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How Budgets Shape Power Sharing in Autocracies

Darin Christensen[1] and Michael Gibilisco[2*]

[1] *Departments of Public Policy and Political Science, UCLA, Los Angeles, CA, USA; darinc@luskin.ucla.edu*
[2] *Division of Humanities and Social Sciences, California Institute of Technology, Pasadena, CA, USA; michael.gibilisco@caltech.edu*

ABSTRACT

How do government budgets affect autocrats' incentives to share or consolidate power? We estimate a dynamic decision problem in which autocrats build their ruling coalitions to maintain power and maximize rents amid fluctuating budgets. Even for unconstrained autocrats, we find that ousting (potential) rivals is costly and, when budgets are tight, reduces their short-term survival prospects. Despite these upfront costs, exclusion has dynamic benefits during periods of prolonged budget contraction: autocrats reduce patronage obligations that they may struggle to afford on a tighter budget, which increases their long-term survival chances and share of spoils. By contrast, 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 ruling coalitions by over 10 percentage points over 25 years. Case studies of Sudan and Liberia indicate that our model and results describe the tradeoffs and survival strategies of real-world autocrats.

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Survival is expensive for autocrats. Past research finds that cash-rich autocrats — e.g., those enjoying large flows of natural resource revenues (Ross, 2015; Wright *et al.*, 2013) or foreign aid (Morrison, 2009) — survive longer in office. Assuming that these autocrats want to retain control and maximize the benefits that flow from it, we ask how government budgets affect their decisions to consolidate power or share it with other elites.

The relationship between budgets and power sharing is not well understood, likely due to countervailing and dynamic effects. When budgets are plentiful, leaders can afford a larger coterie of ministers. Yet they may worry about empowering would-be rivals during periods when the budget and thus returns to seizing power are larger. When budgets tighten, autocrats may want to consolidate power to cut back on their patronage obligations. Yet when they lack funds to buy off or repress would-be challengers, leaders may fear stirring discontent among elites by purging coalition members. In this scenario, leaders' immediate concerns about provoking challengers when resources are scant cut against the long-term benefits of consolidating power. Government budgets and power sharing may then be positively or negatively correlated, depending on how leaders assess these tradeoffs.

We present reduced-form evidence that illustrates autocrats' dilemmas. First, cash-strapped autocrats tend to concentrate power; budget windfalls promote power sharing. Exploiting the as-if random discovery of giant oilfields — an identification strategy introduced in Lei and Michaels (2014) — we show that these resource windfalls increase the likelihood and extent of power sharing in unconstrained autocracies.[1] Second, we find that these autocrats are more likely to be immediately deposed if they concentrate power when budgets are tight. Existing research also argues that purging is expensive, which is why cabinet appointments constitute credible promises future patronage (Arriola, 2009; Paine, 2020). Our reduced-form evidence suggests that cash-strapped autocrats more often attempt to concentrate control despite this high cost and the heightened risk removal.

We develop a structural model that reveals the dynamic, long-run incentives that help rationalize the actions of these forward-looking autocrats. Beggarly autocrats do not expect their budgets to quickly rebound; budgets more often

[1]Consistent with these causal estimates in Table 3, we present conditional correlations in Online Appendix Table A.13 that smaller budgets are associated with less power sharing in oil-producing autocracies. Using Geddes *et al.*'s (2018) data on autocracies from 1946 to 2010, we also find that economic decline is associated with greater personalism (i.e., concentration of power in the ruler) in models with country and year fixed effects, further reduced-form evidence that resource shortfalls coincide with autocratic tightening (results upon request).

persist. Anticipating prolonged budget shortfalls, they gamble and attempt to consolidate power. Over the short-term, this power grab is both costly and raises their risk of removal. Yet, if they survive the initial tumult, they bolster their long-term rents and survival prospects: sidelining rivals reduces their patronage obligations, increases their share of the rents from office, and raises the likelihood that they weather subsequent low-budget periods.

Our analysis combines two strands of work in political economy. The first strand of research focuses on the determinants of power sharing, i.e., when and how autocrats share power (Beiser-McGrath and Metternich, 2020; Francois *et al.*, 2015; Meng, 2019; Paine, 2022). With the exception of Caselli and Tesei (2016), which we discuss below, existing research has not focused on government revenues as a driver of power sharing. The second strand studies the effects of power sharing. Gandhi and Przeworski (2007) and Arriola (2009), for example, focus on how power sharing affects leaders' tenure. While this empirical research sometimes includes the government's budget (or resource endowments) as a covariate, it does not explore whether budgets moderate the effects of power sharing on autocratic survival.[2] Likewise autocrats' decisions to share power can affect governments' budgets. By including other elites in their ruling coalitions or devolving power to parties or legislative bodies, autocrats can ameliorate commitment problems (i.e., concerns about expropriation) that deter private investment, undermine economic development, and limit their tax base (Gandhi and Przeworski, 2006; Gehlbach and Keefer, 2011).

Our structural approach integrates these literatures. It illustrates why the government's (anticipated) budget influences an autocrat's decision to consolidate or share power, how those decisions interact with the budget to affect the leader's survival, and how the budget evolves in response to the leader's choices. More technically, we write down and estimate a dynamic discrete-choice decision problem in which an autocrat repeatedly decides whether or not to share power with rival groups. The model incorporates three essential features of autocratic decision-making. First, including or excluding rival groups not only affects the autocrat's office benefits today, but also their likelihood of survival and tomorrow's budget. Second, the autocrat makes these decisions to maximize long-term expected utility, endeavoring to retain power and maximize rents. Third, power-sharing decisions persist: an inclusive (exclusive) government remains the status quo until the autocrat consolidates (shares) power, a potentially costly action. These features generate a realistic, dynamic tension: an autocrat may want to cut in or exclude rivals today, but worries that tomorrow's budget may render that choice untenable.

[2] Our theoretical focus is on government budgets rather than country-level economic performance more broadly, which is the focus of Bueno de Mesquita and Smith (2010) and Geddes *et al.* (2018). This choice is informed by recent work that views power sharing as a way to credibly commit government funds to opposition groups (Francois *et al.*, 2015; Meng, 2019; Paine, 2020).

We fit the model to data that includes the tenures, budgets, and power-sharing decisions of over 300 autocrats in the post-war period. We first estimate the effects of power sharing — operationalized as the inclusion or exclusion of politically relevant groups from the ruling coalition — on autocratic survival and government budget levels.[3] Given these effects, we then estimate autocrats' payoffs and costs to sharing power or excluding rivals. This structural approach reveals how autocrats tradeoff the effects of power sharing on their political survival, rents, and future budgets. It generates three primary contributions.

First, while shrinking the ruling coalition allows autocrats to consume a larger share of rents in the long term, it entails substantial upfront costs. In terms of leader per-period payoffs, we estimate that the upfront cost of excluding a rival group from the ruling coalition is larger than the per-period cost of sharing power. Furthermore, this immediate cost of exclusion varies in sensible ways: autocrats with fewer institutional constraints or a military pedigree pay a smaller, if still substantial, cost. In terms of leader survival, we find that actively excluding the opposition can immediately imperil survival especially when government budgets are tight. Together, these results imply that power sharing cannot be cheaply undone through purging and, therefore, constitutes a meaningful commitment to future spoils even in autocracies. The result confirms a common but untested assertion that cabinet posts represent "credible" promises of future patronage (e.g., Arriola, 2009; Paine, 2020).

Second, we find that large budgets are necessary for autocrats to share power and maintain inclusive ruling coalitions. When budgets are tight, autocrats more often exclude other groups and then maintain exclusive coalitions. Our structural analysis uncovers the dynamic incentives that generate this behavior. Autocrats with small budgets and inclusive coalitions face a dilemma: excluding potential opponents from a weak financial position increases leaders' chances of being immediately ousted by around 40 percentage points. Yet, maintaining their inclusive coalition with a meager budget also leaves them vulnerable; leaders with tight budgets have larger probabilities of removal with inclusive coalitions than with exclusive coalitions, a difference of roughly 5 percentage points. When autocrats expect lean times to persist, they risk excluding other elites and paying the upfront costs. Should they survive the instability that follows, they will have reduced their patronage obligations, increasing their share of the office spoils, and likelihood of surviving subsequent low-budget

[3] As described below, we use politically relevant societal (i.e., ethnic, linguistic, or religious) groups as defined in the ethnic power relations (EPR) data, because it provides a tractable way of coding power-sharing decisions across the vast majority of unconstrained autocracies (Beiser-McGrath and Metternich, 2020). We show that using the EPR does not meaningfully change the composition of our sample and compare our power-sharing measure constructed from the EPR to others in the literature that do not use the EPR.

periods. These predictions do not describe some unrecognizable sovereign: we show that 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 and find that budgetary expansions (on the scale of recent commodity booms in Africa) generate lasting changes in the likelihood that rulers include potential opponents in their ruling coalitions. After 25 years and despite intervening budget volatility, the autocrat that starts from the more auspicious fiscal position is 12 percentage points more likely to adopt power sharing.

Our theoretical framework is essential for these conclusions. With a one-shot interaction, there would be few incentives for cash-strapped autocrats to purge, as excluding rival groups on an empty budget both increases the autocrat's chances of immediate removal and carries substantial cost. A dynamic model is therefore necessary to explain exclusion when budgets are tight. In addition, our counterfactuals highlight the importance of far-sighted rulers and persistent budgets. Our analysis suggests that as-if random budget fluctuations may not have a large impact on power sharing if autocrats do not expect these shocks to generate persistent changes in their fiscal resources (see Ross, 2015, for a related discussion).

Our work builds upon several recent papers on autocratic survival. Roessler (2011) highlights the dilemma that autocrats face: do they reduce the risks of coups by excluding potential rivals, or mitigate the risk of insurgency by including opponents (see also Roessler and Ohls, 2018)? Recent theoretical work from Meng (2019) and Paine (2020) models this tradeoff in dynamic bargaining environments in which shocks, either to political power or budgets, create commitment problems and bargaining failures between autocrats and their rivals. In these models, autocrats can share power to mitigate such commitment problems, yet doing so leaves autocrats more vulnerable to removal should bargaining fail.

In addition, Caselli and Tesei (2016) and Bidner *et al.* (2015) share our interest in how budget fluctuations affect autocrats' incentives to cede power. Beyond our structural approach, our paper differs from these in two important respects. Empirically, they study changes in political institutions as measured by Polity scores and their components. Caselli and Tesei (2016) find that undemocratic regimes become more autocratic after budget windfalls,[4] and Bidner *et al.* (2015) show that this relationship is primarily driven by decreases

[4] As Caselli and Tesei (2016, Figure 3, p. 587) demonstrate, this effect only appears in country-years with Polity scores between −5 and 0, which are traditionally considered anocracies. By contrast, we find that windfalls encourage inclusive ruling coalitions in our sample of autocracies. Only 23% of our sample of admin-years has Polity scores between −5 and 0; over 74% of our sample scores below −5.

in the competitiveness of executive selection.[5] In contrast, we examine how autocrats rearrange their ruling coalitions by including or excluding politically relevant groups. As such, we more directly measure leaders' actions, rather than analyzing regime type, which may incorporate choices or institutions beyond leaders' direct control. Theoretically, we incorporate a realistic, dynamic tension whereby autocrats' decisions persist, and they have to take potentially costly actions to unwind past power-sharing arrangements. Autocrats may, for example, need to employ costly force to purge rivals that they previously invited into their ruling coalitions. This modeling choice also differentiates our work from Francois *et al.* (2015) who use a structural model to explain how leaders compose their ruling coalitions. While they focus on how ethnic divisions shape cabinet composition in African countries, we focus on how autocrats' power-sharing strategies shape and respond to government budgets, allowing us to quantify both the short- and long-term effects of budget shocks on power sharing.

Before proceeding, it is important to acknowledge a modeling choice that deviates from other formal work on autocratic survival: the autocrat is the only actor in our model. This is also different from the model of power sharing analyzed in Francois *et al.* (2015).[6] On the one hand, our decision-theoretic approach allows us to accommodate the government's budget and power-sharing decision as endogenous and persistent state variables in a dynamic setting. The structural analysis would be substantially complicated by the introduction of game-theoretic considerations; dynamic discrete-choice games can have multiple equilibria, for example. On the other hand, our approach does not unpack the mechanisms through which autocrats' decisions affect their survival and future budgets (e.g., by affecting the choices of other elites). Two reasons inform our decision to trade off theoretical complexity for tractability. First, previous work provides game-theoretic underpinnings for why inclusive coalitions affect autocratic survival (Meng, 2019; Paine, 2020) and government revenues (Gehlbach and Keefer, 2011). We build on this theoretical literature and study how forward-looking autocrats make power-sharing decisions that incorporate the empirical relationships between leaders' actions, survival, and

[5]Bidner *et al.* (2015, Table 3, p. 38) find no relationship between budget windfalls and political inclusiveness in their sample. Their results likely differ from our own because of how they measure inclusiveness and the much more varied set of regimes included in their analysis. They use a binary measure of inclusiveness that only takes a 1 in a country-year if Polity codes the competitiveness of participation as 4 (transitional) or 5 (competitive). The autocracies in our sample almost never cross this threshold: only 4.1% of our observations would be considered "inclusive" by Bidner *et al.*'s (2015) definition; nearly 80% of our observations score 1 (repressed) or 2 (suppressed) by Polity's measure. Overall, the variation in power sharing that we study is not captured by their measure. Bidner *et al.* (2015, Figure A2) shows that the inclusiveness they study emerges in countries with Polity2 levels around 8, which are countries that have been excluded from our sample.

[6]The structural conflict literature in international relations, for example, also considers games (e.g., Crisman-Cox and Gibilisco, 2018; Lewis and Schultz, 2003; Signorino, 1999).

the budget. Second, our counterfactual exercises consider how power sharing evolves when autocrats assume power with different budget endowments, and budgets are observed in our data. We do not explore how autocrats' decisions change as a function of institutional characteristics or other actors' preferences.[7] Thus, we do not explicitly model or estimate the effects of changing these features.

Model Rationale

Leader's Goals

"In my account, all dictators are presumed to be motivated by the same goal — survive in office while maximizing rents," Magaloni (2008, p. 717) writes. This is common in models of authoritarian decision-making, even those which acknowledge that autocrats may also have policy preferences (e.g., Bueno de Mesquita *et al.*, 2005; Gandhi and Przeworski, 2007).[8] Accordingly, we assume that leaders' maximize their expected discounted payoffs while in office, which comprise survival and rents.

An autocrat's survival and 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, only 10% lost power in a popular uprising during the post-WWII era. Roessler (2011, p. 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."

Ruling Coalitions

Autocrats carefully compose their ruling coalitions to ensure survival (Beiser-McGrath and Metternich, 2020; Bueno de Mesquita *et al.*, 2005; Francois *et al.*, 2015). Gandhi and Przeworski (2007, p. 1281–2) observes that the "distribution of spoils" is one of the primary instruments that autocrats use to "solicit cooperation and thwart rebellion." Inclusion in the ruling coalition represents an important type of patronage. Arriola (2009, p. 1340–1) argues that "leaders use high-level government appointments to make credible their

[7] By contrast, the counterfactuals in Francois *et al.* (2015) show the effects of changing the cost of revolution, the likelihood of successful coups, and the size of the non-transferable office benefits, which are key structural parameters that are estimated. For example, they trace an increase in the cost of revolution to changes in excluded elites' payoffs through to leaders crafting more exclusive coalitions.

