$, using an autoregressive model with country fixed effects, where the dependent variable is the log of the government revenue and the independent variables follow the left-hand-side of Equation 10. In this version, government revenue is a continuous variable and has not been discretized.

(C) Estimate σ_l using the residuals from the regression in step (B). Here we pool information across leaders from the same country. That is, if leaders l and l' are from the same country, then $\sigma_l = \sigma_{l'}$.

(D) Create the transition probabilities of leader survival, g_l, using the predicted values from (A). Discretize the log budget variable using the $J = 50$ equally spaced levels $\mathcal{B}$ and use Equation 11—along with the estimates of ϕ and σ_l from (B) and (C), respectively—to create the budget transition probabilities, f_l.

(E) Fixing the transition probabilities, g_l and f_l, estimate θ via MLE following the fixed point algorithm in Rust (1994). Specifically, for every guess of θ and for every leader l, we compute V_l by solving Equation 8. Then using Equation 9, we can evaluate l's contribution to the likelihood as

$$\mathcal{L}_l(\theta \mid Y_l, x_l, z_l) = \Pi_{t=1}^{T_L} P(a_l^t; s_l^t, V_l),$$

where the overall likelihood is $\mathcal{L}(\theta | Y, X, Z) = \Pi_{l=1}^{L} \mathcal{L}_l(\theta \mid Y_l, x_l, z_l)$. We maximize this likelihood to estimate θ.

D.2 Identification

Besides the standard identification assumptions arising from the known and i.i.d. distribution of payoff shocks, three moments in the data allow us to pin down the autocrats' payoff parameters, $\theta = (\beta, \kappa, \rho)$. Recall that $x_l \cdot \beta$ denotes l's per-period office benefit. Here, we can pin down the parameters β because we have normalized l's payoff of losing power to zero. Thus, all else equal, leaders who more likely to take actions with high probabilities of removal have smaller office benefits than those who more likely choose actions with low probabilities of removal. Thus, we need states or actions that entail differing survival strategies, i.e., the function g_l cannot be constant in (a_l, s_l). Second, recall that $x_l \cdot \kappa$ denotes l's per-period cost of purging, and we can isolate these payoffs from l's frequency of purging given an inclusive cabinet. Third, the parameter ρ denotes the per-period (dis)utility l receives from adopting or maintaining inclusive cabinets. We isolate ρ from the frequency with which l adopts inclusive cabinets given that the opposition is currently excluded.

D.3 Standard Errors

We compute standard errors using three approaches. We use the outer-product of gradients estimator, and these standard errors are reported in the main text. Second, we use two jackknife procedures. Here, for each leader l (for each country $c = 1, \ldots, C$), we drop l (c) from the data set and re-estimate the model following the steps in Section D.1 producing point estimates $\hat{\theta}^l$ ($\hat{\theta}^c$) for leader l (country c). We then compute the standard errors using the L (C) estimates. For each jackknife sample, we repeat Steps A–E of the estimation procedure as in Section D.1. All standard errors are reported in Table A.10 for comparison.

Table A.10: Comparison of standard errors.

		Point estimates	Outer product	Jackknife leaders	Jackknife countries
Office benefits, β	Constant	-3.61	0.03	0.20	0.32
	Unconstrained	0.45	0.05	0.29	0.41
	Military leader	-1.64	0.05	0.26	0.36
	Oil producer	-0.85	0.05	0.38	0.56
	Cum. civil wars	-0.77	0.02	0.06	0.09
	Exports	-0.07	0.02	0.13	0.16
Repression cost, κ	Constant	-11.23	0.26	0.27	0.48
	Unconstrained	1.54	0.28	0.17	0.30
	Military leader	0.59	0.28	0.15	0.23
	Oil producer	0.66	0.20	0.13	0.26
	Cum. civil.wars	-0.01	0.09	0.05	0.09
	Exports	-0.16	0.13	0.07	0.10
Inclusion costs, ρ	Constant	-1.15	0.00	0.02	0.05

