How Budgets Shape Power Sharing in Autocracies*

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Abstract

How do budgets affect autocrats' incentives to share or consolidate power? We estimate a dynamic model of autocrats who compose 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 overwhelming dynamic benefits during periods of prolonged austerity: autocrats reduce patronage obligations that they may struggle to afford amid austerity, increasing 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 10 percentage points over 20 years. Case studies of Sudan and Liberia indicate that our model and results describe the tradeoffs and survival strategies facing real-world autocrats.

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1. Introduction

Dispensing spoils and side-lining rivals — strategies that autocrats commonly use to maintain control — require resources. Social scientists have, thus, focused attention on how leaders expend their budgets and compose their ruling coalitions to keep hold of power. de Waal (2015, 25), for example, writes, "the health of the political budget is the indicator of whether a political entrepreneur will thrive or fail, whether a political CEO will sustain his empire, or be plunged into crisis." Revenues from natural resources or foreign aid replenish budgets, allowing autocrats to survive longer (e.g., Morrison 2009; Wright, Frantz and Geddes 2013; Ross 2015), and large budgets are essential to coup-proofing ruling coalitions (Quinlivan 1999).

A related but as-yet-separate line of research asks how autocrats' decisions affect the course of the economy and government 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 (e.g., Acemoglu, Johnson and Robinson 2005; Gandhi and Przeworski 2006; Gehlbach and Keefer 2011).

The structural approach we adopt allows us to integrate this literature and illustrate both how today's budget affects an autocrat's survival strategy as well as how their choice of strategy considers and influences tomorrow's budget. We write down and estimate a model of autocratic survival in which an autocrat repeatedly decides whether or not to share power with an opposition. The model incorporates three essential features of autocratic decision making. First, including or excluding groups from government not only affect the autocrat's office benefits today but also his 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, decisions to include the opposition are persistent: an inclusive government remains the status quo until the autocrat consolidates power, a potentially costly action. These components generate a dynamic tension where the autocrat may want to adopt specific power-sharing arrangements today given the current budget but worries that fiscal resources may change tomorrow, making the arrangements untenable.

We fit the model to data that describes the tenures, budgetary resources, and power-sharing decisions of autocrats in the post-WWII era. We first estimate the effects of power-sharing arrangements — specifically, the inclusion or exclusion of politically relevant groups (e.g., ethnic, linguistic, or religious groups) from the ruling coalition — on the likelihood of autocratic survival and budget fluctuations.[1] Given these effects, we then estimate autocrats' office benefits and their costs associated with sharing power and excluding rivals. Thus, our structural approach allows us to identify how autocrats balance the effects of power-sharing arrangements on their political survival, rents, and future budgets. In doing so, we make three primary contributions.

First, although excluding potential rivals allows autocrats to consume more office benefits going forward, it entails substantial upfront expense. We estimate that this cost is an order of magnitude larger than the cost of power sharing. This implies that power sharing cannot be cheaply undone and thus constitutes a meaningful commitment even in autocracies. This result confirms a common but untested assertion that cabinet posts represent "credible" promises of future patronage (e.g., Arriola 2009; Paine 2020). Furthermore, the cost of exclusion varies in sensible ways. Autocrats with little institutional constraints, a military pedigree, and oil exports pay a smaller, albeit still substantial, price for exclusion.

Second, we find that large budgets are necessary for autocrats to share power and maintain inclusive ruling coalitions. When fiscal resources are tight, autocrats more often exclude other elites and then maintain exclusive coalitions. Our 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 30 percentage points. Yet, maintaining their inclusive coalition amid austerity 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 tumult that follows, they will have reduced their patronage obligations, increasing their share of the office spoils and likelihood of weathering subsequent low-budget periods. These predictions do not describe some unrecognizable sovereign; our in-sample predictions match de Waal's (2015) case study of Sudanese politics and help to explain the downfall of Samuel Doe in Liberia.

Third, we analyze the evolution of power-sharing in response to budget shocks and find that budgetary expansions (on the scale of recent commodity booms in Africa) generate lasting changes in the likelihood that rulers include potential opponents in their ruling

[1] As described in Section 4, we use politically relevant societal groups (as defined in the EPR), 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 these societal groups' inclusion or exclusion does not meaningfully change the composition of our sample and, if anything, attenuates our estimates.

coalitions. After twenty years (and despite intervening budget volatility), the autocrat that starts from the more auspicious fiscal position is ten percentage points more likely to adopt power sharing. This difference shrinks with time but remains of similar magnitude even after fifty years. These findings have implications for how we expect autocrats to respond to sanctions or aid conditionality — the economic sticks and carrots of foreign policy. Denying autocrats aid until they liberalize could be ineffectual, because leaders have little incentive to include rivals without first having a flow of funds needed to secure their loyalty.

Our theoretical framework is essential for these conclusions. With a one-shot interaction, there would be few incentives for autocrats with tight fiscal constraints to purge, as excluding potential rivals under these conditions both increases the autocrat's chances of immediate removal and carries substantial cost. Thus, a dynamic model is necessary to explain exclusion amid austerity. In addition, our counterfactuals contrast with more recent work which, in pursuit of credible causal identification, focuses on short-term responses to as-if random budget fluctuations (e.g., Caselli and Tesei 2016). Our analysis, in fact, 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 unified theoretical and empirical model distinguishes this paper from previous work. Empirical work highlights how autocrats trade-off coup threats for civil wars when deciding whether or not to share power (Roessler and Ohls 2018; Roessler 2011). Theoretically, Meng (2019) and Paine (2020) endogenize these trade-offs by showing how shocks to political power or budgets generate commitment problems and lead to bargaining break down within the ruling coalition. Our model is similar to Caselli and Tesei (2016) who study the effects of budget shocks on autocrats incentives to democratize. Besides the structural approach, the analysis below is distinct in that incorporates two endogenous variables representing budget levels and power-sharing. Most notably, Francois, Rainer and Trebbi (2015) also undertake a structural exercise to explain cabinets' ethnic composition in African countries. Like their paper we study whether or not a leader accommodates or excludes potential rivals when constituting a ruling coalition, but we illustrate how changing and endogenous budgets shape those decisions.

2. Model Rationale

2.1 Goals

"In my account, all dictators are presumed to be motivated by the same goal — survive in office while maximizing rents," Magaloni (2008, 717) writes. This is common in models of authoritarian decision-making, even those which acknowledge that autocrats may also have policy preferences (e.g., Gandhi and Przeworski 2007; Bueno de Mesquita et al. 2005).[2] 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 percent lost power in a popular uprising during the post-WWII era. Roessler (2011, 308) writes, "the imminence, proximity, and the secrecy of the threat, coupled with its incredibly high costs, have forced rulers to be on the defensive at all times and adopt a set of 'coup proofing' techniques."

2.2 Ruling Coalitions

Autocrats carefully compose their ruling coalitions to ensure survival (Bueno de Mesquita et al. 2005; Francois, Rainer and Trebbi 2015; Beiser-McGrath and Metternich 2020). Gandhi and Przeworski (2007, 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, 1340-1) argues that "leaders use high-level government appointments to make credible their promises to distribute patronage among political elites and the constituencies whom they represent." Likewise, Kramon and Posner (2016, 27) contend that "the implicit understanding is that holders of these cabinet seats will enrich themselves, distribute resources to their clients, and support the incumbent from whom their benefits flow."

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

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

Ohls 2018). In addition, 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 remove would-be rivals from their coalitions to create more exclusive governments and, thereby, shore up their survival prospects. Excluding rivals often requires up-front security costs (Wright, Frantz and Geddes 2013) and could invite counter-coups (Sudduth 2017).

2.3 Budgets

Leaders more easily retain power when they control large flows of unearned income, such as royalties from natural resources or foreign aid (Morrison 2009; Bueno de Mesquita and Smith 2010). The budget also affects the sustainability of different ruling coalitions. Indeed, coup-proofing (e.g., through the exclusion of potential rivals) 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, 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, 3).

Finally, budgets not only shape leaders' strategies, they also reflect how leaders govern. 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).