[8] Our model permits leaders to have policy preferences and, thus, find concessions costly. This is reflected in the cost of adopting inclusive ruling coalitions.

promises to distribute patronage among political elites and the constituencies whom they represent." Likewise, Kramon and Posner (2016, p. 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." While autocrats cannot credibly promise ongoing financial transfers, this research asserts that cabinet positions are sticky. Sacking a minister is assumed to be costly, and thus the appointment entails a more credible promise of future spoils.

There are, however, downsides to including potential rivals in the ruling coalition. Not only do inclusive governments siphon spoils away from the autocrat, but they can also raise the risk of removal. Government insiders can launch coups, which are more likely to overthrow the ruler than challenges by government outsiders (Roessler, 2011; Roessler and Ohls, 2018). Meng (2019) and Paine (2020) illustrate how shocks to political power or budgetary resources, respectively, create commitment problems within inclusive ruling coalitions raising the risk of coups. As such, leaders may at times want to exclude would-be rivals from their coalitions to shore up their survival prospects. Excluding rivals can be costly, requiring upfront security expenditures (Wright *et al.*, 2013) or inviting counter-coups (Sudduth, 2017).

Budgets

Leaders more easily retain power when they control large flows of unearned income, such as royalties from natural resources or foreign aid (Bueno de Mesquita and Smith, 2010; Morrison, 2009). The budget also affects the sustainability of different ruling coalitions. Indeed, coup-proofing requires considerable resources (Quinlivan, 1999), and negative economic performance elevates coup risk (Londregan and Poole, 1990). "Reform and economic austerity can be imposed on the general population," observes van de Walle (1993, p. 398) in his study of Cameroon, but "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." 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. By contrast, leaders flush with revenues survive longer because they can afford to dole out patronage, "exchanging money for loyalty" (de Waal, 2015, p. 3).

Finally, budgets not only shape leaders' strategies, they also reflect how leaders govern, as alluded to above. Autocrats' previous power-sharing decisions could influence the course of the economy and, thus, future budgets. Inclusive governing coalitions may limit leaders' discretion and, thus, ameliorate the commitment problems that undermine private investment and economic growth (Gandhi and Przeworski, 2006; Gehlbach and Keefer, 2011).

Model

We consider autocrats $\{1, \ldots, L\}$ where $l \in \{1, \ldots, L\}$ denotes the model parameterized for a specific leader. The setup is a dynamic discrete-choice decision problem in which 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 they first observe 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 observable to researchers. 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 equally spaced budget levels such that $j' > j$ if and only if $b_{j'} > b_j$. The second, $C_l^t \in \{0, 1\}$, indicates whether potential rivals (who we term the opposition) are included in the ruling coalition at the beginning of the period. The remaining state variable, $\varepsilon_l^t \in \mathbb{R}^2$, captures the temporary costs and benefits to excluding or including the opposition that are known to leader l but unobservable to the researchers.

After observing s_l^t and ε_l^t, the leader decides whether or not to change their ruling coalition. If $C_l^t = 0$, then the 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 coalition, and the leader decides whether or not to exclude the opposition. Formally, l chooses an action $a_l^t \in A(C_l^t)$, where

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

$a_l^t = i$ denotes including the opposition; $a_l^t = e$, excluding them; and $a_l^t = \varnothing$, maintaining the status quo.

After the leader chooses action a_l^t, they accrue payoffs: $u_l(a_l^t, s_l^t; \theta) + \varepsilon_l^t(a_l^t)$. The function $u_l(a_l^t, s_l^t; \theta)$ captures the systematic component of the leader's utility and is parameterized by the to-be-estimated vector θ. We give u_l the following form:

$$u_l(a_l^t, s_l^t; \theta) = \underbrace{B_l^t}_{\text{Budget benefits}} + \overbrace{x_l \cdot \beta}^{\text{Office benefits/costs}} + \underbrace{\rho \cdot \mathbf{I}(a_l^t, C_l^t)}_{\text{Cost of inclusion}} + \underbrace{\mathbf{E}(a_l^t) \cdot x_l \cdot \kappa}_{\text{Cost of exclusion}}, \quad (1)$$

where $\theta = (\beta, \kappa, \rho)$, x_l is a vector of leader characteristics, $\mathbf{I}(a_l^t, C_l^t)$ indicates whether the opposition is included in the government, and $\mathbf{E}(a_l^t)$ indicates whether the leader removed the opposition.[9]

The payoffs in Equation (1) have a natural interpretation. First, the leader receives the budget B_l^t, and this revenue is offset by $x_l \cdot \beta$. The adjustment

[9] Specifically, $\mathbf{E}(a_l^t) = \mathbb{1}(a_l^t = e)$, and $\mathbf{I}(a_l^t, C_l^t) = \mathbb{1}((a_l^t, C_l^t) \in \{(i, 0), (\varnothing, 1)\})$, where $\mathbb{1}(\cdot)$ is the indicator function. We sometimes conserve on notation by using just $\mathbf{E}_l^t$ and $\mathbf{I}_l^t$.

$x_l \cdot \beta$ could be positive if governing entails additional benefits beyond observed budget revenues, and it could be negative if the leader cannot consume benefits equivalent to the entire government budget. This adjustment can also vary with leaders' characteristics: for example, leaders of war-ravaged countries may derive fewer benefits from office.[10] Second, the coefficient ρ captures the cost (or benefit) of sharing power.[11] The parameter ρ includes both the monetary resources extracted by the opposition, as well as any ideological or policy costs that the autocrat bears by including the opposition. Finally, $x_l \cdot \kappa$ represents the expected upfront cost of consolidating power, which arises because purging may require the use of force or invite a backlash. If the autocrat can easily oust a coalition member, then $\kappa \approx 0$, which is a case subsumed by the model. These payoffs from of inclusion or exclusion are separate from the effects that these actions have on the leader's survival probability.

Equation (1) does not explicitly incorporate the rents or policy payoffs consumed by the leader, which are unobserved. In standard discrete-choice fashion, we characterize variation in leaders' expected net payoffs from sharing or consolidating power as a function of their observable characteristics.[12] This approach allows us to consider the effects of variables that previous work has found to be important predictors of power sharing in autocracies: the leader characteristics in x_l can amplify (or diminish) the benefits to holding power or the costs of exclusion. For example, we find that autocrats with military backgrounds pay smaller costs to purging, consistent with their connections to the state's security forces.

After the leader accrues payoffs, they may lose power due to removal or death. This occurs with probability $[1 - g_l(a_l^t, s_l^t)]$, where g_l (which we describe below) is a function that depends on the current state and endogenous actions chosen by the leader. If the leader loses power, then their decision process ends, and their payoff in all future periods is zero.[13] If the leader survives, then they enter period $t + 1$, in which case the state variables s_l^t and ε_l^t evolve as follows. First, as is standard in these models, ε_l^{t+1} is drawn from a type-one extreme value distribution with probability density function h, which is independent across states, actions, and time periods. Second, the power-sharing variable

[10] The covariates x_l do not vary over time and, thus, are not indexed by t. If they did, then they would need to be incorporated as additional dimensions of the state space, which exponentially increases the size of the state space and introduces uncertainty as their law of motion would need to be estimated. We adopt the more parsimonious specification because budgets and power sharing are our main variables of interest.

[11] We do not allow the cost of power sharing to vary by observed covariates. While this is not essential for identification, it reduces the dimensionality of the parameter space, which is a feature given the limited number of administrations in our sample.

[12] Analogously, discrete-choice models of market entry in industrial organization rarely incorporate explicit costs and revenues but rather estimate net benefits as a function of observed covariates (e.g., Holmes, 2011).

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

is fully endogenous. If power is shared 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. The function $f_l(b_j; a_l^t, s_l^t)$ (which we describe below) denotes the probability that budget level $b_j \in \mathcal{B}$ is next period's budget given actions a_l^t and the current state $s_l^t = (B_l^t, C_l^t)$. Period $t+1$'s expected budget depends not only on the budget in period t, but can also depend on the power-sharing decision of the leader.

Leader's Choice Probabilities

The leader maximizes the expected sum of their discounted utility. Generally, discount factors in dynamic discrete-choice models are not point-identified (Abbring and Daljord, 2020). As such, we fix the discount factor to $\delta = 0.90$. As is standard in dynamic programming, the leader's probability of choosing action a_l is Markovian (only depending on the state s_l) and unique. Let $V_l(s_l)$ denote the leader's expected continuation value in state s_l, and let $V_l = (V_l(s_l))_{s_l \in \mathcal{S}}$. For housekeeping, let $F_l(s_l'; a_l, s_l)$ denote the transition probabilities over the state space $\mathcal{S}$ implied by f_l and $C^{t+1} = \mathbf{I}(a_l^t, C_l^t)$. That is, $F_l(s_l'; a_l, s_l)$ is the probability of transitioning to state s_l' given a_l was chosen in state s_l. Following Rust (1994), we characterize the leader's value function using the integrated Bellman equation as

$$\begin{aligned} V_l(s_l) = \int \max_{a_l \in A(C_l)} \Bigg\{ & u_l(a_l, s_l; \theta) + \varepsilon_l(a_l) \\ & + g_l(a_l, s_l)\delta \sum_{s_l' \in \mathcal{S}} V_l(s_l') F_l(s_l'; a_l, s_l) \Bigg\} h(\varepsilon_l) d\varepsilon_l \\ \equiv \Upsilon_l(s_l, V_l). & \end{aligned}$$

When deciding optimally, leader l's value function solves

$$\Upsilon_l(V_l) - V_l = 0, \tag{2}$$

where $\Upsilon_l(V_l) = \times_{s_l \in \mathcal{S}} \Upsilon_l(s_l, V_l)$. Because ε_l is type-one extreme value, leader l chooses $a_l \in A(C_l)$ in state s_l with probability:

$$\begin{aligned} &\Pr(a_l; s_l, V_l) \\ &= \frac{\exp\left\{u_l(a_l, s_l; \theta) + g_l(a_l, s_l)\delta \sum_{s_l' \in \mathcal{S}} V_l(s_l') F_l(s_l'; a_l, s_l)\right\}}{\sum_{a_l' \in A(C_l)} \exp\left\{u_l(a_l', s_l; \theta) + g_l(a_l', s_l)\delta \sum_{s_l' \in \mathcal{S}} V_l(s_l') F_l(s_l'; a_l', s_l)\right\}}, \end{aligned} \tag{3}$$

where V_l solves Equation (2). Given the transition functions g_l and f_l and payoff parameters θ, Equation (3) is the likelihood of leader l choosing action a_l in state s_l.

Transition Probabilities

To complete the model, we specify the transition probabilities g_l and f_l, which capture how the leader's actions affect their survival and the evolution of the budget, respectively.

Starting with leaders' survival, let $\mu_l^r[a_l, s_l; \gamma^r]$ denote the expected probability that leader l is removed from office after choosing $a_l \in A(C_l)$ in state $s_l = (B_l, C_l)$. We assume a linear functional form, where γ^r is the vector of to-be-estimated parameters:

$$\mu_l^r[a_l, s_l; \gamma^r] = \gamma_1^r \, \mathbf{I}(a_l, C_l) + \gamma_2^r \, \mathbf{E}(a_l) + \gamma_3^r \, B_l + \gamma_4^r \, \mathbf{I}(a_l, C_l) \cdot B_l + \gamma_5^r \, \mathbf{E}(a_l) \cdot B_l + \gamma_6^r \, Z_l. \tag{4}$$

This linear model has three attractive properties. First, it implies a linear probability model that can be estimated using common methods for panel data. Second, the budget can have direct effects on leaders' survival, as well as effects that depend on their actions through the interacted terms.[14] Finally, the vector Z_l can include leader-specific covariates (e.g., age when assuming power, country fixed effects), alleviating concerns about omitted variables. In a similar manner, we define $\mu_l^d[a_l, s_l; \gamma^d]$ as the expected probability that leader l dies in office, where μ_l^d takes the same form as μ_l^r in Equation (4). A leader's expected probability of survival is then $g_l(a_l, s_l) = (1 - \mu_l^r[a_l, s_l; \gamma^r]) \cdot (1 - \mu_l^d[a_l, s_l; \gamma^d])$ — the probability they are not removed *and* do not die in office.

For the evolution of the budget f_l, we pursue a similar approach. We account for multiple discrete budget levels with Tauchen's (1986) model of a discrete autoregressive (AR-1) process. Let $\mu_l^b[a_l, s_l; \gamma^b]$ and σ_l^2 denote the mean and variance of the budget after the autocrat chose a_l in state $s_l = (B_l, C_l)$, where μ_l^b takes the same form as μ_l^r in Equation (4). Given the autocrat chose a_l in state $s_l = (B_l, C_l)$ and period t, budget level $b_j \in \mathcal{B}$ arises in period $t + 1$ with probability

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

[14] While we focus on leaders' power-sharing decisions, the model accommodates leaders expending their budgets on unobserved actions that also affect their survival (e.g., transfers, defense spending). If large budgets enable leaders to shore up support, then their likelihood of survival will increase with the budget level. If, by contrast, a larger budget entices would-be challengers, then the leaders' survival prospects could decline with the budget level, all else being equal.

where $2d$ measures the distance between the equally spaced budget levels.[15] In other words, f_l is the discretized normal distribution with mean $\mu_l^b[a_l, s_l; \gamma^b]$ and variance σ_l^2. The parameters γ^b and σ_l can be estimated using standard autoregressive models given a sufficient number of discrete budget levels. Notice that μ^r, μ^d, and μ^b all use the same functional form and, thus, permit similar flexibility: leaders' survival and the evolution of the budget can depend on the past budget, leaders' actions, and the interaction of the two.

Numerical Example

Our model is decision-theoretic. While potential challengers play an important role, their maneuvering is captured in the functions g_l and f_l, which summarize how the leader's actions affect their survival and the evolution of the budget. Such a setup can still capture power-sharing tradeoffs highlighted in the theoretical literature, albeit in a reduced-form way.

To better illustrate this, we provide a simplified example. There are two budget levels, small and large, $\mathcal{B} = \{0, 5\}$. Office-holding benefits are modest, $x_l = 1$ and $\beta = 1$, and leaders face more substantial costs of inclusion and exclusion, $\rho = -2$ and $\kappa = -3$. Sharing power and actively purging the opposition are costly, and the former carries less cost than the latter ($\kappa < \rho < 0$). Together, this implies that short-sighted autocrats would tend to preserve the status-quo power-sharing arrangement.