D.4 Robustness: Alternative Codings of States and Actions

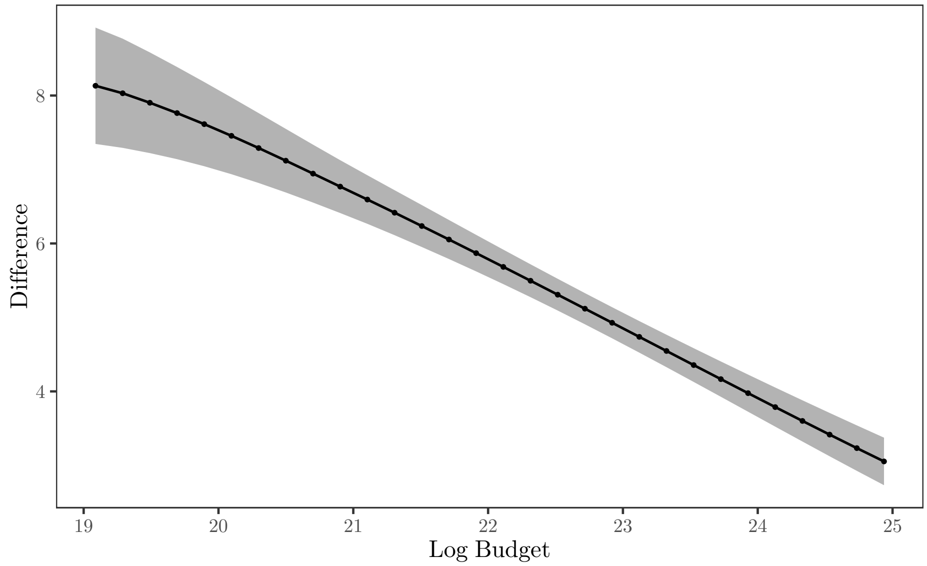
Table A.11: Estimates of leaders' payoff parameters with alternative codings.

Leader's Utility:	$u_l(a_l^t, s_l^t; \theta) = B_l^t + x_l \cdot \beta + \rho \boldsymbol{I}(a_l^t, C_l^t) + \boldsymbol{P}(a_l^t) x_l \cdot \kappa$			
		Baseline	Failed Purges	Dominant
Office Benefits ($\widehat{\beta}$)	Constant	-3.61	-3.66	-5.29
		(0.03)	(0.03)	(0.04)
	Unconstrained	0.45	0.05	0.03
		(0.05)	(0.04)	(0.04)
	Military Leader	-1.64	-0.82	-0.07
		(0.05)	(0.04)	(0.04)
	Oil Producer	-0.85	-1.07	-0.18
		(0.05)	(0.04)	(0.05)
	Cum. Civil Wars	-0.77	-0.31	-1.23
		(0.02)	(0.01)	(0.02)
	Exports	-0.07	0.22	0.53
		(0.02)	(0.01)	(0.02)
Inclusion Cost ($\widehat{\rho}$)		-1.15	-0.99	-1.26
		(0.00)	(0.00)	(0.00)
Purging Payoff ($\widehat{\kappa}$)	Constant	$-11.23.$	-10.15	-12.85
		(0.26)	(0.24)	(0.20)
	Unconstrained	1.54	1.21	1.99
		(0.28)	(0.28)	(0.26)
	Military Leader	0.59	0.67	0.65
		(0.28)	(0.24)	(0.23)
	Oil Producer	0.66	0.17	0.12
		(0.20)	(0.25)	(0.16)
	Cum. Civil Wars	-0.01	0.13	-0.42
		(0.09)	(0.10)	(0.09)
	Exports	-0.16	-0.09	-0.66
		(0.13)	(0.13)	(0.11)
	Log Likelihood	209.74	264.87	187.09
	Administrations	303	303	303

Note: Standard errors based on outer product of gradients.

E. Substantive Effects

Figure A.3: Difference between $V_l(B_l, C_l = 0) - V_l(B_l, C_l = 1)$.



All variables, z_l and x_l are held at their sample medians, and the shaded area denotes the 90% confidence intervals from a country-level jackknife.

E.1 Historical Budget Shocks

Figure A.4: Budget implications of commodity boom in Africa.