3. Model

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

After observing s_l^t and ε_l^t, the leader chooses the composition of the ruling coalition. If $C_l^t = 0$, then period begins with an excluded opposition, and the leader decides whether or not to include them. If $C_l^t = 1$, then the period begins with an inclusive 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

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

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

After the leader chooses action a_l^t in states s_l^t and ε_l^t, he accrues payoffs: $u_l(a_l^t, s_l^t; \theta) + \varepsilon_l^t(a_l^t)$. The value $\varepsilon^t(a^t)$ captures the stochastic, unobserved costs and benefits to excluding or including the opposition. The function $u_l(a^t, s^t; \theta)$ captures the systematic component of the leader's utility and is parameterized by the to-be-estimated vector θ. We endow u_l with the following form:

$$u_l(a_l^t, s_l^t; \theta) = \underbrace{B_l^t}_{\text{Budget benefits}} + \overbrace{x_l \cdot \beta}^{\text{Office benefits/costs}} + \underbrace{\rho \cdot \mathbf{I}(a_l^t, C_l^t)}_{\text{Costs of inclusion}} + \underbrace{\mathbf{E}(a_l^t) \cdot x_l \cdot \kappa}_{\text{Cost of exclusion}} \tag{2}$$

where $\theta = (\beta, \kappa, \rho)$, $\mathbf{E}(a_l^t)$ is an indicator function denoting whether or not the leader removed a rival, and $\mathbf{I}(a_l^t, C_l^t)$ is an indicator function denoting whether or not the opposition is included in the government given (a_l^t, s_l^t).[3]

The payoffs in Equation 2 have an intuitive interpretation. First, the leader receives the government revenue B_l^t, and this revenue is offset by an additional cost or benefit $x_l \cdot \beta$. The adjustment $x_l \cdot \beta$ could be positive if governing entails additional benefits beyond observed revenue, and it could be negative if the leader cannot consume the entire government budget. These additional office benefits or costs vary with leader characteristics.[4] Second,

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

[4]The covariates x_l are not indexed by t, i.e., they do not vary over time. If they did, then they would need to additional dimensions of the state space, which exponentially increases the size of the state space and introduce 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.

the coefficient ρ captures the degree to which power sharing diminishes or increases the autocrat's office benefit. Thus, ρ includes both the monetary resources extracted by any coalition members *and* any ideological or policy costs that autocrat may receive by including the opposition. Finally, the value $x_l \cdot \kappa$ represents the upfront cost of consolidating power, which arise because purging may require the use of force or invite a backlash. If the autocrat can easily oust a coalition member, then $\kappa \approx 0$, a case which is 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.

After the leader accrues payoffs, he may lose power either due to death or removal. This occurs with probability $1 - g_l(a_l^t, s_l^t, \gamma)$, where g_l is a function parameterized by γ that explicitly depends on the current state and endogenous actions chosen by the leader. This framework allows the leader's survival to depend on his power-sharing decisions and the current budget level.[5] For example leaders who consolidate power may face a larger probability of removal than those who maintain power-sharing arrangements.

If the leader exits office, then his decision process ends, and his payoff in all future periods is zero.[6] If the leader remains in office, then he enters period $t+1$, in which case, the state variables s_l^t and ε_l^t evolve as follows. First, as is standard in these models, ε_l^{t+1} is drawn from a type one extreme value distribution and is independent across states, actions, and time periods. Second, the power-sharing variable 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. That is, $f_l(B_l^{t+1}; a_l^t, s_l^t, \phi)$ is a probability function, parameterized by ϕ, denoting the probability that B_l^{t+1} is next period's budget given actions a_l^t and the current state $s_l^t = (B_l^t, C_l^t)$. Thus, period $t+1$'s budget depends not only on the budget in period t but also on the power-sharing decision of the leader, a_l^t. Along with g_l, we calibrate f_l to match common empirical analyses in the literature.

The leader chooses optimally to maximize the expected sum of his discounted utility. As is standard in the dynamic programming, the leader's optimal choice is Markovian and unique. In Section A.1, we characterize the leader's optimal choice as a vector of continuation values via the Bellman Equation. Using this, Equation 7 characterizes the probability with which the leader excludes and includes given the current budget level and

[5]The model is agnostic to the size and direction of power-sharing's effect on the autocrat's survival probability. We estimate these effects below.

[6]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.

coalition type. We use this probability to fit the model to data via maximum likelihood estimation.

Before proceeding, it is important to acknowledge that the autocrat is the only strategic actor in our model. Potential challengers play an important role, but their machinations are captured in the survival function g_l and the evolution of the budget f_l, which we calibrate to data. Previous work provides theoretical underpinnings for why more or less inclusive ruling coalitions affect survival rates (Paine 2020; Meng 2019) and why inclusive coalitions may increase investment (Gehlbach and Keefer 2011).[7] By contrast, we to study how forward-looking autocrats "best respond" to would-be challengers by making power-sharing decisions that incorporate the empirical associations — estimated here and explored in previous literature — between leaders' budgets and actions and their survival. Doing so allows us to quantify the short- and long-term effects of budget shocks on the propensity for leaders to share power. Focusing on the autocrat also avoids layering on assumptions about how challengers affect the interaction and permits empirical progress without data (which does not exist in most settings) on the characteristics of would-be challengers, as these attribute affect challengers' returns to seizing power.

3.1 Numerical Example

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

$$g_l(a_l, s_l) = 0.85 - 0.05\,\mathbf{I}(a_l, C_l) - 0.2\,\mathbf{E}(a_l) - 0.03B_l + \\ 0.06\,\mathbf{I}(a_l, C_l) \times B_l + 0.05\,\mathbf{E}(a_l) \times B_l, \tag{3}$$

which is an equivalent to the representation in Table 1. Notice that the functional form of 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 in low budget periods. As for fiscal resources, the budget in period t remains the budget in period $t+1$ with probability $\phi \in (0, 1)$, where we set $\phi = 0.8$ as the persistence of the budget in the example.[8]

[7] In particular, Paine (2020) shows that shocks to the leader's budget can lead to coups with inclusive governments.

[8] This is a simplification to ease exposition. The model allows the budget in period $t+1$ to depend on the leader's power-sharing choices in period t.

Table 1: Example of leader's survival probabilities.

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

We choose this specification because it matches several patterns in the data and reveals real tradeoffs. Excluding the opposition in high budget periods imperils the leader's survival as maintaining an exclusive coalition with a high budget reduces the survival probability by 20 percentage points. This is consistent with comparative politics research on neopatrimonial regimes, which argues that opposition elites may be inclined to depose the leader if denied spoils (Kramon and Posner 2016, 27). Yet inclusion is not always recommended, and not just because it is costly to dole out patronage. If the budget falls, then the leader, with an inclusive coalition, faces a dilemma: if he maintains the status quo, his survival probability is 0.80, and if he actively excludes his survival probability is 0.65. Both of these are smaller than the survival probability in a low budget state in an already exclusive ruling coalition of 0.85. Thus, even though excluding the opposition reduces his survival probability by 15 points, the leader may be better off consolidating power if he expects the lean times to persist. Our leader's dilemma — not wanting to alienate other elites, all the while recognizing that their inclusion is unsustainable amid ongoing scarcity — is a tradeoff apparent in this example and one that emerges when we fit the model to data.

Table 2: Optimal choice quantities.

State $s_l = (B_l, C_l)$	Continuation Value $V_l(s_l)$	Pr(Changing Status Quo) $\Pr(a_l \neq \varnothing; s_l, V_l)$
$(0,0)$	11.21	0.00
$(0,1)$	6.88	0.65
$(5,0)$	17.24	0.63
$(5,1)$	16.72	0.09

Table 2 reports the quantities describing the leader's optimal choice and associated expected payoffs. The first column lists the four states in this example, i.e, all possible (B_l, C_l) pairs, and the second column provides the associated continuation values, where the leader has larger expected utilities in large budget states. The third column reveals how our hypothetical leader's survival strategies change across different states of the world. When budgets are tight, the leader wants to maintain an exclusive ruling coalition. He almost never adopts inclusive governments when the opposition is already excluded. If necessary, he's inclined (with probability 0.65) to remove the opposition to consolidate power. Though it initially reduces his survival prospects, he prefers to remove the opposition given the persistence of the low budget. In high-budget periods, the leader generally maintains inclusive coalition. He excludes the opposition when the government currently shares power only with probability 0.09. In addition, with probability 0.63 he opts to share power when the opposition is currently excluded. On the one hand, adopting an inclusive coalition in this state guarantees the leader a large likelihood of remaining in power tomorrow (with probability 0.95), but on the other hand, it also entails substantial costs ($\rho = -2$).

3.2 Transitions

Our model is flexible enough to incorporate a variety of transition probabilities that capture the effects of the leader's actions on his survival and the evolution of the budget, g_l and f_l. A benefit of this approach is that we can specify these probabilities to match the empirical analyses common in the comparative politics literature, subject to a specification that preserves the model's stationarity.[9]

Section C details the statistical models that relate the action a_l^t chosen in state s_l^t and period t to (a) leader l's survival probability at the end of period t, and (b) the future budget B^{t+1}. These models exhibit three features. First, tomorrow's budget may depend on the power-sharing decisions chosen today. As in Gehlbach and Keefer (2011), inclusive governing coalitions may encourage investment and therefore higher budgets. Second, the effects of inclusion or exclusion on the leader's survival (or tomorrow's budget) may depend on the current budget level. It could be the case that, adopting inclusive coalitions successfully deters coups in large budget periods but not in low budget periods when there are less spoils to distribute and diminished resources available to coup-proof. Third, other factors may determine leader survival or budgets, so we include leader-specific information such as his start age, military background, whether his administration produces oil, etc. We

[9] For examples, see Bueno de Mesquita and Smith (2010), Gandhi and Przeworski (2007), Gehlbach and Keefer (2011), and Wright, Frantz and Geddes (2013).

also include country fixed effects to alleviate concerns about omitted variable bias that arises from time-invariant county characteristics.