The probability that leaders survive in office after choosing action a_l in state s_l is

$$\begin{aligned} g_l(a_l, s_l) = 0.90 - 0.15\,\mathbf{I}(a_l, C_l) - 0.25\,\mathbf{E}(a_l) - 0.04B_l \\ + 0.088\,\mathbf{I}(a_l, C_l) \times B_l + 0.07\,\mathbf{E}(a_l) \times B_l, \end{aligned} \tag{5}$$

which is equivalent to the representation in Table 1. Notice that g_l explicitly models the effects of exclusion and inclusion as a function of the current budget level, and both actions are more detrimental to the leader's survival with low budgets. As for fiscal resources, the budget in period t remains the budget in period $t+1$ with probability $\phi \in (0, 1)$, where we fix $\phi = 0.95$ as the persistence of the budget in the example.[16]

High budget periods exhibit a tradeoff emphasized in the literature on power sharing: excluding the opposition imperils the leader's survival but also increases their rents. Inversely, inclusion enhances survival but decreases per-period consumption. If the budget falls, then leaders with an inclusive coalition face a dilemma. If they exclude the opposition, they both pay κ

[15] This expresses the probability of budget level b_j for $j = 2, \ldots, J-1$. It is straightforwardly modified to account for the smallest and largest budget levels, b_1 and b_J.

[16] This is a simplification to ease exposition. The model allows the expected budget in period $t+1$ to depend on the leader's power-sharing choices in period t via f_l and μ_l^b.

Table 1: Leader's survival probabilities in the numerical example.

State (s_l)			
Budget (B_l)	Coalition (C_l)	Action (a_l)	Survival prob. (g_l)
Low (0)	Exclusive (0)	Status Quo ($\varnothing$)	0.90
Low (0)	Exclusive (0)	Include (i)	0.75
High (5)	Exclusive (0)	Status Quo ($\varnothing$)	0.70
High (5)	Exclusive (0)	Include (i)	0.99
Low (0)	Inclusive (1)	Status Quo ($\varnothing$)	0.75
Low (0)	Inclusive (1)	Exclude (e)	0.65
High (5)	Inclusive (1)	Status Quo ($\varnothing$)	0.99
High (5)	Inclusive (1)	Exclude (e)	0.80

Table 2: Optimal choice quantities.

State $s_l = (B_l, C_l)$	Continuation value $V_l(s_l)$	Pr(Changing status Quo) $\Pr(a_l \neq \varnothing; s_l, V_l)$
$(0,0)$	12.42	0.00
$(0,1)$	6.61	0.82
$(5,0)$	31.74	1.00
$(5,1)$	31.74	0.00

(which exceeds the per-period cost of sharing power) and their survival chances drop to 0.65, 10 percentage points lower than their survival probability if they maintain the status quo. These are the large and immediate downsides of excluding rivals when budgets are tighter. Yet, if they expect the lean times to persist, then they may still choose to consolidate power. Leaders with exclusive coalitions are best able to weather low-budget periods: if they simply maintain that status quo, their survival probability is 0.90. While the immediate downside is large, the long-term benefits, in terms of survival and rents, can be even larger for leaders with longer time horizons.

Table 2 computes the leader's value functions and associated choice probabilities when deciding optimally. 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.[17] The third column reveals how the leader's survival strategies change across the different states of the world.

[17]These specific values are the solution to Equation (2) given the payoff parameters and the definitions of g_l and f_l.

These probabilities are computed using Equation (3) given V_l in the second column. When budgets are tight, leaders want to maintain an exclusive ruling coalition. They almost never adopt inclusive governments when the opposition is already excluded. If necessary, they are inclined (with probability 0.82) to remove the opposition to consolidate power. Though it initially reduces survival prospects and per-period payoffs, they prefer to remove the opposition as the low-budget periods are likely to persist. In high-budget periods, leaders almost surely create or maintain inclusive coalition, as far-sighted autocrats sacrifice per-period rents for higher survival chances.

To illustrate why rulers sometimes choose coalitions that are not in their immediate interests, Figure 1 graphs expected per-period consumption over time as a function of the initial states and actions. In these graphs, we fix initial states and actions in period $t = 1$, and then assume that the leader chooses optimally in all future periods $t > 1$. We compute the leader's expected per-period consumption over time via simulation. When the autocrat is removed, payoffs in future periods are zero.

In the left panel, the leader starts with the smaller budget. If they inherit and maintain an exclusive ruling coalition (the top, black line), this provides

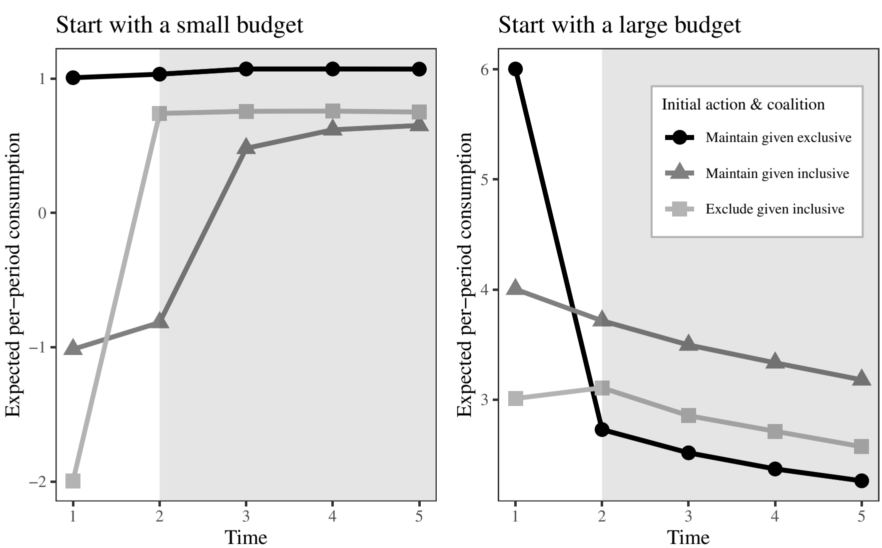

Figure 1: Expected per-period consumption in the numerical example.

Expected consumption over time given a small initial budget (left) and a large initial budget (right). States and actions are fixed in period $t = 1$. The leader chooses optimally in period $t > 1$, shaded in gray.

the highest initial (in $t = 1$) and cumulative consumption. If the leader inherits an inclusive coalition, the figure illustrates the tension between their short- and longer-run interests. If the leader excludes rivals (the lightest grey line), they receive the lowest consumption in $t = 1$, because the cost of purging is larger than the cost of power sharing. And yet, after purging, the leader's consumption can rebound. If the budget is persistent (ϕ close to 1), then an exclusive coalition provides the leader the best survival prospects and smallest patronage obligations in subsequent periods ($t > 1$). So long as the leader is forward-looking and does not discount the future too aggressively, the long-run benefits of excluding rivals are likely to outweigh the short-run expense.[18]

In the right panel of Figure 1, the leader starts with the larger budget. Maintaining an exclusive coalition gives the leader the highest initial consumption, as sharing power is costly. However, refusing to share power when the budget is large reduces the leader's survival probability, and this heightened risk of removal lowers their expected consumption in future periods. Forward-looking leaders have a dynamic incentive to include rivals when the budget is large, sacrificing rents today for higher survival and thus future office benefits.

In Figure 1, we fixed $\delta = 0.9$. But we noted above that the leader's decision depends on their time horizon. If the leader places little weight on the future, then longer-run benefits or costs are less likely to influence their actions. We illustrate this in Figure 2, which shows how our exemplary leader's behavior changes as a function of their discount factor, i.e., the degree to which they are forward looking. Suppose the leader starts with a small budget and inclusive coalition (bottom left panel). When they write off future consumption ($\delta = 0$), they are inclined to maintain the present power-sharing arrangement to avoid the upfront cost of purging (as $\kappa < \rho < 0$). As δ increases and the leader places more weight on future consumption, so too does the probability that they exclude rivals, as this increases the longer-term survival prospects and office benefits. Suppose instead that the leader starts with a large budget and exclusive coalition (top right panel). If $\delta = 0$, the leader is inclined to forego power sharing and the associated patronage costs (ρ). Facing the same scenario, a more forward-looking leader has a high probability of including rivals, paying ρ in return for a higher probability of surviving in office. Figure 2 shows how discount factors shape autocrats' decisions about whether to share or consolidate power as budgets fluctuate.

[18] We only fix the leader's action in $t = 1$; in subsequent periods, the leader chooses optimally. A low-budget leader who inherits and maintains an inclusive coalition in $t = 1$ sees their per-period consumption rebound by $t > 2$. This improvement reflects, in part, this leader's propensity to purge rivals when we allow them to choose optimally in $t > 1$.

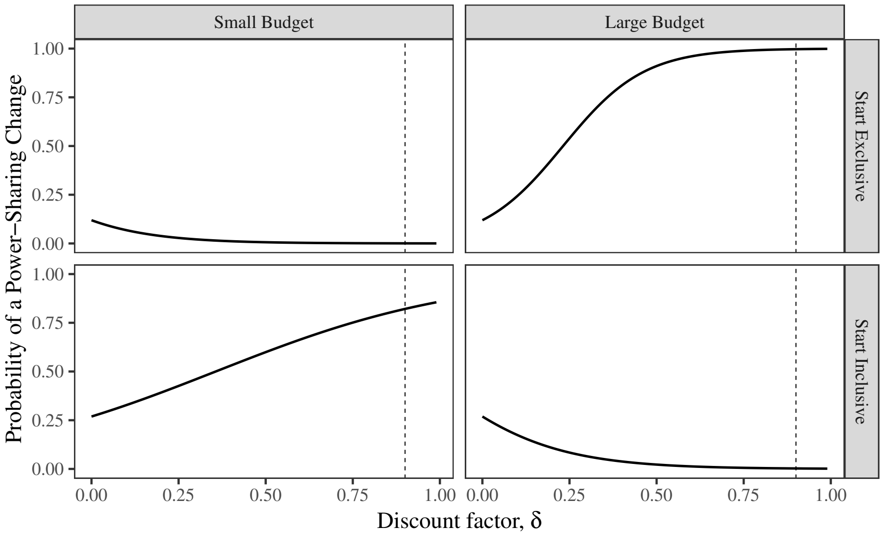

Figure 2: Patience and probability of inclusion and exclusion in the numerical example. We graph the probability of including (top) and the probability of excluding (bottom) as a function of the autocrat's discount factor, δ. Columns correspond to the two budget levels. The dashed vertical line denotes $\delta = 0.9$, which is the value generating the results in Table 2.

Data

Sample

We restrict attention to autocratic regimes that impose few or no constraints on leaders — settings where, as in our model, leaders' actions are not institutionally constrained. Specifically, our sample constitutes administrations that score 5 or below on the Polity2 scale; are classified as non-democracies according to the Autocracies of the World database; and have, at most, limited constraints on executive authority as recorded in the Polity database.[19] As our measurement of leaders' actions (discussed below) relies on the inclusion or exclusion of different politically relevant groups, we retain countries with multiple politically relevant groups from the EPR dataset. This leaves us with a panel of 303 administrations from 88 countries over 54 years. We measure explanatory variables at the time the leader assumes power, thereby ensuring that sample

[19] Online Appendix Section E contains robustness checks when we change these sample criteria. The Polity and Autocracies of the World criteria are distinct. We record 12 administrations (e.g., Ecuadorian president José Velasco, 1960–61) that have Polity2 scores of less than 5 and at most limited executive constraints but are labeled democracies in the Autocracies of the World database.

selection is not an outcome of leaders' decisions in office. Online Appendix Table A.3 provides summary statistics.

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) (Banks and Wilson, 2014; Feenstra *et al.*, 2015; ICTD/UNU-WIDER, nodate). While the sources employ different definitions of government revenue, the pairwise correlations across the series (see Online Appendix 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% of country-years.[20] By contrast, the CNTS covers 65% 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 a reflection of leaders' priorities. Furthermore, our model accommodates the possibility that autocrats cannot control 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.

Leader's Actions

We use the EPR data to code whether leaders include or exclude rival groups (Cederman *et al.*, 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 very broadly, incorporating groups defined by a common language, race, or religion. We only retain administrations with at least two groups in the EPR, as mentioned above. This criterion leads to relatively few exclusions: unconstrained autocrats in eight states are missing from the EPR; another 11 states include only one group (see Online Appendix Table A.4). The excluded states tend to be small (e.g., Comoros, Suriname, Lesotho) and collectively account for just 35% of the people living in unconstrained autocracies.[21]

[20] Online Appendix Table A.2 shows that listwise deletion due to missing covariates does not meaningfully change the composition of our sample.

[21] Administrations excluded at this stage do not differ from our sample along most dimensions: the timing of the administration, polity score, the leader's age upon assuming office, or whether the leader has a military background. We do, however, drop some small oil-producing countries (e.g., Equatorial Guinea, Oman, Qatar, United Arab Emirates). See Online Appendix Tables A.4 and A.5.

Our baseline coding scheme classifies an administration as exclusive ($C_l^t = 0$) if and only if it is dominated by a single politically relevant group. An inclusive action ($a_l^t = i$) involves adding another group as a junior or senior partner in government from a previously exclusive state ($C_l^t = 0$). An exclusive action ($a_l^t = e$) involves reducing the number of groups in power from a previously inclusive state ($C_l^t = 1$). In all other cases, we code the leader preserving the status quo $a_l^t = \varnothing$.[22] We acknowledge that there are multiple ways code power sharing from the EPR data. In Online Appendix Section A.3, we construct two alternative codings and show that our estimates of the leader's payoffs are largely unchanged across these approaches (see Online Appendix Table A.14).[23]

Our use of the EPR data requires that the leader views elites from other politically relevant ethnic, linguistic, or religious groups as *potential* rivals — an assumption consistent with past research (e.g., Beiser-McGrath and Metternich, 2020). Roessler (2011, p. 324) 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 (Arriola *et al.*, 2021; Francois *et al.*, 2015).[24] If EPR groups are not salient (e.g., contestation occurs along a left-right divide), then this should attenuate our estimates, because the actions we code should not affect the leader's survival (or next year's budget) if they are not relevant to domestic politics. The results we report below suggest that the inclusion and exclusion of these groups affect leaders' budgets and survival prospects.

[22]In the first year of any administration, we code the leader as preserving the status quo, $a_l^t = \varnothing$. Note that this coding also permits incomplete efforts to consolidate power: cases in which the number of groups decreases in t (i.e., a group is excluded), but this does not result in a single politically dominant group.

[23]Francois *et al.* (2015) and Arriola *et al.* (2021) provide more detailed data on ethnic and opposition representation in African countries' cabinets. In Online Appendix Section A.4, we show that measures of power sharing derived from the EPR are positively correlated with measures by these other authors. In Online Appendix Section F, we reestimate the model using data from Francois *et al.* (2015).

[24]We recognize that other forms of power sharing exist, e.g., granting monopolies or decentralization. However, the literature asserts that cabinet appointments represent a more credible promise of ongoing spoils (e.g., Arriola, 2009), and panel data exist on this form of power sharing, enabling empirical analysis.

Survival Data

The Archigos data record the tenure of primary rulers for every independent state until 2015 (Goemans *et al.*, 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 irregularly removed. That latter is defined as “when the leader is 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).[25]

Covariates

Guided by past research on autocratic politics, we include covariates thought to affect leaders’ office benefits and their costs to excluding potential rivals. Using Polity’s executive constraints measure, we code an indicator for whether or not the autocrat has unlimited authority. We also add an indicator for whether or not the leader has a military background (Ellis *et al.*, 2015), as military leaders are thought to generate less rents and have stronger connections to security forces (Yu and Jong-A-Pin, 2016). Because oil-flushed dictators may find it easier to suppress opposition members without harming economic performance (Wright *et al.*, 2013), 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 generate government revenues and discourage leaders from repressing opponents (Gandhi and Przeworski, 2007), we include exports as a percent of GDP from the PWT. All covariates are measured during the year the leader takes office, and we standardize the covariates to have a mean of 0 and a standard deviation of 1.

Estimation

To fit the model to data, we follow a two-step method proposed by Rust (1994, p. 3108): we first estimate how leaders’ actions affect their survival and evolution of the budget (g_l and f_l, respectively) and then estimate leaders’ payoff parameters (θ). Specifically, for the first step we estimate three linear models of the form:

$$Y_l^{t+1} = \gamma_1 \, \mathbf{I}_l^t + \gamma_2 \, \mathbf{E}_l^t + \gamma_3 \, B_l^t + \gamma_4 \, \mathbf{I}_l^t \cdot B_l^t + \gamma_5 \, \mathbf{E}_l^t \cdot B_l^t + \gamma_6 \, Z_l + \varepsilon_l^t, \qquad (6)$$

[25]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.

where l indexes administrations and t indexes years. (Note that the right-hand-side variables lag the outcome by one year.) Y_l^{t+1} is one of three outcomes: irregular removal from power, natural death, and the government budget (logged). $\mathbf{I}_l^t$ indicates whether the leader's action or state are inclusive in year t; $\mathbf{E}_l^t$ indicates whether the leader takes an exclusive action in year t; B_l^t is the logged government budget; and Z_l are leader-specific covariates, including a full set of country fixed effects, the year each leader assumes office, their age at the start of their administration, whether they served in the military, the number of politically relevant groups, and whether the country produces oil.[26] With the exception of the error term, these regression models take the same form as Equation (4).

We use the predicted values from these models to generate the transition probabilities, g_l and f_l.[27] For example, suppose $\widehat{\gamma}^{\,r}$ and $\widehat{\gamma}^{\,d}$ are the estimated regression coefficients from Equation (6), when Y_l^{t+1} is leader removal and natural death, respectively. Then we can compute $g_l(a_l, s_l) = (1 - \mu_l^r[a_l, s_l; \widehat{\gamma}^{\,r}]) \cdot (1 - \mu_l^d[a_l, s_l; \widehat{\gamma}^{\,d}])$, which is the probability that the leader is not removed and does not die in office. The probability function f_l, which describes the evolution of the budget, is computed in a similar manner.

In the second step, we assume that the power-sharing decisions we observe in the data are made by leaders seeking to maximize their discounted expected utility. Equation (3) characterizes the probability that such leaders choose each action in each state. These choice probabilities depend on the functions estimated in the first step (g_l and f_l), a fixed discount factor (δ), and the leaders' payoff parameters (θ). We estimate θ via maximum likelihood. Fixing the other features of our model, each guess of θ generates probabilities that leaders will choose different actions in each state. Our parameter estimates are the value of θ such that those probabilities best match the decisions we see autocrats make in the real world.

More technically, focus on leader l and suppose we see leader l in office for $T_l \in \mathbb{N}$ years. Collect the leader's observed decisions in $Y_l = \{(a_l^t, s_l^t)\}_{t=1}^{T_l}$, where (a_l^t, s_l^t) means leader l chose action $a_l^t \in \{\varnothing, i, e\}$ in state $s_l^t = (B_l^t, C_l^t)$ in the data Y_l. Equation (3) characterizes the probability that leader l chooses a_l^t in state s_l^t. Given a vector of payoff parameters θ, we can write the likelihood of observing Y_l as

$$\mathcal{L}_l(\theta \mid Y_l) = \prod_{t=1}^{T_l} \Pr(a_l^t; s_l^t, V_l).$$

[26]These covariates maintain the model's stationarity while limiting confounding due to omitted features of states or leaders that influence their actions, budgets, and survival in office. Online Appendix Section B describes these covariates.

[27]To estimate the conditional variance of the budget (σ_l^2), we compute the variance of the residuals from Equation (6) when the dependent variable is the government budget. We pool information across leaders from the same country.

Inspecting Equation (3) shows that, if the leader were short-sighted ($\delta = 0$), then $\mathcal{L}_l(\theta \mid Y_l)$ would be a standard logit likelihood, where the per-period payoffs u_l would represent the systematic component of the leader's latent choice utilities. If $\delta > 0$, then the leader anticipates the future. As such the choice probabilities incorporate the leader's expected continuation values. Notice that δ is a fixed constant, f_l (which determines F_l) and g_l are fixed to the fitted values in Step 1, and θ is given. To evaluate $\Pr(a_l^t; s_l^t, V_l)$, and hence the likelihood $\mathcal{L}_l(\theta \mid Y_l)$, the only unknown quantities in Equation (3) are the leader's continuation values, V_l. In Equation (2), V_l is the solution to $\#\mathcal{S}$ equations with $\#\mathcal{S}$ unknowns. In other words, Equation (2) implicitly defines the leader's continuation value as a function of the payoff parameters, θ (along with δ, g_l, and f_l, which are known and fixed in this step). As such, we can compute V_l by solving Equation (2) using a numerical equation solver, allowing us to subsequently evaluate $\mathcal{L}_l(\theta \mid Y_l)$.[28] The overall likelihood is $\mathcal{L}(\theta \mid Y) = \Pi_{l=1}^{L} \mathcal{L}_l(\theta \mid Y_l)$, where $Y = \{Y_l\}_{l=1}^{L}$ collects the observed decisions of all leaders. To compute the overall likelihood at parameters θ, we need to evaluate $\mathcal{L}_l(\theta \mid Y_l)$ for each leader l, which means we need solve Equation (2) for each leader l. To estimate θ, we maximize the log of $\mathcal{L}(\theta \mid Y)$.[29]

This estimation procedure is called the nested fixed point algorithm (Rust, 1994, p. 3108). For every guess of potential payoff parameters θ and every leader l, we compute V_l by solving Equation (2). This allows us to the evaluate the log-likelihood at θ. This is the "inner" algorithm in the language of Rust (1994). We then search over θ to maximize the overall log-likelihood. This is the "outer" algorithm. In this step, we leverage three sources of variation in the data. We can pin down leaders' office benefit parameters (β), because we have normalized the payoff to losing power to zero. All else being equal, leaders who take actions that heighten their risk of removal have smaller office benefits. We recover the parameters affecting the cost of exclusion (κ) from variation in leaders' propensity to exclude groups from a previously inclusive coalition. All else equal, leaders who more frequently purge the opposition from inclusive coalitions will have smaller upfront costs of removal. Finally, we isolate leaders' disutility from power sharing (ρ) from the frequency with which they include new groups in a previously exclusive administration.

[28] The integral in expression $\Upsilon_l(s_l, V_l)$ has a closed-form solution because $\varepsilon_l^t(a_l^t)$ is drawn independently and identically from a type one extreme value distribution (McFadden, 1978, Corollary p. 82). The solution is a smooth function of θ and V_l, so we use Newton's method to solve Equation (2). The method requires an initial guess, which we provide by repeatedly iterating Υ_l.

[29] We use the nonlinear minimization function `nlm` in the `R` programming language. The function uses a Newton-type, hill-climbing algorithm, and we provide first derivatives of the likelihood function using the implicit function theorem as described in Rust (1994, p. 3110). It also offers a derivative-check option — which our implementation passes — to test the code for exact derivatives against finite-difference approximations.

Results

Reduced-form Evidence that Budgets Affect Power Sharing

We first use our data to estimate the reduced-form relationship between budgets and power sharing. To provide more causal evidence, we use a research design introduced by Lei and Michaels (2014), which exploits the as-if random timing of giant oilfield discoveries (encompassing 500 million barrels of ultimate recoverable reserves), which generate a major budget windfall.[30] Focusing on a relatively short window after such discoveries (2–6 years) and conditioning on country and year fixed effects, Lei and Michaels (2014) argue that the timing of such discoveries is plausibly exogenous, i.e., beyond the control of any cash-hungry autocrat. We are interested in identifying the effect of these government budget shocks on leaders' power-sharing decisions.

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 Online Appendix Table A.12 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 15–20%.

In Table 3, we show that these discoveries increase the likelihood of an inclusive administration (models 1–2) and reduce the probability that a single

Table 3: Reduced-form relationship between giant oil discoveries and power sharing.

	$\mathbf{I}_l^t \equiv$ Included		No dominant group		# Included groups	
Giant oil discovery	0.06		0.06		0.06	
from $t-2$ to $t-6$	(0.04)		(0.04)		(0.07)	
Giant oil discovery		0.06		0.06		0.10
from $t-4$ to $t-6$		(0.03)		(0.03)		(0.08)
N	2,643	2,630	2,643	2,630	2,643	2,630
Country fixed effects	87	87	87	87	87	87
Year fixed effects	49	49	49	49	49	49

Models 1–6: linear models with country and year fixed effects. Discovery from $t-2$ (or $t-4$) to $t-6$ is an indicator for whether there was a giant oil discovery made in the previous two (or four) to six years. Included is the indicator for power sharing that we define in Section ; "No Dominant Group" is an indicator that takes a one if the EPR does not code a dominant or monopoly group; and "# Included Groups" counts the number of groups included in government according to the EPR. Standard errors clustered on administration.

[30]While Lei and Michaels (2014) focus on the reduced-form relationship between giant oilfield discoveries and internal conflict, both their formal model and empirical strategy indicate that they view such discoveries as an instrument for government resource revenues.

group monopolizes or dominates government (models 3–4).[31] Models that also consider the intensive margin — namely, the number of groups included in government — also generate positive estimates but are less precise (models 5–6). This analysis suggests that resource windfalls increase power sharing and, inversely, that administrations which do not benefit from such discoveries maintain more exclusive coalitions.

Transition Probabilities

Table 4 summarizes results from the linear models used to construct the transition probabilities g_l and f_l. We are primarily interested in how leaders' actions and budgets in the previous year affect their likelihood of irregular

Table 4: Transition probabilities: estimates used to construct g_l and f_l.

	Irregular removal	Death	Budget
Outcomes measured in $t+1$:	(1)	(2)	(3)
(γ_1) $B_l^t \equiv$ Log(Budget)	0.03	0.00	0.94
	(0.01)	(0.01)	(0.01)
(γ_2) $\mathbf{I}_l^t \equiv$ Included	0.39	−0.08	−0.44
	(0.21)	(0.12)	(0.29)
(γ_3) $\mathbf{E}_l^t \equiv$ Excluded	2.52	−0.06	−0.47
	(0.89)	(0.12)	(0.45)
(γ_4) $\mathbf{I}_l^t \cdot B_l^t$	−0.02	0.00	0.02
	(0.01)	(0.01)	(0.01)
(γ_5) $\mathbf{E}_l^t \cdot B_l^t$	−0.11	0.00	0.02
	(0.04)	(0.01)	(0.02)
p-value from test H_0: $\{\gamma_1 = 0, \ldots, \gamma_5 = 0\}$	0.01	0.29	0.00
Additional controls:	{First year in office, start age, military pedigree, EPR groups, oil producer}		
Country fixed effects	87	87	87
N	2,674	2,674	2,674

Models 1–3: linear models with country fixed effects per Equation (6). Time-varying covariates lag the outcome by one year. Models include covariates for the leader's first year in office, their age when assuming power, whether they have a military pedigree, the number of EPR groups in the country, and whether the country produces oil; coefficients omitted to conserve space. Standard errors clustered on administration.

[31] In Online Appendix Table A.13, we estimate the relationship between our budget measure (logged) and power sharing among the oil-producing autocracies in our sample. In models with country and year fixed effects and additional leader-specific controls, we find a positive and significant conditional correlation between budgets and power sharing.

removal and natural death and the evolution of the budget.[32] At the bottom of the table, we report the the p-value from a joint test, where the null hypothesis is that the direct and interacted effects of leaders' actions and the budget are zero. For inference, we cluster our standard errors on administration to account for temporal dependence within leaders' terms in office. We use the regressions (and their predicted values) to create the transition probabilities in g_l and f_l. Table A.10 in Online Appendix Section B provides the predicted transition probabilities — the probability that a leader survives and the expected future budget — for different actions and budget levels (fixing the values of the other control variables).

The outcome in model 1 is irregular removal of the leader. We can reject the null hypothesis ($p = 0.01$) that leaders' actions and the budget in the previous year have no effect on their probability of removal. To aid in interpretation, we present the marginal effects of inclusion or excluding when the budget is two (pooled) standard deviations above and below its mean in Online Appendix Figure A.1. The figure illustrates one tradeoff leaders face. When budgets are tight, inclusive governing coalitions and especially acting to exclude rivals from government increase the likelihood of an irregular removal. When times are good, these actions are less detrimental to leader's survival. 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. Thus, leaders who maintain exclusive coalitions with large budgets face larger chances of removal, perhaps because they are not sharing the available spoils.

The outcome in model 2 is leader death from natural causes. We cannot reject the joint null hypothesis ($p = 0.29$): leaders actions related to power-sharing and the budget do not predict their succumbing to age or health issues. Intuitively, we find that younger leaders and those starting their tenures more recently are less likely to die from natural causes (see Table A.8).

The outcome in model 3 is the government budget (logged). We note two important patterns. First, we find strong evidence of persistence: the coefficient on the previous year's budget (also in logs) is 0.94, with a 95% confidence interval of $(0.91, 0.96)$. Leaders can anticipate that the budget at their disposal will remain stable year to year. Second, at higher budget levels, we find evidence that inclusive coalitions are associated with larger future budgets: $\widehat{\gamma}_4$ is positive and statistically significant at conventional levels.[33] This aligns with findings from Gandhi and Przeworski (2007) and Gehlbach

[32]We omit the coefficients on the other leader-specific covariates to save space. These coefficients, as well as more parsimonious specifications, are reported in Online Appendix Section B, Tables A.7–A.9.

[33]Looking at Table A.10, inclusion in period t is associated with a larger future budget in period $t+1$. This bump is bigger when the current budget (B_l^t) is already large. Although $\widehat{\gamma_5}$ is positive, exclusion does not increase the expected budget.

and Keefer (2011) who argue that inclusive governing coalitions can solve commitment problems and, consequently, increase private investment and government revenues.

To substantiate these results, we conduct three types of robustness checks in Online Appendix Section B. First, we change the control variables in Z_l^t and show that the effects of inclusion and exclusion do not meaningfully change. Second, to preserve the model's stationarity, we do not include time-varying covariates beyond the action and state variables in the baseline regression. In Table A.11, we relax this assumption and show that our estimates remain stable when we include time-varying covariates and year fixed effects (as in models 4–6). Finally, we leverage exogenous variation in government budgets using the timing of giant oilfield discoveries as in Lei and Michaels (2014). We estimate the relationship between giant oilfield discoveries and irregular leadership removal by reestimating Equation (6) but substituting an indicator for recent discoveries for our budget measure. In Online Appendix Figure A.2(b), we show the marginal effects of leaders' actions when they do and do not enjoy a recent giant oilfield discovery. Similar to Online Appendix Figure A.1, it shows that inclusive coalitions and actively excluding groups detract from the leader's survival absent the windfall; however, these strategies are not detrimental to (and may benefit) leaders' survival following a discovery.