The first two features mark important differences between our approach and selectorate theory, a work-horse model of (autocratic) politics in which leaders buy the "votes" of a winning coalition with private transfers or public goods (see Gehlbach 2013). In selectorate theory, the budget does not change as a consequence of the leader's past decisions; the leader can devise their survival strategy without regard for the economy. Moreover, the size of the minimum winning coalition is fixed. In response to budget fluctuations, leaders therefore adjust the benefits provided to members of the winning coalition rather than enlarging or contracting their coalitions through inclusion and exclusion. Furthermore, leaders are never deposed in equilibrium because they can divide budget to satisfy the demands of their coalition members. Although selectorate models illustrate why leaders opt for patronage or public goods, they provide less guidance on why leaders rearrange their governing coalition (absent other institutional changes) even when doing so results in a temporarily larger probability of removal.

4. Data

4.1 Sample

We restrict attention to autocratic regimes that impose few or no constraints on leader — settings where, as in our model, leaders' survival tactics are not limited by other political actors. Our sample constitutes administrations that score five or below on the Polity scale; are classified as non-democracies; and have, at most, limited constraints on executive authority.[10] As our measurement of leaders' actions (discussed below) relies on the inclusion or exclusion of different societal groups, we retain countries with multiple politically relevant groups. This leaves us with a panel of 303 administrations from 88 countries over 54 years. Table A.2 shows that listwise deletion due to missing covariates does not meaningfully change the composition of our sample. We measure explanatory variables at the time the leader assumes power, thereby ensuring that sample selection is not an outcome of leaders' decisions in office. Table A.3 provides summary statistics.

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

4.2 Budget

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

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

4.3 Leader's Actions

We use the EPR data to code whether leaders include or exclude rival groups (Cederman, Min and Wimmer 2012). The EPR "identifies all politically relevant ethnic groups and their access to state power in every country of the world from 1946 to 2013." Ethnicity here is defined very broadly, incorporating groups defined by a common language, race, or religion. We only retain administrations with at least two groups in the EPR. This criterion leads to relatively few exclusions: unconstrained autocrats in 8 states are missing from the EPR; another 11 states include only one group (see Table A.4). The excluded states tend to be small (e.g., Comoros, Suriname, Lesotho) and collectively account for just 3.5 percent of the people living in unconstrained autocracies.[11]

An 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

[11] 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 Tables A.4 and A.5.

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 ($a_l^t = 0$).[12]

This operationalization implies that the leader views elites from other politically relevant ethnic, linguistic, or religious groups as *potential* rivals — an assumption consistent with past research. Roessler (2011, 324), for example, finds that "two-thirds of groups involved in successful coups [in Africa] are different from the ruler's ethnic group." His analysis also suggests that the ruler's co-ethnics are less likely to stage a rebellion. More broadly, the literature on neopatrimonialism views the inclusion of elites from other ethnic, linguistic, or religious groups as an effort to buy their otherwise wavering loyalty (Bratton and van de Walle 1994; Kramon and Posner 2016). Our use of the EPR data and coding scheme capture a common way of identifying autocrats that do and do not permit power sharing (Francois, Rainer and Trebbi 2015).[13] If EPR groups not salient are, however (e.g., contestation occurs along a left-right divide), this would generally attenuate our estimates because the actions we code should not then affect the leader's survival (or the budget) when they are not relevant to local politics. Despite this potential, the results we report below suggest that the inclusion and exclusion of these groups affect leaders' budgets and survival prospects.

4.4 Survival Data

The Archigos data record the tenure of primary rulers for every independent state until 2015 (Goemans, Gleditsch and Chiozza 2009). This enables us to code when an administration starts and ends. Archigos also includes information on how each leader lost power. Of particular interest for us is when leaders die or are removed through "irregular means" — "when the leader was removed in contravention of explicit rules and established conventions." The Archigos codebook notes, "Most Irregular removals from office are done by domestic forces. Irregular removal from office is overwhelmingly the result of the threat

[12] In Section B.3, we consider two alternative codings. The first codes $a_l^t = e$ even if reducing the number of partners in a coalition does not consolidate power to a single group. The second uses changes in whether or not there is a dominant group in government to code both the action and the state variable. In Tables A.9 and A.10, we show our first-stage results for these different codings; in Table A.14, we show that our estimates of the leader's payoffs are largely unchanged.

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

or use of force as exemplified in coups, (popular) revolts and assassinations" (3). While multiple administrations can pass in a single country-year, our other variables are measured at the country-year level. We collapse Archigos to the country-year level by retaining the leader that serves the most months in a given year.

4.5 Payoff Covariates

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

5. Results

To fit the model to data, we follow Rust (1994) and detail the specifics in Appendix D. Informally, we proceed in three steps following. First, we estimate panel models describing how leader removal and budgets depend on past values of power-sharing decisions and budget levels. We use these models to construct the transition probabilities describing leader survival (g_l) and the evolution of the budget (f_l). Second, we estimate the leader's payoff parameters given the estimated transition probabilities in the first step. Essentially, when we fix the transition probabilities to those estimated in step 1, we can use the leader's Bellman equation to derive the probability that autocrats share power or exclude rivals at any budget level given payoff parameters θ (see Appendix A.1). This probability is used to estimate the θ via MLE. Finally, once we know the transition probabilities and the payoff parameters, we can study the substantive effects of budgets on the leader's power-sharing decisions.

5.1 Transition Probabilities

To specify the transition probabilities, we estimate

$$Y_{lc,t+1} = \alpha_c + \gamma_1 \mathbf{I}_{lct} + \gamma_2 \mathbf{E}_{lct} + \gamma_3 B_{lct} + \gamma_4 \mathbf{I}_{lct} \times B_{lct} + \gamma_5 \mathbf{E}_{lct} \times B_{lct} + \omega \mathbf{Z}_{lc} + \varepsilon_{lc,t+1} \quad (4)$$

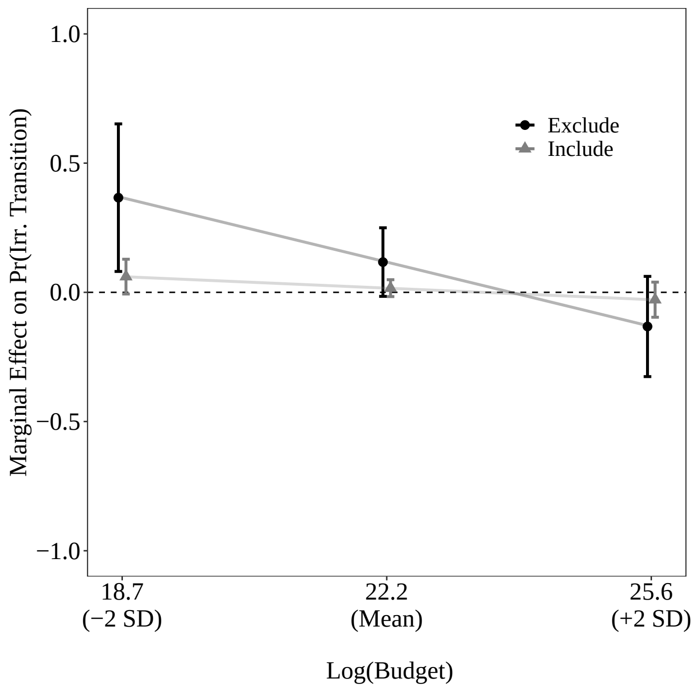
for three outcomes of interest: leader removal, natural death, and government consumption. In Equation 4, l indexes administrations; c, countries; and t, years. Our right-hand-side variables lag our outcome measures by one year, and our budget variable B_{lct} is in logs. Notice we include interaction terms between the current budget level (B_{lct}) and the decisions of the leader to exclude or include their rivals (E_{lct} and I_{lct}). We also include country fixed effects (α_c) and leader-specific covariates $\mathbf{Z}_{lc}$. We present the full regression results when the dependent variable is irregular transitions in Table A.6. Our coefficients remain consistent in magnitude across specifications; the inclusion of additional covariates improves precision. In all models, we cluster our standard errors on administration.

To aid in interpretation, we present the marginal effects of inclusion or excluding when the budget is two (pooled) standard deviations above and below its mean in Figure 1. This plot is based on estimates from Model 5 in Table A.6, which includes all of our leader-specific covariates. The figure illustrates one tradeoff leaders face. When budgets are tight, inclusive governing coalitions and especially excluding rivals from government increase the likelihood of an irregular transition. Yet, when times are good, these strategies 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 as they are not sharing available spoils.