Leaders' Payoff Parameters

Table 5 presents our estimates of leaders' payoff parameters, which are our main quantities of interest.[34] We restrict the coefficient on the log budget (B_l^t) to one, lending the other estimates a straightforward interpretation: these marginal effects are relative to a one log point increase in the budget. The table reports two coefficient estimates for each leader characteristic in x_l, one describing how the variable affects the leader's office benefits (β) and one describing how it affects their costs to excluding potential rivals (κ). We also includes two sets of standard errors, a conventional estimate based on the outer-product of gradients and a second computed using a country-level jackknife procedure. The latter generates larger standard errors as it incorporates uncertainty from the estimation of the transition probabilities.

Starting with office benefits, leaders with a military pedigree gain less from holding office. This aligns with seminal work on autocracies, which argues that military leaders often reluctantly assume power, staging a coup only to preserve order or the cohesiveness of the military (Geddes, 2003). We find that leaders enjoy greater office benefits in countries with more exports. Yet, accounting for exports, oil production does not further amplify the benefits

[34] In Online Appendix Section D, we show that the estimates are robust to changes in how we code power sharing from the EPR data. In Online Appendix Section E, we show that the estimates are robust to changes in the sample criteria.

Table 5: Estimates of leaders' payoff parameters.

Leader's utility: $u_l(a_l^t, s_l^t; \theta) = B_l^t + x_l \cdot \beta + \rho \cdot \mathbf{I}(a_l^t, C_l^t) + \mathbf{E}(a_l^t) \cdot x_l \cdot \kappa$		Point estimate	Standard errors: Outer product	Standard errors: Jackknife
Office benefits (β)	Constant	−3.60	(0.03)	(0.23)
	Unlimited authority	−0.05	(0.04)	(0.30)
	Military pedigree	−0.70	(0.04)	(0.21)
	Oil producer	−0.82	(0.04)	(0.39)
	Cum. civil wars	−0.30	(0.01)	(0.05)
	Exports	0.23	(0.02)	(0.10)
Inclusion cost (ρ)		−0.98	(0.00)	(0.03)
Exclusion cost (κ)	Constant	−9.95	(0.25)	(0.41)
	Unlimited authority	1.17	(0.29)	(0.23)
	Military pedigree	0.64	(0.25)	(0.16)
	Oil producer	0.14	(0.25)	(0.21)
	Cum. civil wars	0.12	(0.11)	(0.06)
	Exports	−0.11	(0.13)	(0.08)
	Administrations	303		

Estimates of $\theta = (\beta, \rho, \kappa)$, which characterize how leaders' office benefits and their costs to inclusion and exclusion vary as a function of the covariates included in x_l. The coefficient on the log budget (B_l^t) has been constrained to one. Section describes the estimation procedure. The last two columns provide two different estimates of the standard errors: the first uses the outer-product of gradients; the second, a country-level jackknife procedure.

to holding power. Unsurprisingly, a history of civil war is associated with diminished office benefits; conflict destroys the tax base and forces leaders to divert revenues to fighting rebellion.

The parameter ρ captures the payoff leaders receive from an inclusive ruling coalition. Our estimate indicates that power sharing is costly for rulers: inclusive governments cost the leader roughly one logged unit of government revenue. While some ministers may hold peripheral portfolios (e.g., over sports), rulers pay a cost for including groups. All else equal, leaders would prefer an exclusive coalition. Yet, as we described above, at certain budget levels, a inclusive approach improves leaders' survival prospects and can place their budget on a more favorable path.

Finally, we turn to the upfront costs of consolidating power. Negative estimates indicate less utility and a *higher* exclusion cost; positive estimates imply more utility and a *lower* exclusion cost. First, we note that the constant is large and negative, implying that excluding potential rivals from government is costly. This provides an empirical grounding for assertions that cabinet positions represent a credible promise of future spoils: the substantial cost that autocrats pay to remove their rivals provides ministers with some assurance that they will not be heedlessly sacked. These costs are roughly 10% lower for autocrats with unlimited authority or a military background. While we do not know of past work that estimates leaders' costs of consolidating power, these findings are easy to rationalize using folk theories of autocracy. Leaders who are not checked by any other institution find it less costly to remove potential rivals. Those with prior ties to the security forces likely find it easier to threaten or use coercive force to purge an opposition group.

How Budgets Affect Leaders' Choices

The results suggest dynamic tradeoffs: purging potential rivals is costly and, when budgets are meager, can imperil the autocrat's survival. And yet, maintaining an inclusive coalition year after year is costly. Given these short- and longer-run costs and benefits, when should we expect autocrats to opt for inclusion or exclude potential rivals?

To answer this question we consider a hypothetical autocrat: this leader has unlimited executive authority, has a military background, and entered office in the mid-1970s at the age of 45 (median values of the covariates). In addition, their country does not have oil and has had no civil wars.[35] Using our estimates of the transition probabilities and payoff parameters, we can compute this hypothetical autocrat's likelihood of changing their governing coalitions.

Figure 3 presents the optimal choice probabilities. The left panel is the probability that a leader removes a group from an inclusive coalition; the right panel, the probability that a leader includes the opposition in their ruling coalition. Two immediate patterns emerge. First, the autocrat is most likely to consolidate power at small budget levels. At two standard deviations below the mean budget level, the likelihood of moving from inclusion to exclusion is 20–30 percentage points. Second, given an exclusive coalition, the autocrat shares power when the budget is large. At the average budget level in the data ($B_l = 22$), the autocrat almost never includes other groups, but this per-period (i.e., annual) probability increases to approximately 10% at the upper end of the range ($B_l \approx 25$).

Removing members of a coalition is a risky action when budgets are tight. Why are budget-starved autocrats more likely to pursue such a strategy? First, budgets persist as demonstrated in Table 4, model 3. Second, at low budget levels the autocrats' survival probabilities are greatest when they can simply maintain an exclusive coalition (i.e., $C_l = 0$, and $a_l = \varnothing$). Anticipating future lean periods, autocrats then risk purging to reach this steadier state. Should they survive the initial tumult, they then enjoy the full spoils of office and a

[35] We fix the conditional standard deviation of the budget to $\sigma_l = 0.117$, the median in the sample.

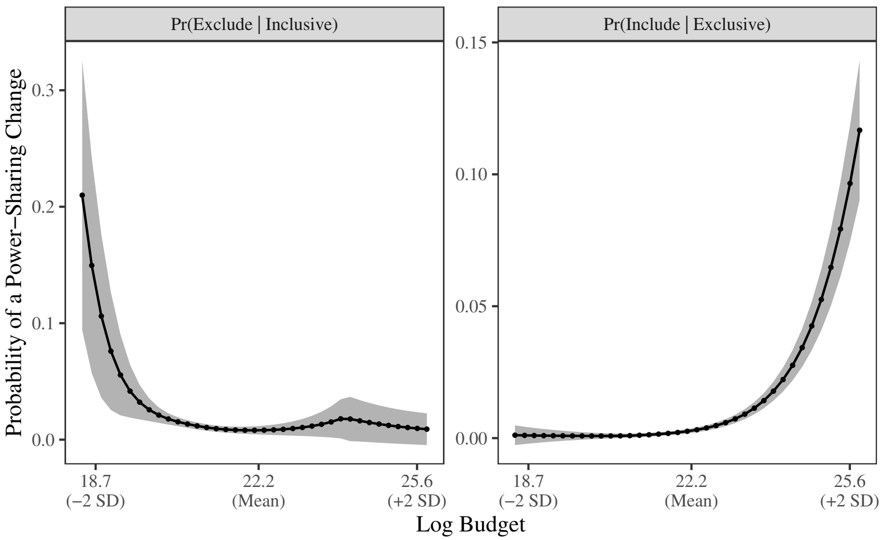

Figure 3: Effect of budget levels on autocratic power sharing.

Predicted probability that the leader excludes an included opposition (left) and includes an excluded opposition (right) in their cabinet. All variables are held at their sample medians; the conditional standard deviation 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 country-level jackknife.

higher likelihood of remaining in power through what they expect will be an extended period of budget shortfalls. Despite the short-run risks, there are long-term benefits to consolidating power given that autocrats expect budgets to remain low.[36]

In Online Appendix Section F, we reestimate the model using data from Francois *et al.* (2015), who code the ethnicities of cabinet ministers in 15 African countries. (Online Appendix Section A.4 shows that measures of power sharing coded from these data are correlated with our primary measures derived from the EPR.) Only 19% of our observations are covered by these data, but we find similar substantive effects (see Online Appendix Figures A.3 and A.4): leaders forge and maintain more inclusive ruling coalitions with larger budgets, but are more likely to concentrate power and exclude rival groups when budgets are smaller. Compared to the EPR data, the data from Francois *et al.* (2015) more finely delineate ethnic groups and, as such, there appear to be more fluctuations in ruling coalitions even if these changes do not

[36]Online Appendix Figure A.5 graphs the difference in expected utilities between periods with exclusive and inclusive coalitions for a fixed budget, $V_l(B_l, C_l = 0) - V_l(B_l, C_l = 1)$. This difference is always positive, yet when budgets are tight, autocrats have a larger incentive to switch from an inclusive to an exclusive coalition or simply maintain the latter.

cross politically salient cleavages. It appears in these data that leaders are more frequently concentrating and sharing power, and that reduces their estimated costs of excluding or including rivals (see Online Appendix Table A.16).

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

> 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.

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 patronage obligations, so they adopt and maintain more exclusive coalitions.

How Budgets Affect Long-run Power Sharing

Figure 3 indicates that larger budgets raise the probability that an autocrat opts for power sharing and decrease the likelihood that they exclude potential rivals. In any given year, the probability that an autocrat expands their coalition is modest — such action is costly to reverse and infrequent. Yet, our estimates indicate that budgets are persistent (Table 4) and, thus, that autocrats repeatedly face the same hazards. To quantify the longer-run effects, we use the estimated model to predict the evolution of power sharing when a hypothetical autocrat is endowed with different initial budgets. (As in our model, the initial budget evolves over time following f_l.) In Figure 4, we endow the autocrat with different initial budgets: the average budget or levels that are one to two pooled standard deviations from the mean. We then compute the probability that the leader includes the opposition in their coalition as years pass.[37]

Consistent with the logic sketched above, larger budgets promote power sharing. Suppose the autocrat starts with an exclusive coalition (left panel). After 10 years, there is a 3% chance that a leader endowed with the average budget has included the opposition. That probability rises to 12% for a leader with a budget one standard deviation above the mean; it falls to just 1% for a leader with a budget one standard deviation below the mean. These differences widen with time: after 25 years, the leader with an average initial budget has an 9% probability of sharing power, while their more richly endowed counterpart (at one standard deviation above the mean) has a 20% probability.

[37] After a leader dies or is removed from office in the simulations, we assume they are replaced with another leader with identical background characteristics.

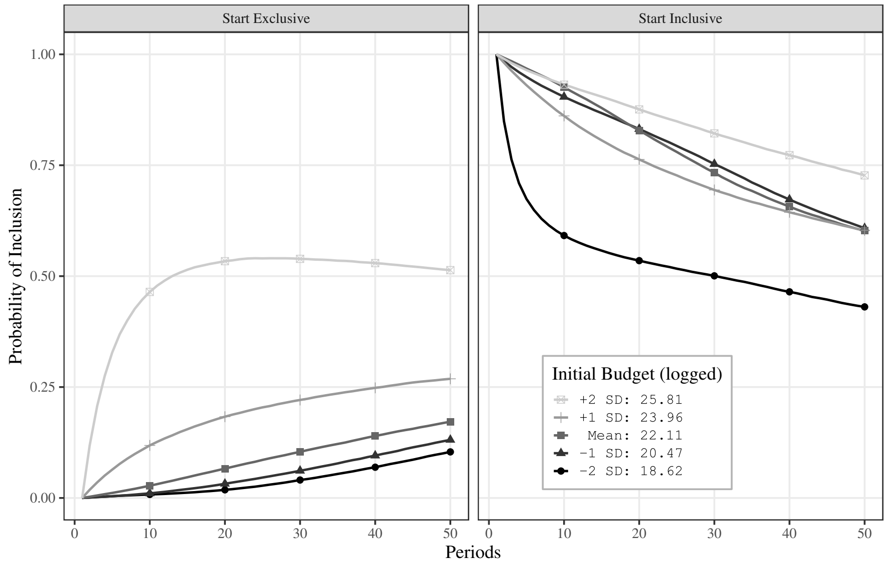

Figure 4: Budgets and the probability of inclusion over time.

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 or 2 pooled standard deviations. All variables are held at their sample medians; the conditional standard deviation of the budget is set at the median, $\sigma_l = 0.117$.

If instead the autocrat starts with an inclusive coalition (right panel), they are least likely to maintain the power-sharing arrangement when starting at the lowest budget level (two standard deviations below the mean).[38] Relative to a leader endowed with the average budget, after 25 years powering sharing is 7 percentage points more likely for a leader blessed with an initial budget two standard deviations above the mean and 26 percentage points less likely for a leader provided a budget two standard deviations below the mean.

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. Between 2000 and 2012, 13 mineral producing African countries saw budget increases of more

[38]Leaders with initial budgets within one standard deviation of the mean follow similar trajectories; Figure 3 shows that the per-period probabilities of exclusion are relatively constant across these budget levels.

than one log point; seven experienced increases of more than 1.8 log points, roughly a standard deviation in our data (see Online Appendix Figure A.6). These positive fiscal shocks ought, by our model, to have promoted power sharing. And over this same period, the probability of power sharing in this sample increased by 12 percentage points from 0.73 to 0.85. 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 saw a major windfall during this period due to rising oil prices (see left panel of Figure 5). Before the boom, 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, p. 82–4) argues that this budgetary expansion facilitated

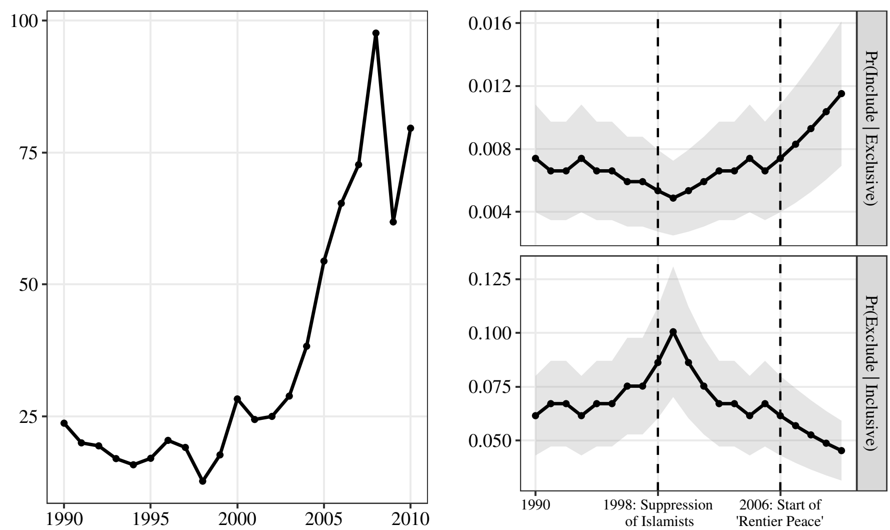

Figure 5: In-sample predictions for Sudan.