To keep our analysis tractable, we restrict the state space to the budget and coalition type. As a consequence, Equation 4 does not include other covariates that change over a leader's term.[14] As a robustness check, we relax this assumption and permit $\mathbf{Z}$ to vary within administrations over time. In these models, we also include year or continent-by-year fixed effects to account for global or continent-specific trends. The marginal effects of interest are qualitatively unchanged (see Table A.11).

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

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



Marginal effects (and confidence intervals for $\alpha = 0.1$) of including an excluded group or 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.6.

To further validate these results, we leverage exogenous variation in government budgets using the timing of giant oilfield discoveries as in Lei and Michaels (2014).[15] This identification strategy does not rely on cross-national variation in oil dependence; rather, it leverages changes that occur within countries in the immediate aftermath (2–6 years) of a major oil discovery. Focusing on a relatively short window after such discoveries and conditioning on country and year fixed effects, Lei and Michaels (2014) show that the timing of such discoveries is plausibly exogenous (i.e., beyond the control of any cash-hungry autocrat). Such giant oilfield discoveries increase budgets for the administrations in our sample by 15 to 20 percent (see Table A.12). Furthermore, we estimate the reduced-form relationship between giant oilfield discoveries and irregular leadership transition by re-estimating Equation 4 but substituting an indicator for recent discoveries for our budget measure B. In Figure A.2, we reproduce Figure 1 (left) and then show the relevant marginal effects for leaders who do and do not enjoy a recent giant oilfield discovery (right). We again find that inclusive coalitions and actively excluding groups detract from the leader's survival absent

[15] Giant oilfields encompass 500 million barrels of ultimate recoverable reserves.

the windfall; however, these strategies are not detrimental to (and may benefit) leaders' survival following a discovery.

The Appendix contains our other results describing the evolution of the budget and leader death. Table A.8 reports models of the budget transitions. We find evidence of strong budget persistence as the coefficient associated with a lagged budget level is roughly 0.94.[16] Importantly, we find evidence that inclusive coalitions, particularly at higher budget levels, increase the expected budget in the upcoming year. This matches findings in Gandhi and Przeworski (2007) and Gehlbach and Keefer (2011) who argue that inclusive governing coalitions can solve commitment problems, increase investment, and rents for the leader. Finally, Table A.7 reports models of leader death. Reassuringly, we find that young leaders or those who began their tenure more recently are less likely to die from natural causes while in office.

5.2 Leader's Payoff Parameters

Table 3 presents our estimates of leaders' payoff parameters. We restrict the coefficient on the 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 variable, one describing how the variable affects the leader's office benefits, β, and one describing how it affects the leaders upfront costs of excluding included groups, κ.[17] Table 3 also includes two sets of standard errors, a conventional estimate based on the outer-product of gradients and a second computed by a country-level jackknife procedure. The latter generates larger standard errors as it also incorporates the uncertainty of our estimated transition probabilities.

Starting with office benefits, leaders with a military pedigree gain less from holding executive office. This aligns with seminal work on autocracies, which argues that military leaders often assume power reluctantly, staging a coup only to maintain order or the cohesiveness of the military (Geddes 2003). We also find, unsurprisingly, that a history of repeated civil wars reduces the benefits from holding office. Conflict can destroy the tax base, deter investment, and force leaders to divert revenues to fighting rebellion. The remaining variables have estimates that are not significant at conventional levels when using our more conservative standard errors.

[16] We reject the the null hypothesis that the autoregressive process has a unit root at the $\alpha < 0.001$ level in all specifications.

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

Table 3: Estimates of leaders' payoff parameters.

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

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

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

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

5.3 Optimal Choice of Including or Excluding

The previous subsections demonstrate that power sharing (and its absence) affect both autocrats' survival prospects and office benefits. When budgets are small, maintaining inclusive coalitions or removing groups reduces the leader's likelihood of keeping office. When resources are ample, both are less detrimental to survival. In addition, inclusion with large budgets increases the probability that the budget will be large tomorrow. As for office benefits, we find that inclusion is costly, but the costs of excluding groups are an order of magnitude larger. Given these tradeoffs, when should leaders exclude or share power?

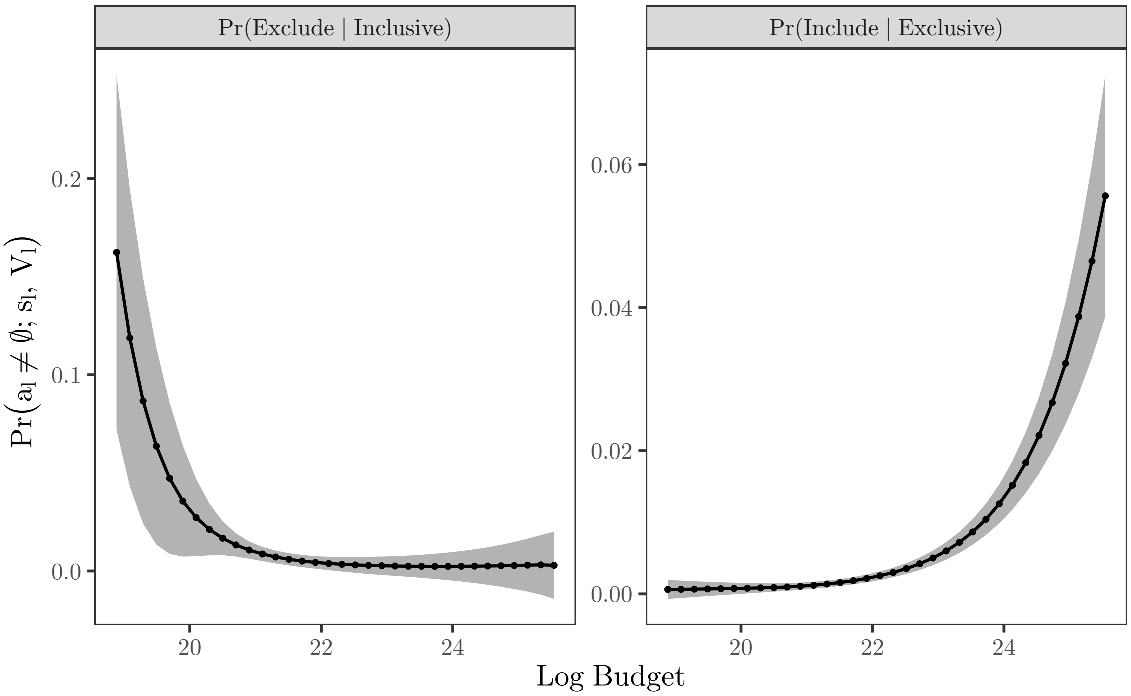
To answer this question we consider a hypothetical autocrat who takes on median values of the covariates. This leader is unconstrained, has a military background, and entered office in the mid-1970s at the age of 45. In addition, his country does not have oil and has had no civil wars.[18] Fixing the coefficient estimates to those in Table 3, we can compute the autocrat's optimal probabilities of changing their governing coalitions.

Figure 2 presents the optimal choice probabilities. The right panel graphs the probability that leader includes an excluded opposition, and the left is the probability that a leader removes a group from an inclusive coalition. Two immediate patterns emerge. First, given an exclusive coalition, the autocrat only broadens his coalition when the budget is large. At the average budget (logged) in the data ($B_l = 22.2$), the autocrat almost never includes other groups, but this per-period probability increases to approximately seven percent at the upper end of the range ($B_l \approx 25$). Second, the autocrat is most likely to winnow his coalition at small budget levels, occurring with over 15 percent probability in the extreme.

Figure 1 and Table A.8 indicate that, when budgets are high, inclusion can both improve an autocrat's survival prospects and their budget outlook. The latter finding — that inclusion can bolster future revenues — is consistent with past work arguing that autocrats

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

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



Predicted probability that the leader includes an excluded group in their cabinet (**left**) and excludes an included group (**right**). All variables are held at their sample medians; the conditional volatility of the budget is set at the median, $\sigma_l = 0.117$. The shaded area denotes confidence intervals ($\alpha = 0.1$). Standard errors computed using a country-level jackknife

can benefit economically by sharing power and, thus, mitigating the moral hazard problem (Gehlbach and Keefer 2011). Given the relatively high costs of removing rivals, we see autocrats opting for power sharing at high budget levels.

However, Figure 1 also indicates that removing members of a coalition is a risky action when budgets are low. Why are budget-starved autocrats more likely to pursue such a strategy? First, they expect budgets to remain low because budget levels are relatively persistent (see Table A.8). And at low budget levels, the autocrats' survival probabilities are greatest when they 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 preferred state. Should they survive the backlash, they then enjoy the full spoils of office and a higher likelihood of remaining in power in subsequent lean periods. Despite the short-run risks, there are substantial long-term benefits to consolidating power given that autocrats expect budgets to remain low.[19]

[19]Figure A.3 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

Overall, our findings echo de Waal's (2015, 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 his survival by inviting in opponents and creating unaffordable patronage obligations, so they adopt and maintain more exclusive coalitions.