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 ($\alpha = 0.1$).

power-sharing agreements, a "rentier peace."[39] 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 was primarily a rent allocation formula meant to buy the loyalty of elites from both regions. "The arithmetic," de Waal (2015, p. 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 exclude rivals from the government. As the budget increased, the leader could afford to cut in rivals without sacrificing their own survival or stream of rents. Figure 5 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. 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, p. 87). 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 22 cabinet ministers listed in 1985, at least half had held bureaucratic positions in pre-Doe governments" (Reno, 1999, p. 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, p. 85), Doe "found that any long-term strategy [...] included buying off his opposition."

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, p. 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, p. 88). Per our model, he looked

[39] According to the EPR, in 2006 the Dinka join Sudan's ruling coalition as a "junior partner." In that year, the proportion of the population represented by the government increases from 15% to 25%.

to consolidate power amid contraction but feared he could not weather the backlash that would follow a purge. Figure A.7 shows that the predicted probability of a purge shot up at the end of Doe's tenure. Doe lost power and was executed in 1990 as Liberia descended into civil war.

Discussion

Our findings illuminate how autocrats respond to fiscal booms or busts, like the commodity price boom or global recession provoked by the coronavirus pandemic. Autocrats are more inclined to share power during times of fiscal strength but seek to consolidate control during leaner times, even if doing so elevates their immediate risk of removal. Similarly, foreign policy tools like economic sanctions or the withdrawal of aid operate by affecting the budgets at autocrats' disposal.[40] Our analysis therefore provides a framework for considering their effects on authoritarian breakdowns and consolidation.

Wood (2008, p. 509) 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." 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, p. 129) summarize that "the conventional wisdom on sanctions . . . was that sanctions are ineffective."

Marinov (2005, p. 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" (p. 355).

While some view these results as conflicting, both consequences of sanctions — increased repression and instability — are implied by our results. If sanctions reduce an autocrat's budget, this pushes them to exclude 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 the risk of instability and an irregular transition. These empirical results are not contradictory but rather fully consistent with an autocrat attempting to concentrate power from a weak financial position.

[40] Neuenkirch and Neumeier (2015) find that UN and, to a lesser extent, US sanctions decrease GDP. Likewise, the IMF more often denies funds to countries targeted by US sanctions (Peksen and Woo, 2018). The suspension of IMF loans contributed to fiscal problems for Omar al-Bashir and Samuel Doe.

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' self-interest.

These policy implications also raise additional questions and extensions of our work. First, future work could extend our model to incorporate additional survival strategies and actors. For 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. Likewise, our model is decision-theoretic with two endogenous state variables, the budget and the type of ruling coalition. Future work might consider the model's game-theoretic microfoundations by explicitly modeling leader removal via coup threats and mass revolution. 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 specific provisions could affect the autocrat's expectations about future budgets in more nuanced ways.

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Online Appendix

How Budgets Shape Power Sharing in Autocracies

Contents

A Data and Sample

A.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

A.2 Sample

Table A.2: Missingness due to listwise deletion

	(1)	(2)	(3)	(4)
Americas	-0.09			-0.13
	(0.12)			(0.11)
Asia	-0.09			-0.10
	(0.06)			(0.08)
Europe	-0.07			-0.12
	(0.11)			(0.12)
Year		-0.00		-0.00
		(0.00)		(0.00)
Polity			-0.01	-0.01
			(0.01)	(0.01)
EPR Groups				-0.00
				(0.00)
Oil Producer				0.03
				(0.07)
N	3,168	3,168	3,168	3,168

We regress a dummy variable denoting that an administration-year observation is missing on regional dummies, politiy scores, the number of EPR groups, and whether the country is an oil producer. Standard errors are clustered on administration.

Table A.3: Summary statistics.

Variable	N	Mean	SD	Min	q25	q50	q75	Max
B	2807	22.22	1.74	16.75	21.02	22.03	23.46	28.33
$C_t = 0; a_t = 0$	2807	0.58	0.49	0	0	1	1	1
$C_t = 0; a_t = i$	2807	0.01	0.1	0	0	0	0	1
$C_t = 1; a_t = 0$	2807	0.4	0.49	0	0	0	1	1
$C_t = 1; a_t = e$	2807	0.01	0.09	0	0	0	0	1
Irregular Transition	2782	0.04	0.21	0	0	0	0	1
Leader Death	2782	0.01	0.12	0	0	0	0	1
First Year in Office	2807	1976.47	13.49	1960	1964	1975	1986	2012
Military Pedigree	2699	0.51	0.5	0	0	1	1	1
EPR Groups	2807	5.47	5.32	2	3	4	6	37
Start Age	2782	46.09	11.49	17	38	45	54	78
Oil Producer	2807	0.45	0.5	0	0	0	1	1

Table A.4: Unconstrained autocrats excluded due to EPR.

	Country	No. Admin. Excluded	Average Population (mil.)
Admin. Missing from EPR			
1	Fiji	5	0.8
2	Comoros	4	0.3
3	Qatar	3	0.3
4	Suriname	2	0.4
5	Romania	2	19.3
6	Equatorial Guinea	2	0.2
7	Oman	2	0.7
8	Kosovo	1	NA
Only 1 Group in EPR			
9	Haiti	9	5.7
10	Burkina Faso	8	7.2
11	Dominican Republic	5	4.0
12	Swaziland	4	0.7
13	Republic of Korea	4	29.7
14	Portugal	3	8.7
15	Democratic People's Republic of Korea	3	NA
16	Lesotho	2	1.6
17	Tunisia	2	5.8
18	United Arab Emirates	2	1.3
19	Somalia	1	NA
Totals			
	Total Excluded	64	86.6
	Total Included	360	2,355.0

Table A.5: Correlates of exclusion due to EPR.

	(1)	(2)	(3)
First Year in Office	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)
Polity	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)
Oil Producer	0.17	0.16	0.16
	(0.03)	(0.03)	(0.04)
Start Age		0.00	0.00
		(0.00)	(0.00)
Military Pedigree			0.05
			(0.04)
Administrations	424	422	384

We create an indicator for whether an administration includes multiple politically relevant groups in the EPR. We then regress that indicator on other administration-specific covariates to assess how missingness in the EPR affects selection into our sample.

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

Baseline 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, $a_l^t = e$ 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, $a_l^t = \varnothing$.

Excluding Partial Purges A ruling coalition 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 a coalition is in an inclusive state, the leader can exclude members by reducing the number of groups in government ($a_l^t = e$), changing the state in the next year to exclusive. While rare, adding groups from an already inclusive state or subtracting groups from an exclusive state are considered as maintenance of the status-quo ($a_l^t = \varnothing$).

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. A group is dominant if it holds the elite positions of government even though there may be token members from other groups that do not affect decision making. 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 $t-1$. $a_l^t = e$ 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 $C_l^{t+1} = \mathbf{I}(a_l^t, C_l^t)$.

Table A.14 shows how structural estimates differ using these different coding schemes.

A.4 Comparing the EPR to other Datasets on Power Sharing

We compare our measures of power sharing from the EPR to datasets compiled by Arriola, Devaro and Meng (2021) and Francois, Rainer and Trebbi (2015).

First, Arriola, Devaro and Meng (2021) compile data for African countries from 1990–2016 on whether opposition politicians secure a cabinet post. Their focus is on election outcomes, so they only provide this measure for election years; they have, on average, just under four observations per country. Only 2 percent of the observations in our sample appear in this dataset; only 9 percent of the administrations in our sample have at least one observation in these data. In 83 percent of the cases in which Arriola, Devaro and Meng (2021) code opposition representation in the cabinet, the EPR agrees that multiple groups are represented in government. We show in Table A.6 that their measure positively correlates with the EPR's variables for whether multiple distinct groups are included in government, how many groups are included, and the absence of a dominant or monopoly group. We have very little statistical power (just 28 clusters), but the regression coefficient in column 3 is significant at the ten-percent level.

Table A.6: Associations between different power-sharing measures.

EPR Variable:	Multiple Included		Number Included		No Dominant Group	
	(1)	(2)	(3)	(4)	(5)	(6)
$\mathbb{1}$(Opposition in Cabinet)	0.22		1.19		0.10	
(Arriola, Devaro and Meng 2021)	(0.18)		(0.68)		(0.16)	
Groups in "Top" Posts		0.08		0.25		0.07
(Francois, Rainer and Trebbi 2015)		(0.03)		(0.12)		(0.03)
Clusters	28	57	28	57	28	57
N	56	484	56	484	56	484

Notes: We regress the EPR power-sharing measures (column) on the other measures from the literature (row). Standard errors clustered on administration. We drop Tanzania in even-numbered models, as the very high level of ethnic diversity recorded in Francois, Rainer and Trebbi (2015) does not cross the country's salient political cleavage. In 2000, Francois, Rainer and Trebbi (2015) record 13 different ethnic groups represented in top cabinet posts in Tanzania — the most of any country in their sample. By contrast, Arriola, Devaro and Meng (2021) code no opposition representation in the cabinet, which corroborates the EPR coding that "Mainland Africans" (through the CCM Party) were a politically dominant group.

Second, Francois, Rainer and Trebbi (2015) provide data on the ethnic affiliation of ministers in 15 African countries from independence through 2004. Only 19 percent of the observation in our sample appear in this dataset. In 76 percent of the cases in which they record multiple ethnic groups holding "top" cabinet posts (president, prime minister, defense, state, treasury, justice), the EPR agrees that multiple groups are represented in government.[1] We exclude Tanzania in this comparison, as the very high level of ethnic diversity recorded in Francois, Rainer and Trebbi (2015)

[1] Francois, Rainer and Trebbi (2015) use a more inclusive definition of top posts, which includes ministers whose portfolios relate to "economic" affairs. These ministers often lead more peripheral ministries (e.g., fisheries, forestry, foreign investment), so we exclude them from our coding of top posts.

does not cross the country's salient political cleavage. Unlike Francois, Rainer and Trebbi (2015), we are interested in the inclusion of political opponents, not ethnic representation per se. We show in Table A.6 that the number of distinct groups in top cabinet posts is significantly and positively associated with power-sharing measures from the EPR.[2]

One possible reason for the positive correlation between our measure of power sharing and those in Arriola, Devaro and Meng (2021) and Francois, Rainer and Trebbi (2015) is that the EPR measures rather big changes in the composition of leaders' cabinets. It records whether or not a group is a partner in government, not the proportion of government positions controlled by each group. This should provide reassurance that our coding of leaders' actions are capturing meaningful changes in power sharing over time and is not due to measurement error. Furthermore, in Appendix Section A.3, we describe a coarser coding of leaders' action using only changes in whether the group in power is a dominant group or not. We show that our estimates of leaders' payoff parameters do not change using this alternative coding in Appendix D. Finally, we reestimate the model using data from Francois, Rainer and Trebbi (2015) and present the analysis in Appendix Section F

[2]In Francois, Rainer and Trebbi's (2015) data, ministers can be multi-ethnic. Suppose we have two ministers, and one member is group A and the other is 2/3 group A and 1/3 group B. For our purposes, we must decide whether those ministers hail from the same group. To avoid overstating the diversity of cabinets, we would treat these two ministers as sharing a common ethnic identity (group A) and, thus, regard this two-member cabinet as ethnically homogeneous.

B Transition Probabilities

B.1 Covariates

We include additional covariates when estimating the transition probabilities (Equation 6). These reduce confounding by conditioning on 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.[3] 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.

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

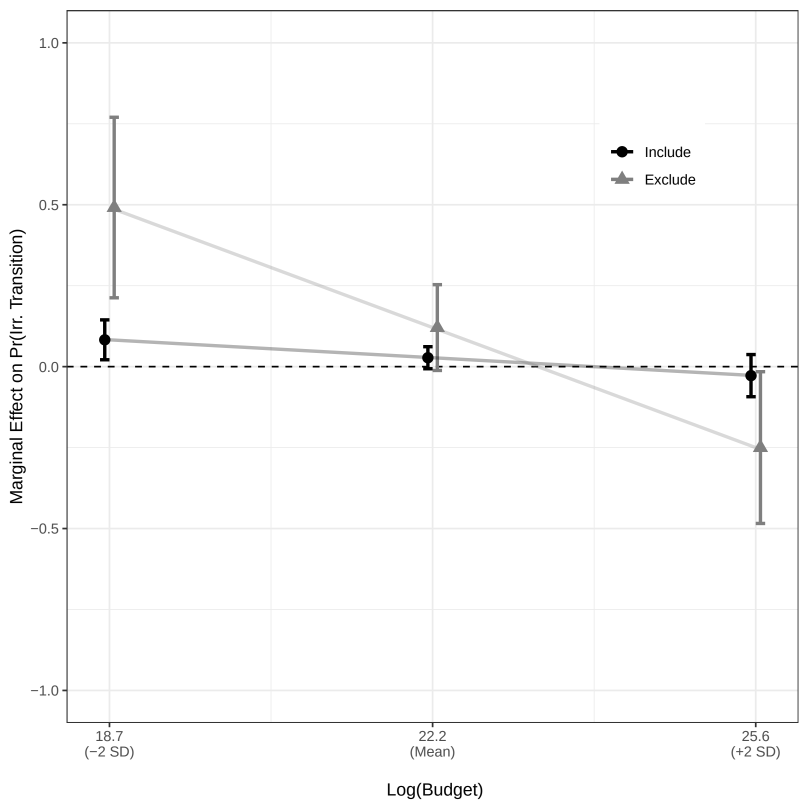
B.2 Regression Estimates

Table A.7: Irregular leader removal.

	(1)	(2)	(3)	(4)	(5)
$B_l^t \equiv$ Log(Budget)	0.02	0.02	0.02	0.02	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbf{I}_l^t \equiv$ Included	0.30	0.31	0.33	0.37	0.39
	(0.20)	(0.19)	(0.20)	(0.21)	(0.21)
$\mathbf{E}_l^t \equiv$ Excluded	2.42	2.38	2.49	2.53	2.52
	(0.85)	(0.87)	(0.86)	(0.86)	(0.89)
$\mathbf{I}_l^t \cdot B_l^t$	-0.01	-0.01	-0.01	-0.02	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbf{E}_l^t \cdot B_l^t$	-0.10	-0.10	-0.11	-0.11	-0.11
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
First Year in Office	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Military Pedigree			-0.05	-0.05	-0.03
			(0.01)	(0.01)	(0.01)
EPR Groups				-0.01	-0.01
				(0.01)	(0.01)
Start Age					0.00
					(0.00)
Oil Producer					-0.00
					(0.03)
N	2674	2674	2674	2674	2674
Country Fixed Effects	87	87	87	87	87
Year Fixed Effects	0	54	0	0	0

Models 1–5: linear probability models with country fixed effects per Equation 6. Time-varying covariates lag the outcome by one year. Standard errors clustered on administration.

Figure A.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 excluding an included group on the probability of an irregular leadership transition when the budget (logged) is at its mean or ± 2 standard deviations. Predictions use estimates from model 5 in Table A.7.

Table A.8: Leader death.