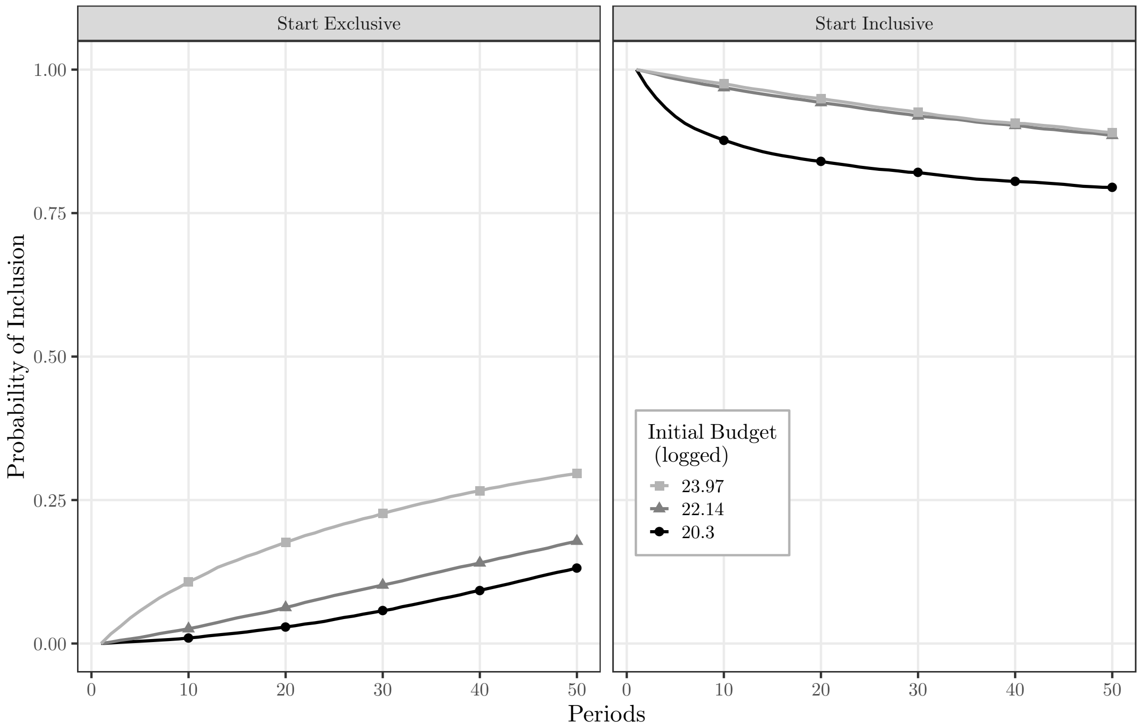
6. Budget Levels and Power Sharing

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

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

budgets are tight, autocrats have a larger incentive to switch from an inclusive to an exclusive coalition or simply maintain the latter.

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



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

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

6.1 Illustrative Cases

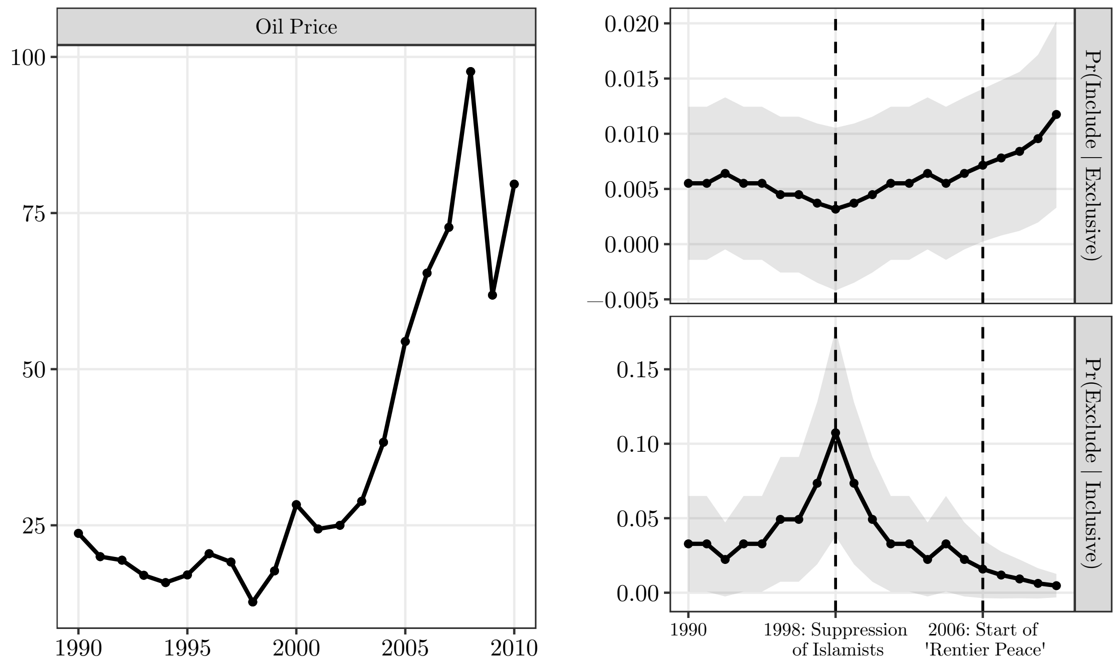
These counterfactuals illuminate the political consequences of large historical shocks to government budgets. To take a recent example, a dramatic increase in world commodity prices between 2000 and 2012 expanded government budgets across a number of mineral-rich countries in Africa. Between 2000 and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

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

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

Budget shortfalls have proven fatal for other autocrats. Liberia's Samuel Doe faced the dilemma formalized earlier: "How was Doe to manage the urgent task of asserting his political authority over strongmen (not to mention satisfying his expensive person tastes)?" (Reno 1999, 87). Doe's tenure illustrates our findings. Upon assuming power and prior to the country's economic collapse, Doe opted for inclusion. While he publicly executed top officials from the overthrown Tolbert government, he also appointed many as ministers: "Doe's first cabinet included four ministers from Tolbert's era, and others from that era were promoted into the top ranks of the civil service. Of twenty-two cabinet ministers listed in 1985, at least half had held bureaucratic positions in pre-Doe governments" (Reno

Figure 4: In-sample predictions for Sudan.



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

1999, 82). Charles Taylor, who would later mount a rebellion against Doe's government, returned to Liberia in 1980 to serve in Doe's cabinet. According to Reno (1999, 85), Doe "found that any long-term strategy [...] 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, iii). "Doe's vulnerability lay in his incapacity to wield resources to counterbalance those controlled by Liberian strongmen or to finance patronage obligations to Liberia's state bureaucrats" (Reno 1999, 88). Per our model, he looked to consolidate power amid contraction but feared he could not weather the backlash that would follow a purge. Doe lost power and was executed in 1990 as Liberia descended into civil war.

7. Discussion

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

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

While some view these results as at odds, both consequences of sanctions — increased repression and instability — are implied by our results. If sanctions reduce an autocrat's budget, this pushes them to 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 their risk of 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.

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

These policy implications also raise additional questions and extensions of our work. First, future work could extend our model to incorporate additional survival strategies. For 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. Second, future work could also examine more nuanced counterfactuals that better mimic conditions on international aid or sanctions. Our counterfactuals examine how leader's immediate and long-term policies change according to different budget levels or shocks. While aid and sanctions affect an autocrat's fiscal resources in this manner, their conditions are complicated, potentially affecting the autocrat's expectations about future budgets in more nuanced ways.

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Supporting Information

How Budgets Shape Autocrats' Survival Strategies

Following text to be published online.

Contents

A. Model

A.1 Leader's Optimal Solution

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

$$
\begin{aligned}
V_l(s_l) &= \int_{\varepsilon_l'} \max_{a_l \in A(C_l)} \left\{ u_l(a_l, s_l; \theta) + \varepsilon_l'(a_l) + g_l(a_l, s_l; \gamma)\delta \sum_{s_l' \in \mathscr{S}} V(s_l') F_l\left(s_l'; a_l, s_l, \phi\right) \right\} d\varepsilon_l' \\
&= \log\left(\sum_{a_l \in A(C_l)} \exp\left\{ u_l(a_l, s_l; \theta) + g_l(a_l, s_l . \gamma)\delta \sum_{s_l' \in \mathscr{S}} V(s_l') F_l\left(s_l'; a_l, s_l, \phi\right) \right\} \right) + C \qquad (5) \\
&\equiv \Upsilon_l(s_l, V_l; \theta, \gamma, \phi),
\end{aligned}
$$

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

$$
\Upsilon_l(V_l; \theta, \gamma, \phi) - V_l = 0, \qquad (6)
$$

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

$$
P(a_l; s_l, V_l) = \frac{\exp\left\{ u_l(a_l, s_l; \theta) + g_l(a_l, s_l, \gamma)\delta \sum_{s_l' \in \mathscr{S}} V(s_l') F_l\left(s_l'; a_l, s_l, \phi\right) \right\}}{\sum_{a_l' \in A(C_l)} \exp\left\{ u_l(a_l', s_l; \theta) + g_l(a_l', s_l, \gamma)\delta \sum_{s_l' \in \mathscr{S}} V(s_l') F_l\left(s_l'; a_l', s_l, \phi\right) \right\}}, \qquad (7)
$$

where V_l solves Equation 6. Given a vector of parameters (θ, γ, ϕ), Equation 7 defines the likelihood of observing action a_l in state s_l, which we use to fit the model to data via maximum likelihood estimation.