	(1)	(2)	(3)	(4)	(5)
$B_l^t \equiv$ Log(Budget)	0.00	-0.02	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbf{I}_l^t \equiv$ Included	-0.08	-0.15	-0.08	-0.08	-0.08
	(0.12)	(0.12)	(0.13)	(0.13)	(0.12)
$\mathbf{E}_l^t \equiv$ Excluded (E)	-0.07	-0.16	-0.05	-0.06	-0.06
	(0.11)	(0.13)	(0.12)	(0.12)	(0.12)
$\mathbf{I}_l^t \cdot B_l^t$	0.00	0.01	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbf{E}_l^t \cdot B_l^t$	0.00	0.01	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
First Year in Office	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Military Pedigree			-0.01	-0.01	-0.00
			(0.01)	(0.01)	(0.01)
EPR Groups				0.00	0.00
				(0.01)	(0.01)
Start Age					0.00
					(0.00)
Oil Producer					-0.01
					(0.02)
N	2674	2674	2674	2674	2674
Country Fixed Effects	87	87	87	87	87
Year Fixed Effects	0	54	0	0	0

Models 1–5: linear probability models with country fixed effects per Equation 6. Time-varying covariates lag the outcome by one year. Standard errors clustered on administration.

Table A.9: Budget.

	(1)	(2)	(3)	(4)	(5)
$B_l^t \equiv$ Log(Budget)	0.94	0.93	0.94	0.94	0.94
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
$\mathbf{I}_l^t \equiv$ Included	-0.48	-0.44	-0.47	-0.43	-0.44
	(0.29)	(0.28)	(0.29)	(0.29)	(0.29)
$\mathbf{E}_l^t \equiv$ Excluded	-0.52	-0.55	-0.52	-0.47	-0.47
	(0.46)	(0.45)	(0.46)	(0.45)	(0.45)
$\mathbf{I}_l^t \cdot B_l^t$	0.02	0.02	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbf{E}_l^t \cdot B_l^t$	0.02	0.02	0.02	0.02	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
First Year in Office	0.00	-0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Military Pedigree			-0.00	-0.00	-0.00
			(0.01)	(0.01)	(0.01)
EPR Groups				-0.01	-0.01
				(0.01)	(0.01)
Start Age					-0.00
					(0.00)
Oil Producer					-0.02
					(0.02)
N	2674	2674	2674	2674	2674
Country Fixed Effects	87	87	87	87	87
Year Fixed Effects	0	54	0	0	0

Models 1–5: linear models with country fixed effects per Equation 6. Time-varying covariates lag the outcome by one year. Standard errors clustered on administration.

B.3 Predicted Values

Table A.10: Predicted transition probabilities.

		Budget Level (B_l^t)				
		$-\sigma_B$	$-\sigma_B/2$	$\overline{B}$	$+\sigma_B/2$	$+\sigma_B$
		20.46	21.28	22.11	23.14	23.96
Probability of Leader Survival: $g_l(a_l^t, C_l^t, B_l^t)$						
Included	$\mathbf{I}_l^t$	0.94	0.93	0.92	0.90	0.89
Excluded	$\mathbf{E}_l^t$	0.69	0.75	0.82	0.91	0.97
Maintained	$a_l^t = \varnothing, C_l^t = 0$	0.98	0.97	0.94	0.92	0.89
Expected Future Budget: $E[B_l^{t+1} \mid a_l^t, C_l^t, B_l^t]$						
	$\mathbf{I}_l^t$	20.63	21.42	22.21	23.20	23.99
	$\mathbf{E}_l^t$	20.56	21.35	22.14	23.13	23.92
	$a_l^t = \varnothing, C_l^t = 0$	20.61	21.39	22.16	23.13	23.90

Using the first-stage regressions in Table 4 and the definitions of g_l and f_l in Section , we show how leader survival (g_l) and next year's budget (B_l^{t+1}) evolve after the autocrat chooses action a_l^t in state $s_l^t = (C_l^t, B_l^t)$. The columns denote the current budget level, where the values represent the mean ($\overline{B}$) and plus/minus a half or full standard deviation (σ_B). The table uses the same background characteristics as in Figure 3: the autocrat has unlimited authority, has a military background, entered office in the mid-1970s at the age of 45, and rules a country with no oil and no past civil wars.

B.4 Robustness: Including Time-Varying Covariates

Table A.11: Transition probabilities estimated with time-varying covariates.

Outcomes measured in $t+1$:	Irregular Removal (1)	Death (2)	Budget (3)	Irregular Removal (4)	Death (5)	Budget (6)
$B_l^t \equiv$ Log(Budget)	0.03	0.00	0.93	0.02	-0.02	0.92
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
$\mathbf{I}_l^t \equiv$ Included	0.34	0.01	-0.57	0.27	-0.09	-0.57
	(0.23)	(0.13)	(0.32)	(0.23)	(0.14)	(0.31)
$\mathbf{E}_l^t \equiv$ Excluded	2.54	-0.01	-0.68	2.41	-0.13	-0.74
	(0.95)	(0.13)	(0.46)	(0.97)	(0.14)	(0.49)
$\mathbf{I}_l^t \cdot B_l^t$	-0.01	-0.00	0.03	-0.01	0.00	0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
$\mathbf{E}_l^t \cdot B_l^t$	-0.11	-0.00	0.03	-0.10	0.01	0.03
	(0.04)	(0.01)	(0.02)	(0.04)	(0.01)	(0.02)
p-value from test H_0: $\{\gamma_1 = 0, \ldots, \gamma_5 = 0\}$	0.02	0.39	0.00	0.06	0.11	0.00
Additional Controls:	{First Year in Office, Start Age, Military Pedigree, EPR Groups, Oil Producer}					
Country Fixed Effects	87	87	87	87	87	87
Year Fixed Effects	0	0	0	45	45	45
N	2,459	2,459	2,459	2,459	2,459	2,459

Models 1–6: linear regression models with country fixed effects. Models 4–6 include year fixed effects. Models with irregular leader transitions and leader death as the dependent variable are linear probability models. The budget and leader action variables lag the dependent variable by one year. All models include covariates for the leader's first year in office, their age when assuming power, whether they have a military pedigree, the number of EPR groups in the country, and whether the country produces oil. These covariates are permitted to vary over time and missingness leads to a slight reduction in our sample size. We omit coefficients on these controls to conserve space. Standard errors are clustered on administration.

B.5 Robustness: Using Giant Oilfield Discoveries an an Exogenous Budget Shock

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.12: Effects of giant oilfield discoveries on oil production and budgets.

	Log(Oil & Gas Production)			Log(Budget)		
	(1)	(2)	(3)	(4)	(5)	(6)
Discovery in $t-4$	0.21			0.15		
	(0.11)			(0.07)		
Discovery from $t-2$ to $t-6$		0.26			0.15	
		(0.15)			(0.06)	
Discovery from $t-4$ to $t-6$			0.24			0.21
			(0.12)			(0.07)
Country Fixed Effects	52	52	52	87	87	87
Year Fixed Effects	48	48	48	48	49	49
N	1,222	1,233	1,222	2,514	2,552	2,539

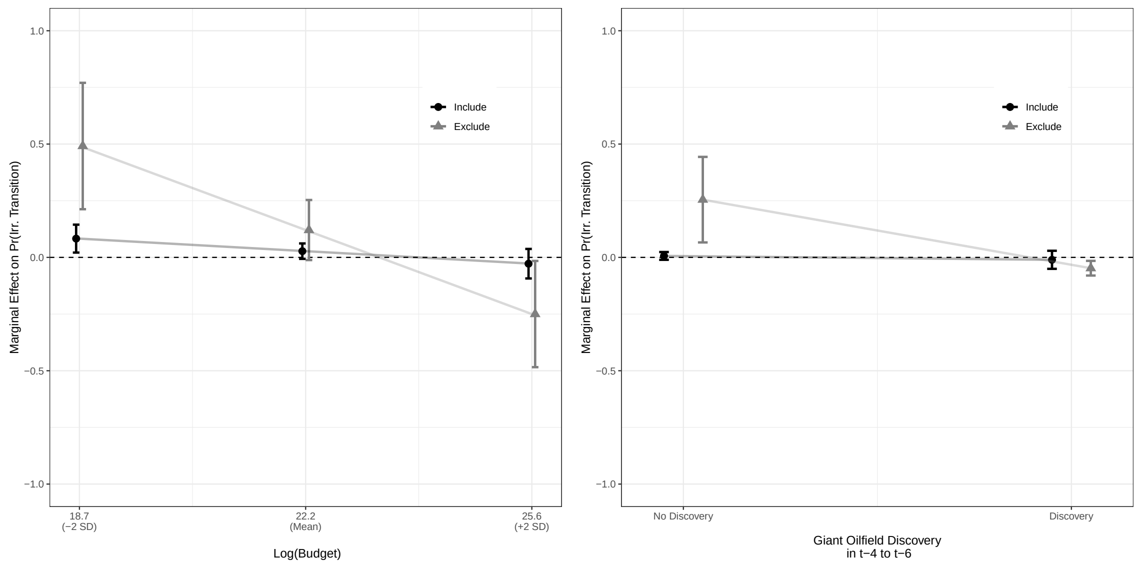
Notes: Standard errors clustered on administration.

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.12 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, reestimating Equation 6, but substituting an indicator for past oil discoveries for our budget measure B. In

Figure A.2, we reproduce Figure A.1 (left) and then show the marginal effects of excluding potential rivals 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.

C Reduced-form Evidence that Budgets Affect Power Sharing

In Table A.13, we show that power sharing is more likely and inclusive in oil-producing autocracies as our budget measure increases. These associations are robust to the inclusion of year fixed effects and the leader-specific controls used in Table 4.

Table A.13: Reduced-form relationship between budgets and power sharing.

	Included ($\mathbf{I}_l^t$)		No Dominant Group		# Included Groups	
Log(Budget) (B)	0.11	0.14	0.12	0.15	0.29	0.34
	(0.03)	(0.03)	(0.03)	(0.03)	(0.07)	(0.08)
Additional Controls:	{First Year in Office, Start Age, Military Pedigree, EPR Groups}					
N	1,212	1,212	1,212	1,212	1,212	1,212
Country Fixed Effects	44	44	44	44	44	44
Year Fixed Effects	0	54	0	54	0	54

Notes: Sample restricted to oil-producing countries. Standard errors clustered on administration.

D Leader's Payoffs with Different Action Codings

Section A.3 describes two alternative codings of the leaders' actions. Table A.14 reports the resulting payoff estimates using these alternative codings, where we rerun both the first- and second-stage estimation procedures using the alternative codings.

Table A.14: Estimates of leaders' payoff parameters with alternative codings.

Leader's Utility:		$u_l(a_l^t, s_l^t; \theta) = B_l^t + x_l \cdot \beta + \rho \cdot \mathbf{I}(a_l^t, C_l^t) + \mathbf{E}(a_l^t) \cdot x_l \cdot \kappa$		
		Baseline	Excl. Partial Purges	Dominant
Office Benefits (β)	Constant	-3.60	-3.70	-5.23
		(0.03)	(0.03)	(0.04)
	Unlimited Authority	-0.05	0.39	-0.00
		(0.04)	(0.05)	(0.04)
	Military Pedigree	-0.70	-1.36	-0.00
		(0.04)	(0.05)	(0.04)
	Oil Producer	-0.82	-0.69	-0.31
		(0.04)	(0.05)	(0.02)
	Cum. Civil Wars	-0.30	-0.69	-1.22
		(0.01)	(0.02)	(0.02)
	Exports	0.23	-0.03	0.54
		(0.02)	(0.02)	(0.02)
Inclusion Cost (ρ)		-0.98	-1.14	-1.25
		(0.00)	(0.00)	(0.00)
Exclusion Cost (κ)	Constant	-9.95	-11.21	-12.76
		(0.25)	(0.27)	(0.20)
	Unlimited Authority	1.17	1.51	1.91
		(0.29)	(0.29)	(0.26)
	Military Pedigree	0.64	0.73	0.65
		(0.25)	(0.28)	(0.23)
	Oil Producer	0.14	0.65	0.13
		(0.25)	(0.20)	(0.17)
	Cum. Civil Wars	0.12	0.02	-0.44
		(0.11)	(0.09)	(0.09)
	Exports	-0.11	-0.16	-0.68
		(0.13)	(0.13)	(0.11)
	Log Likelihood	-261.59	-210.98	-187.38
	Administrations	303	303	303

Standard errors based on outer-product of gradients. Alternative codings of the action and state variables are described in Section A.3.

E Leader's Payoffs with Different Sample Criteria

As described above, our baseline analysis focuses on leaders in countries (i) with polity2 scores of weakly less than 5, (ii) included in the Autocracies of the World database (AoW), and (iii) that impose at most slight to moderate limitation on executive authority.[4] Because we use the EPR data to code power sharing, we also require that countries have more than one ethnic group. We relax these sample criteria along two dimensions and reestimate model; we rerun both the first- and second-stage estimation procedures using alternative sample criteria. First, we drop the democracy requirements from (i) and (ii), i.e., the country has a polity2 score of less than 5 and is included in AoW. Second, we relax the executive constraints requirement and include countries in an intermediate category between limited constraints and substantial constraints (i.e., the country has an executive constraint measure from Polity of less than or equal to four). Table A.15 compares the estimates of the leaders' payoff parameters across our three samples. It shows that the point estimates have similar magnitudes and directions regardless of the specific sample criteria. The one exception is how unlimited authority affects the leader's office benefits, but this effect was not significant at conventional levels in the baseline model.

[4] That is, we require that a country's executive constraint measure from Polity is less than or equal to three.

Table A.15: Estimates of leaders' payoff parameters with different sample criteria.

Leader's Utility:	$u_l(a_l^t, s_l^t; \theta) = B_l^t + x_l \cdot \beta + \rho \cdot \mathbf{I}(a_l^t, C_l^t) + \mathbf{E}(a_l^t) \cdot x_l \cdot \kappa$			
		Baseline	Drop AoW & Polity	Relax unconstrained criteria
Office Benefits (β)	Constant	-3.60	-3.43	-2.96
		(0.03)	(0.03)	(0.02)
	Unlimited Authority	-0.05	-0.56	1.29
		(0.04)	(0.04)	(0.03)
	Military Pedigree	-0.70	-0.35	-1.90
		(0.04)	(0.04)	(0.03)
	Oil Producer	-0.82	-0.63	-3.03
		(0.04)	(0.05)	(0.03)
	Cum. Civil Wars	-0.30	-0.35	-0.43
		(0.01)	(0.01)	(0.01)
	Exports	0.23	0.14	0.39
		(0.02)	(0.01)	(0.02)
Inclusion Cost (ρ)		-0.98	-0.99	-1.05
		(0.00)	(0.00)	(0.00)
Exclusion Cost (κ)	Constant	-9.95	-9.86	-9.61
		(0.25)	(0.27)	(0.23)
	Unlimited Authority	1.17	1.10	2.35
		(0.29)	(0.31)	(0.30)
	Military Pedigree	0.64	0.65	-0.49
		(0.25)	(0.29)	(0.24)
	Oil Producer	0.14	-0.08	-1.06
		(0.25)	(0.27)	(0.23)
	Cum. Civil Wars	0.12	0.12	-0.05
		(0.11)	(0.14)	(0.09)
	Exports	-0.11	-0.06	-0.06
		(0.13)	(0.13)	(0.14)
	Log Likelihood	-261.59	-264.41	-281.08
	Administrations	303	326	315

Standard errors based on outer-product of gradients.