B. Data and Sample

B.1 Budget Data

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

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

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

B.2 Sample

Table A.2: Missingness due to listwise deletion

	(1)	(2)	(3)	(4)
Americas	-0.089			-0.128
	(0.122)			(0.115)
Asia	-0.092			-0.103
	(0.060)			(0.078)
Europe	-0.074			-0.120
	(0.111)			(0.121)
Year		-0.004***		-0.004***
		(0.001)		(0.001)
Polity			-0.010	-0.007
			(0.007)	(0.006)
EPR Groups				-0.001
				(0.004)
Oil Producer				0.025
				(0.068)
N	3168	3168	3168	3168

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

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
$C_t = 1; a_t = 0$	2807	0.41	0.49	0	0	0	1	1
$C_t = 0; a_t = 0$	2807	0.58	0.49	0	0	1	1	1
$C_t = 1; a_t = p$	2807	0.01	0.08	0	0	0	0	1
$C_t = 0; a_t = i$	2807	0.01	0.08	0	0	0	0	1
Irregular Leader 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	-0.001	-0.002	-0.002
	(0.002)	(0.002)	(0.002)
Polity	0.011	0.011	0.012
	(0.008)	(0.008)	(0.008)
Oil Producer	0.169***	0.161**	0.159**
	(0.064)	(0.065)	(0.065)
Start Age		0.001	0.001
		(0.002)	(0.002)
Military Pedigree			0.048
			(0.039)
N	424	422	384

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

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

Failed Purges For states, $C_l^t = 0$ if and only if we observe that leader l's country in year t has a dominant group in government as recorded in the EPR data. For actions, $a_l^t = e$ 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, $a_l^t = \varnothing$.

Note that this coding permits "failed" attempts to consolidate power because the number of groups in government may decrease in period t, i.e., there is a purge, but there may still not be a dominant group in period $t+1$ so $C_l^{t+1} = 1$. Using this coding, seven out of 35 purges fail. We use this coding in Tables A.9 and A.14.

Dominant For $t = 1$, $C_l^1 = 0$ if and only if we observe that leader l's country in year t has a dominant group government as recorded in the EPR data. If there is no dominant group, then $C_l^1 = 1$. For $t > 1$, $a_l^t = \varnothing$ if there is no change in the country's dominant group status, i.e., there was a (no) dominant group in both t and $t-1$. $a_l^t = e$ 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 $C_l^{t+1} = \mathbf{I}(a_l^t, C_l^t)$. We use this coding in Tables A.10 and A.14.

C. Transition Probabilities

We model the means of the transition probabilities, g_l and f_l. First, suppose leader l chooses action a_l in state s_l, and consider the probability that he is not forcibly removed from office. We model this as a liner probability model with expectation $\mu_l^r[a_l, s_l; \gamma^r]$, which takes the form:

$$\mu_l^r[a_l, s_l; \gamma^r] = \gamma_1^r \mathbf{I}(a_l, C_l) + \gamma_2^r \mathbf{P}(a_l) + \gamma_3^r B_l + \gamma_4^r \mathbf{I}(a_l, C_l) \times B_l + \gamma_5^r \mathbf{P}(a_l) \times B_l + \gamma_6^r z_l. \tag{8}$$

Then $\mu_l^r[a_l, s_l; \gamma^r]$ is the expected probability that l is not forcibly removed from office after choosing action a_l in state s_l. This setup has several useful properties due to its flexibility and ease of interpretation. First, the effect of power sharing depends on the current budget level. For example, it could be the case that, in large budget periods, adopting an inclusive coalition successfully deters coups, but not in low budget periods. Likewise, a higher budget may enhance the ability of an autocrat to successfully exclude members of the ruling coalition. The vector z_l contains pertinent information about the leader such has his start age, military background, whether his administration produces oil, and country-specific dummies. Thus, our model and data alleviates some concerns about omitted variable bias that arise from time-invariant characteristics of states (e.g., geography, colonial origin) by accommodating country fixed effects in the transitions. In a similar manner, we define $\mu_l^d[a_l, s_l; \gamma^d]$ as the expected probability that the leader does not die in office, and $\mu_l^d[a_l, s_l; \gamma^d]$ takes an identical form as μ_l^r in Equation 8 which includes country-specific fixed-effects. Letting $\gamma = (\gamma^r, \gamma^d)$, we define $g_l(a_l, s_l, \gamma) = \mu_l^r[a_l, s_l; \gamma^r]\mu_l^d[a_l, s_l; \gamma^d]$, where γ is a vector of to-be-estimated parameters.[20]

For the transition probabilities governing the evolution of the budget, we pursue a similar approach, but we account for multiple discrete budget levels following Tauchen's (1986) model of a discrete AR-1 process. Let $\mathscr{B} = \{b_1, \ldots, b_J\}$ denote a set of equally spaced budget levels such that $i > j$ if and only if $b_i > b_j$. Let $\mu_l^b[a_l, s_l; \phi]$ and σ_l^2 denote the mean and *conditional* variance of tomorrow's budget (what we subsequently refer to as volatility) given the action and state pair (a_l, s_l).[21] We parameterize μ_l^b in a manner identical to Equation 8, which includes country-specific fixed effects. For $j = 2, \ldots, J-1$, budget level $b_j \in \mathscr{B}$ arises tomorrow with probability

$$f_l(b_j; a_l, s_l, \phi) = \Phi\left(\frac{b_j + d - \mu_l^b[a_l, s_l; \phi]}{\sigma_l}\right) - \Phi\left(\frac{b_j - d - \mu_l^b[a_l, s_l; \phi]}{\sigma_l}\right) \tag{9}$$

[20] We also impose the constraint that $g_l(a_l, s_l, \gamma) \in (0, 1)$ when needed.

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

where $2d$ describes the distance between the equally spaced budget levels. Equation 9 is straightforwardly modified to account the smallest and largest budget levels, b_1 and b_J, respectively. Not only does the specification in Equation 9 permit the same flexibility and identification strategy as those above, it can also be estimated consistently from standard autoregressive models, as long as the number of budget levels is not too small. In our results below, we set $J = 50$ and estimate σ_l at the country level. In words, if leaders are from the same country, then they face the same budget volatility, i.e., the same conditional variance of tomorrow's budget. Monte Carlo evidence indicates that we can uncover the model's true parameters relatively accurately if $J = 50$.

C.1 Covariates

We include additional covariates when estimating the transition probabilities (Equation 4). These reduce confounding by conditioning on time-varying features that affect leaders' actions, the budget, and their survival. (Country fixed effects absorb any static differences across countries.) The Archigos data enable us to code the leader's age at the start of their administration, as well as the first year of their tenure. Older leaders might have reduced survival probabilities. Stationarity in our model excludes measures that vary over time within administrations. Yet, we capture changes over time that affect survival (e.g., in medical technologies) by including each leader's first year in office. Using data from Ellis, Horowitz and Stam (2015), we code whether the leader has a military background, as this might enable the leader to more effectively wield coercive power and repress rivals.[22] 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.

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

C.2 First-stage Results

Table A.6: Irregular leader transition.

	(1)	(2)	(3)	(4)	(5)
Log(Budget) (B)	0.015	0.019	0.020*	0.020*	0.022**
	(0.010)	(0.013)	(0.011)	(0.011)	(0.010)
Included (I)	0.255	0.268	0.287	0.305	0.301
	(0.192)	(0.189)	(0.206)	(0.218)	(0.230)
Excluded (E)	1.569**	1.504*	1.797**	1.802**	1.708**
	(0.753)	(0.792)	(0.808)	(0.809)	(0.831)
I x B	-0.011	-0.012	-0.013	-0.014	-0.013
	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
E x B	-0.066**	-0.063*	-0.076**	-0.076**	-0.072**
	(0.033)	(0.035)	(0.035)	(0.035)	(0.036)
First Year in Office	-0.001***	-0.001	-0.002***	-0.001***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Military Pedigree			-0.045***	-0.045***	-0.033**
			(0.015)	(0.015)	(0.015)
EPR Groups				-0.006	-0.001
				(0.011)	(0.013)
Start Age					0.004***
					(0.001)
Oil Producer					-0.004
					(0.034)
Country FEs	87	87	87	87	87
Year FEs	0	54	0	0	0
N	2782	2782	2674	2674	2674

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

Table A.7: Leader death.

	(1)	(2)	(3)	(4)	(5)
Log(Budget) (B)	-0.001	-0.016***	0.002	0.002	0.002
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Included (I)	-0.076	-0.139	-0.064	-0.066	-0.071
	(0.115)	(0.115)	(0.124)	(0.125)	(0.123)
Excluded (E)	-0.059	-0.200	-0.042	-0.043	-0.065
	(0.125)	(0.134)	(0.131)	(0.132)	(0.141)
I x B	0.003	0.006	0.003	0.003	0.003
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
E x B	0.002	0.008	0.001	0.001	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
First Year in Office	-0.001**	-0.002***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Military Pedigree			-0.007	-0.007	-0.004
			(0.006)	(0.006)	(0.006)
EPR Groups				0.001	0.002
				(0.007)	(0.007)
Start Age					0.001**
					(0.000)
Oil Producer					-0.008
					(0.017)
Country FEs	87	87	87	87	87
Year FEs	0	54	0	0	0
N	2782	2782	2674	2674	2674

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

Table A.8: Budget.

	(1)	(2)	(3)	(4)	(5)
Log(Budget) (B)	0.941***	0.934***	0.938***	0.938***	0.938***
	(0.013)	(0.017)	(0.014)	(0.014)	(0.014)
Included (I)	-0.478*	-0.401	-0.501*	-0.456	-0.463
	(0.277)	(0.265)	(0.299)	(0.294)	(0.295)
Excluded (E)	-0.204	-0.186	-0.184	-0.170	-0.168
	(0.441)	(0.409)	(0.459)	(0.461)	(0.464)
I x B	0.024*	0.020	0.025*	0.023*	0.024*
	(0.013)	(0.012)	(0.014)	(0.014)	(0.014)
E x B	0.008	0.008	0.008	0.007	0.007
	(0.021)	(0.019)	(0.022)	(0.022)	(0.022)
First Year in Office	0.001**	-0.000	0.001**	0.001***	0.001***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Military Pedigree			-0.003	-0.003	-0.004
			(0.010)	(0.010)	(0.010)
EPR Groups				-0.016	-0.015
				(0.012)	(0.013)
Start Age					-0.000
					(0.001)
Oil Producer					-0.024
					(0.020)
Country FEs	88	88	88	88	87
Year FEs	0	54	0	0	0
N	2807	2807	2699	2699	2674

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

C.3 Robustness: Coding that Permits Failed Purges

Table A.9: Irregular leader transition.

	(1)	(2)	(3)	(4)	(5)
Log(Budget) (B)	0.017*	0.021*	0.021**	0.021**	0.025***
	(0.010)	(0.012)	(0.010)	(0.010)	(0.010)
Included (I)	0.287	0.301*	0.327*	0.366*	0.386*
	(0.186)	(0.183)	(0.198)	(0.206)	(0.210)
Excluded (E)	2.257***	2.223***	2.490***	2.530***	2.523***
	(0.831)	(0.853)	(0.858)	(0.863)	(0.889)
I x B	-0.012	-0.013	-0.014	-0.016*	-0.016*
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
E x B	-0.097***	-0.096**	-0.107***	-0.109***	-0.108***
	(0.037)	(0.038)	(0.038)	(0.038)	(0.039)
First Year in Office	-0.001***	-0.001	-0.002***	-0.001***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Military Pedigree			-0.045***	-0.045***	-0.034**
			(0.015)	(0.015)	(0.014)
EPR Groups				-0.011	-0.006
				(0.009)	(0.012)
Start Age					0.004***
					(0.001)
Oil Producer					-0.000
					(0.033)
Country FEs	87	87	87	87	87
Year FEs	0	54	0	0	0
N	2782	2782	2674	2674	2674

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

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

Table A.10: Irregular leader transition.

	(1)	(2)	(3)	(4)	(5)
Log(Budget) (B)	0.018*	0.021*	0.022**	0.022**	0.026***
	(0.010)	(0.012)	(0.010)	(0.010)	(0.010)
Included (I)	0.378*	0.395**	0.434**	0.470**	0.495**
	(0.203)	(0.199)	(0.216)	(0.215)	(0.210)
Excluded (E)	0.803	0.529	0.880	0.896	0.739
	(0.805)	(0.799)	(0.812)	(0.815)	(0.817)
I x B	-0.016*	-0.017*	-0.019*	-0.021**	-0.021**
	(0.009)	(0.009)	(0.010)	(0.010)	(0.009)
E x B	-0.032	-0.019	-0.035	-0.036	-0.029
	(0.035)	(0.035)	(0.036)	(0.036)	(0.036)
First Year in Office	-0.001***	-0.001	-0.002***	-0.001***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Military Pedigree			-0.044***	-0.044***	-0.032**
			(0.015)	(0.015)	(0.015)
EPR Groups				-0.010	-0.006
				(0.011)	(0.013)
Start Age					0.004***
					(0.001)
Oil Producer					0.002
					(0.033)
Country FEs	87	87	87	87	87
Year FEs	0	54	0	0	0
N	2782	2782	2674	2674	2674

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

C.5 Robustness: Including Time-Varying Covariates

Table A.11: Irregular leader transition with time-varying covariates

	(1)	(2)	(3)	(4)	(5)	(6)
Log(Budget) (B)	0.02**	0.02*	0.02	0.01	0.02	0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Included (I)	0.30	0.25	0.27	0.19	0.21	0.12
	(0.23)	(0.25)	(0.23)	(0.26)	(0.25)	(0.28)
Excluded (E)	1.71**	1.63*	1.57*	1.47	1.58*	1.49*
	(0.83)	(0.88)	(0.86)	(0.92)	(0.85)	(0.90)
I x B	-0.01	-0.01	-0.01	-0.01	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
E x B	-0.07**	-0.07*	-0.07*	-0.06	-0.07*	-0.06
	(0.04)	(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)	(0.00)	(0.00)
Military Pedigree	-0.03**	-0.04**	-0.04**	-0.04***	-0.04**	-0.04***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
EPR Groups	-0.00	0.00	-0.00	-0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Start Age	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Oil Producer	-0.00	-0.02	-0.01	-0.03	-0.01	-0.04
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
Country FEs	87	87	87	87	87	87
Year FEs	0	0	54	45	0	0
Continent-Year FEs	0	0	0	0	196	169
Time-varying Covariates	N	Y	N	Y	N	Y
N	2674	2459	2674	2459	2674	2459

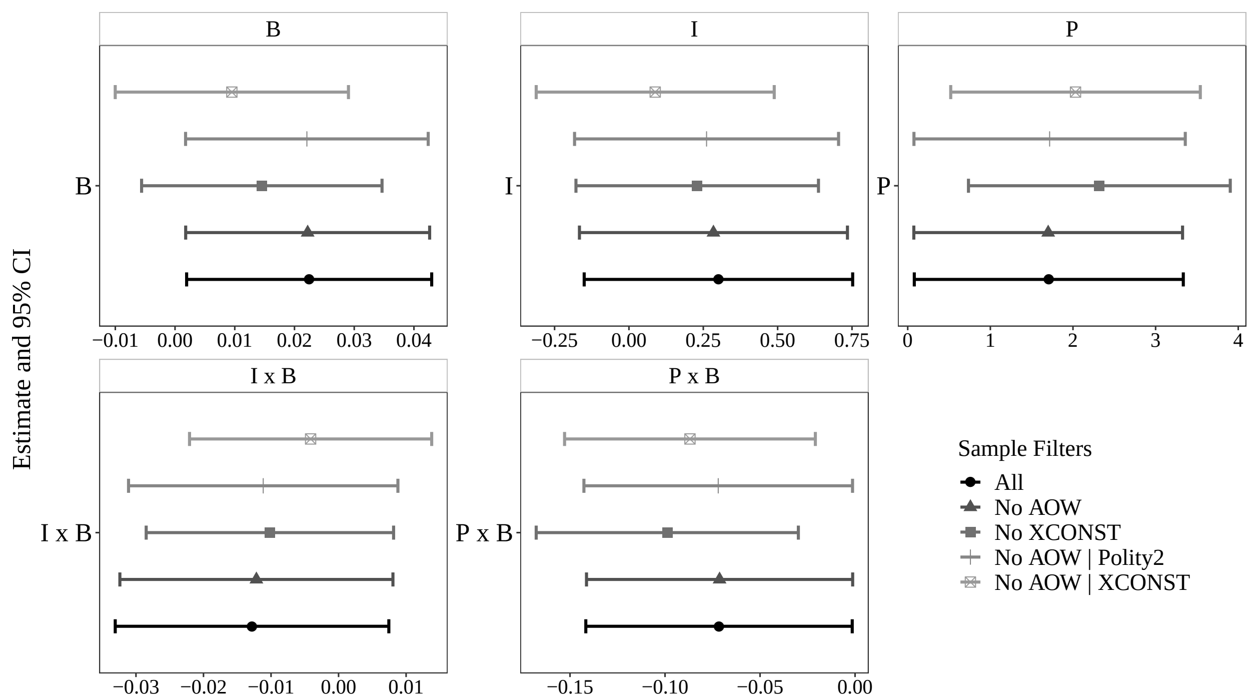
Notes: Standard errors clustered on administration. Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.6 Robustness: Sample Filters

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

In Figure A.1, we show how the coefficients of interest from Table A.6 change when we drop these sample filters. The dot and bar are our estimate and 95% confidence interval when all filters are applied. We then drop the Autocracies of the World (AOW) filter; the executive constraints filter; the AOW and Polity 2 filters; and the AOW executive constraints filter. We always impose some filter on regime or executive constraints, as our interest is in the decision-making of unchecked leaders.