F Leader's Payoffs and Substantive Effects with Different Data

In Appendix Section A.4, we describe how our coding of the EPR data correlates with data from Francois, Rainer and Trebbi (2015, FRT hereafter). In this Appendix section, we reestimate our structural model using the sample and data from FRT, re-running both the first- and second-stage estimation procedures. Table A.16 presents estimates of the leader's payoff parameters across three models. The baseline model presents the estimates from Table 5 in the main text. In model 1, we use the original EPR coding, but we subset the observations to the countries and years included in the FRT data and reestimate the model. In model 2, we use the FRT data to code leaders' actions and then reestimate the model.

Comparing the models reveals two takeaways.[5] First, the coefficient estimates in models 1 and 2 are mostly in the same direction — nine out of 13 estimates have the same sign. Second, inclusion costs and the constant associated with exclusion costs are substantially smaller when using the FRT data (model 2) compared to the EPR data (model 1). In model 2, ρ is positive although the estimate is small and not precise. This difference likely arises because the EPR data focuses on "politically relevant" ethnic groups, where a group is politically relevant if "at least one political organization has claimed to represent its interests at the national level or if its members are subjected to state-led political discrimination" (Cederman, Min and Wimmer 2012, 99). The EPR focuses on politically salient cleavages and, as such, combines groups that are separately enumerated in the FRT data, as in the example of Tanzania described in Section A.4. As another example, the EPR combines several smaller, politically aligned groups in Idi Amin's Uganda as "South-Westerners," rather than separately coding whether the Ankole, Banyoro, Toro, and Banyarwanda were partners in government.[6] For this reason, there are smaller, more finely delineated groups in the FRT data and, thus, there appear to be more fluctuations in power sharing over time (even if the these changes do not cross salient political cleavages). All else equal, more observed variation in power sharing implies that leaders have lower costs to purging groups from government and face lower inclusion costs.

Finally, we also explore the robustness of our substantive predictions using the newly estimated models. To do this, we fix an initial coalition type $C_l \in \{0,1\}$ and plot the sample-average probability of a power-sharing change, i.e., $\frac{1}{L}\sum_{l=1}^{L} \Pr(a_l \neq \varnothing; (B_l, C_l), V_l)$, for each budget level B_l between the mean budget level plus and minus one standard deviation.[7] Figure A.3 shows the substantive effects for model 1 and Figure A.4 shows the effects for model 2. These should be compared to Figure 3 in the main text. Broadly, the results show similar patterns. Leaders are most likely to include an excluded opposition with a larger budgets, and leaders are most likely to exclude an in-

[5]Models 1 and 2 have a different number of administrations. In our data, we record three administrations that last a single year and do not appear in the FRT data (Benin, 1969; Republic of Congo, 1969; Democratic Republic of Congo, 1960).

[6]During this time period, the EPR also combines Uganda's Madi, Lugbara, and Alur ethnic groups into the "Far North-West Nilers."

[7]We use the mean plus/minus one standard deviation because our sample size is smaller in this analysis, so we do not want to extrapolate to the extreme levels of the state space with few observations.

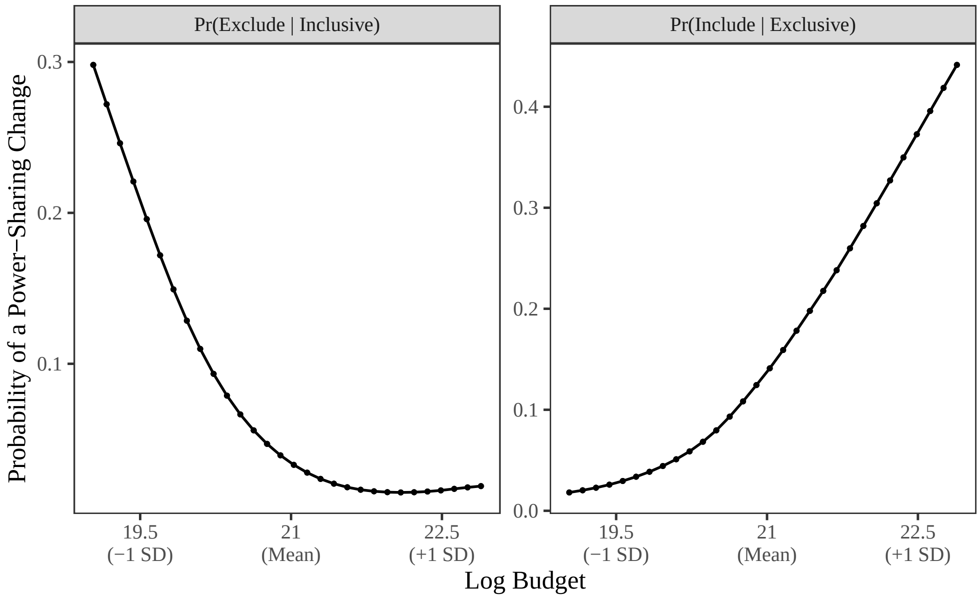
Table A.16: Estimates of leaders' payoff parameters with FRT sample and data

Leader's Utility:		$u_l(a_l^t, s_l^t; \theta) = B_l^t + x_l \cdot \beta + \rho \cdot \mathbf{I}(a_l^t, C_l^t) + \mathbf{E}(a_l^t) \cdot x_l \cdot \kappa$		
		Baseline	Model 1	Model 2
Office Benefits (β)	Constant	-3.60	-1.92	-1.05
		(0.03)	(0.26)	(1.34)
	Unlimited Authority	-0.05	-1.51	-2.02
		(0.04)	(0.14)	(2.15)
	Military Pedigree	-0.82	-2.85	0.22
		(0.04)	(0.10)	(1.83)
	Oil Producer	-0.82	-0.47	-5.59
		(0.04)	(0.11)	(1.67)
	Cum. Civil Wars	-0.30	-1.06	-1.76
		(0.01)	(0.05)	(1.02)
	Exports	0.23	1.03	0.17
		(0.02)	(0.06)	(0.66)
Inclusion Cost (ρ)		-0.98	-0.86	0.13
		(0.00)	(0.07)	0.43
Exclusion Cost (κ)	Constant	-9.95	-8.57	-1.46
		(0.25)	(1.19)	(1.27)
	Unlimited Authority	1.17	-1.35	0.23
		(0.29)	(1.06)	(0.96)
	Military Pedigree	0.64	1.71	0.67
		(0.25)	(1.12)	(1.22)
	Oil Producer	0.14	1.95	-0.48
		(0.25)	(0.86)	(1.28)
	Cum. Civil Wars	0.12	-1.85	-0.37
		(0.11)	(0.86)	(0.82)
	Exports	-0.11	0.76	0.04
		(0.13)	(0.90)	(0.45)
	Log Likelihood	-261.59	-47.60	-255.51
	Administrations	303	60	57

Standard errors based on outer-product of gradients.

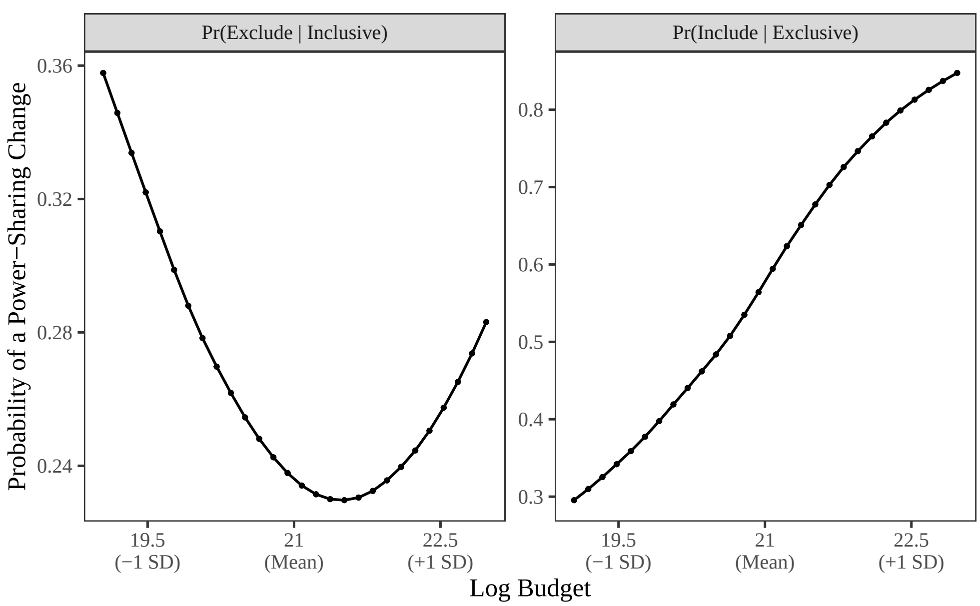
cluded opposition with smaller budgets. One difference emerges, however. Namely, the probability of excluding an included opposition has a potentially non-monotonic relationship with the leader's budget. Specifically, leaders may be the least likely to exclude at mean budget levels, although we hesitate to over interpret this result given the small number of administrations in the sample.

Figure A.3: Effect of budget levels on power sharing using model 1 from Table A.16



Sample-average predicted probability that the leader excludes an included opposition (**left**) and includes an excluded opposition (**right**).

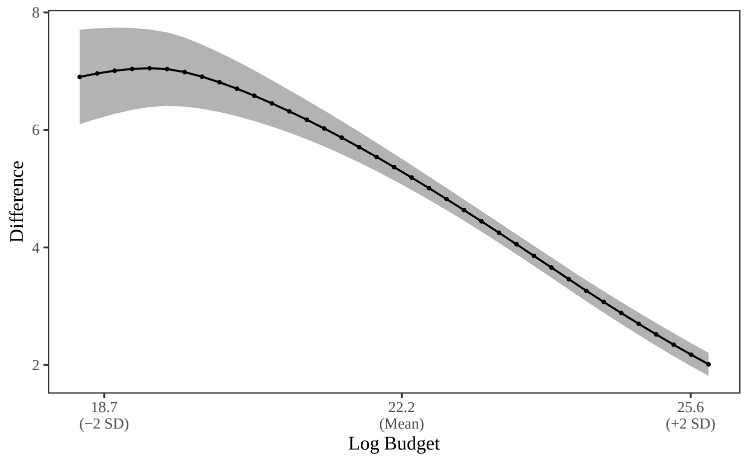
Figure A.4: Effect of budget levels on power sharing using model 2 from Table A.16



Sample-average predicted probability that the leader excludes an included opposition (**left**) and includes an excluded opposition (**right**).

G Additional Figures

Figure A.5: 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.

Figure A.6: Budget implications of commodity boom in Africa.

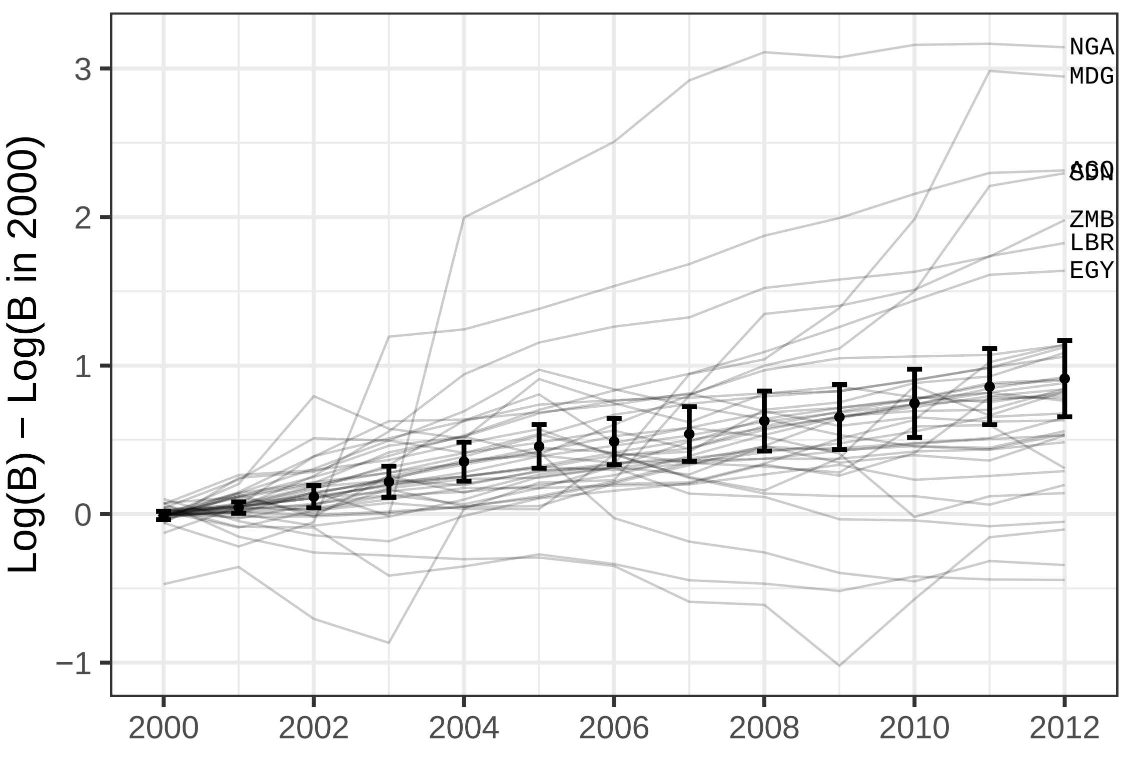
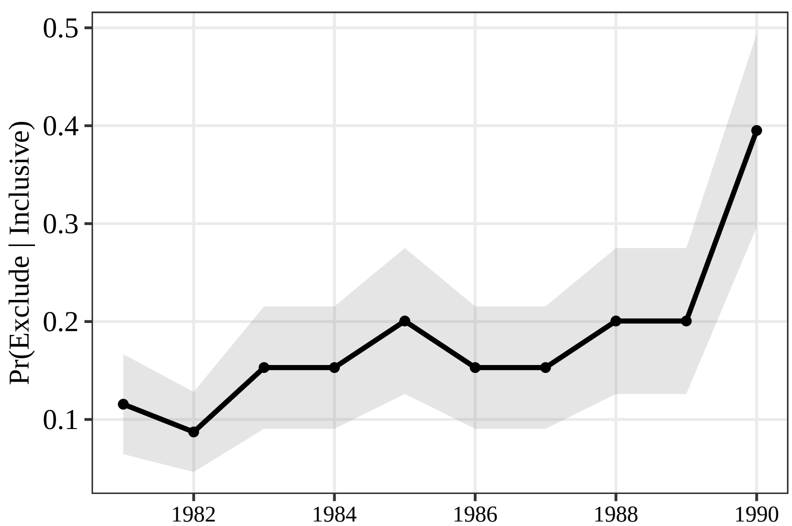


Figure A.7: In-sample Predictions for Liberia.



Y-axis is the predicted probability that the leader purges an included group. All x_l and z_l variables are set using values from Liberia.