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



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

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

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

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

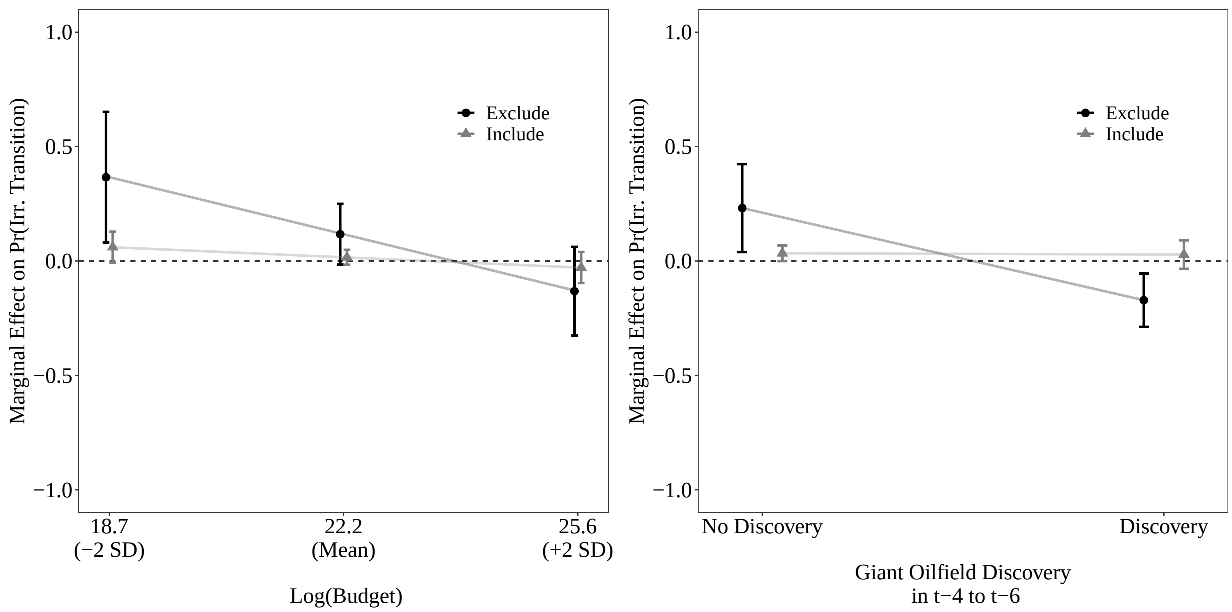
	Log(Oil and Gas Production)			Log(Budget)		
	(1)	(2)	(3)	(4)	(5)	(6)
Discovery in $t-4$	0.210**			0.153**		
	(0.106)			(0.070)		
Discovery from $t-2$ to $t-6$		0.260*			0.151**	
		(0.145)			(0.061)	
Discovery from $t-4$ to $t-6$			0.242**			0.208***
			(0.122)			(0.073)
Country FEs	52	52	52	87	87	87
Year FEs	48	48	48	48	49	49
N	1222	1233	1222	2521	2559	2546

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

We use Lei and Michaels's (2014) replication data but restrict attention to the administrations that overlap with our sample. Employing the authors' preferred specification, we first estimate in Table A.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, re-estimating equation 4, but substituting an indicator for past oil discoveries for our budget measure B. In Figure A.2, we reproduce Figure 1 (left) and then show the marginal effects of 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.

D. Estimation of Leader's Payoffs

D.1 Point Estimates

We consider L leaders, where $l \in \{1,\dots,L\}$ indexes an arbitrary leader. Our data consists of a list comprising three arrays: $\{Y,X,Z\}$. Here, $Y = \{Y_l\}_{l=1}^{L}$ is an array of time series matrices, where $Y_l = \{(a_l^t, s_l^t)\}_{t=1}^{T_l}$ records the observed action-state pairs for each leader, and we observe $T_l \geq 1$ observations for leader l. The matrix $X = (x_l)_{l=1}^{L}$ collects the leader-specific covariates that affect the per-period payoffs of leaders, i.e., the covariates entering Equation 2. Finally, the matrix Z collects the leader-specific covariates that affect the transition probability, i.e., those entering the function $\mu_l^e[a_l, s_l; \gamma]$, for $e = r, d, b$, which is explicitly defined in Equation 8. The goal is to estimate parameters (θ, γ, ϕ). Recall, θ is a vector of coefficients associated with the leaders' per-period payoff and variables x_l, and γ and ϕ are vectors of coefficients associated with the leaders' transition probabilities and variables z_l. We estimate these parameters in following steps.

(A) Estimate $\gamma = (\gamma^r, \gamma^d)$, i.e., $\mu_l^r[a_l, s_l; \gamma^r]$ and $\mu_l^d[a_l, s_l; \gamma^d]$, using linear probability models with country fixed effects. Here the dependent variables are indicators for leader death and leader removal and the independent variables follow the left-hand-side of Equation 8.

(B) Estimate ϕ, i.e., $\mu_l^b[a_l, s_l; \phi]$, using an autoregressive model with country fixed effects, where the dependent variable is the log of the government revenue and the independent variables follow the left-hand-side of Equation 8. In this version, government revenue is a continuous variable and has not been discretized.

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

(D) Create the transition probabilities of leader survival, g_l, using the predicted values from (A). Discretize the log budget variable using the $J = 50$ equally spaced levels $\mathscr{B}$ and use Equation 9—along with the estimates of ϕ and σ_l from (B) and (C), respectively—to create the budget transition probabilities, f_l.

(E) Fixing the transition probabilities, g_l and f_l, estimate θ via MLE following the fixed point algorithm in Rust (1994). Specifically, for every guess of θ and for every leader l, we compute V_l by solving Equation 6. Then using Equation 7, we can evaluate l's contribution to the likelihood as

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

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

D.2 Identification

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

D.3 Standard Errors

We compute standard errors using three approaches. We use the outer-product of gradients estimator, and these standard errors are reported in the main text. Second, we use two jackknife procedures. Here, for each leader l (for each country $c = 1,\ldots,C$), we drop l (c) from the data set and re-estimate the model following the steps in Section D.1 producing point estimates $\hat{\theta}^l$ ($\hat{\theta}^c$) for leader l (country c). We then compute the standard errors using the L (C) estimates. For each jackknife sample, we repeat Steps A–E of the estimation procedure as in Section D.1. All standard errors are reported in Table A.13 for comparison.

Table A.13: Comparison of standard errors.

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

D.4 Robustness: Alternative Codings of States and Actions

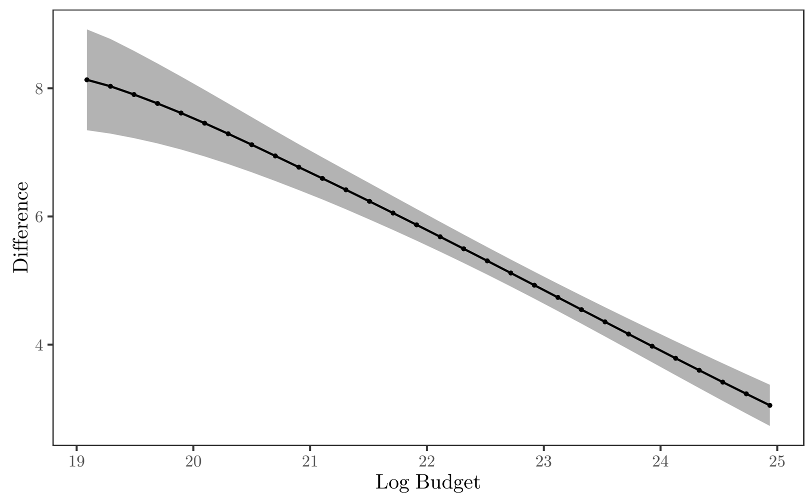
Table A.14: Estimates of leaders' payoff parameters with alternative codings.

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

Standard errors based on outer product of gradients.

E. Additional Figures

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



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

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