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ABSTRACT

This paper presents new evidence on the power sharing layout of national political elites in a panel of African countries, most of them autocracies. We present a model of coalition formation across ethnic groups and structurally estimate it employing data on the ethnicity of cabinet ministers since independence. As opposed to the view of a single ethnic elite monolithically controlling power, we show that African ruling coalitions are large and that political power is allocated proportionally to population shares across ethnic groups. This holds true even restricting the analysis to the subsample of the most powerful ministerial posts. We argue that the likelihood of revolutions from outsiders and the threat of coups from insiders are major forces explaining such allocations. Further, over-representation of the ruling ethnic group is quantitatively substantial, but not different from standard formateur premia in parliamentary democracies. We explore theoretically how proportional allocation for the elites of each group may still result in misallocations in the non-elite population.

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1 Introduction

This paper addresses the question of how political power is shared across ethnic groups in African autocracies. Analyzing how ruling elites evolve, organize, and respond to particular shocks is paramount in understanding the patterns of political, economic, and social development of both established and establishing democracies. For autocratic or institutionally weak countries, many of them in Africa, it is plausible that such understanding is even more critical (Bueno de Mesquita, Smith, Siverson, and Morrow (2003), Acemoglu and Robinson (2001b, 2005), Aghion, Alesina, and Trebbi (2004), Besley and Kudamatsu (2008), Wintrobe (1990, 1998)).

Scarcity and opacity of information about the inner workings of ruling autocratic elites are pervasive. Notwithstanding the well-established theoretical importance of intra-elite bargaining (Acemoglu and Robinson (2005), Bueno de Mesquita et al. (2003)), systematic research beyond the occasional case study is rare[1]. This is not surprising. Institutionally weak countries usually display low (or null) democratic responsiveness and hence lack reliable electoral or polling data[2]. This makes it hard to precisely gauge the relative strength of the various factions and political currents affiliated with different groups. Tullock's (1987) considerations on the paucity of data employable in the study of the inner workings of autocracy are, in large part, still valid.

This paper presents new data on the ethnic composition of African political elites, specifically focusing on the cabinet of ministers, helpful in furthering our understanding of the dynamics of power sharing within institutionally weak political settings. Our choice of focusing on ethnic divisions and on the executive branch are both based on their relevance

[1] Posner (2005) offers an exception with regard to Zambian politics. Other recent studies relevant to the analysis of the inner workings of autocracies include Geddes (2003) and Magaloni (2010), who investigate the role of parties within autocracies, and Gandhi and Przeworski (2006), who consider how a legislature can be employed as a power-sharing tool by the leader. For a discussion also see Gandhi (2008) and Haber, (2006).

[2] Posner and Young (2007) report that in the 1960s and 1970s the 46 sub-Saharan African countries averaged 28 elections per decade, less than one election per country per decade, 36 in the 1980s, 65 in the 1990s, and 41 elections in the 2000-05 period.

within African politics and their proven importance for a vast range of socioeconomic outcomes. First, the importance of ethnic cleavages for political and economic outcomes in Africa cannot be understated[3]. Second, it is well understood in the African comparative politics literature that positions of political leadership reside with the executive branch, usually the president and cabinet[4]. Legislative bodies, on the other hand, have often been relegated to lesser roles and to rubber-stamping decisions of the executive branch[5]. Arriola (2009) encapsulates the link between ethnic divisions and cabinet composition: "*All African leaders have used ministerial appointments to the cabinet as an instrument for managing elite relations.*"

We begin by developing a model of allocation of patronage sources, i.e. the cabinet seats, across various ethnic groups by the country's leader. We then estimate the model structurally. Our model, differently from the large literature following the classic Baron and Farejohn (1989) legislative bargaining setting, revolves around nonlegislative incentives[6]. This makes sense given the focus on African polities. However, similarly to Baron and Ferejohn, we maintain a purely noncooperative approach. We assume leaders wish to avoid revolutions[7] or coups, and enjoy the benefits of power. The leader decides the size of his ruling coalition to avoid revolutions staged by groups left outside the government and allocates cabinet posts in order to dissuade insiders from staging a palace coup. To a first approximation, one can think of the revolution threat as pinning down the size of the ruling coalition

[3] The literature is too vast to be properly summarized here. Among the many, see Bates (1981), Berman (1998), Bienen et al. (1995), and Easterly and Levine (1997), Posner (2004).

[4] Africanists often offer detailed analysis of cabinet ethnic compositions in their commentaries. See Khapoya (1980) for the Moi transition in Kenya, Osaghae (1989) for Nigeria, Posner (2005) for Zambia. Arriola (2009) considers cabinet expansion as a tool of patronage and shows cabinet expansion's relevance for leader's survival in Africa.

[5] See Barkan (2009, p.2).

[6] The literature on bargaining over resource allocation in non-legislative settings is also vast. See Acemoglu, Egorov, and Sonin (2008) for a model of coalition formation in autocracies that relies on self-enforcing coalitions and the literature cited therein for additional examples. Our model shares with most of this literature a non-cooperative approach, but differs in its emphasis on the role of leaders, threats faced by the ruling coalition, and payoff structure for insiders and outsiders.

[7] Throughout the paper we use the term "revolution" to indicate any type of conflict instance that pegs insiders to the national government against excluded groups. Civil wars or paramilitary infighting are typical examples.

(by excluding fewer groups the leader can make a revolution's success less likely) and the coup threat as pinning down the shares of patronage accruing to each group (by making an elite member indifferent between supporting the current leader and attempting to become a leader himself). The empirical variation in size of the ruling coalition and post allocation allows us to recover the structural parameters of the revolution and coup technologies for each country, which in turn we employ in a set of new counterfactuals.

Contrary to a view of African ethnic divisions as generating wide disproportionality in access to power, African autocracies function through an unexpectedly high degree of proportionality in the assignment of power positions, even top ministerial posts, across ethnic groups. While the leader's ethnic group receives a substantial premium in terms of cabinet posts relative to its size (measured as the share of the population belonging to that group), such premia are comparable to formateur advantages in parliamentary democracies. Rarely are large ethnic minorities left out of government in Africa, and their size does matter in predicting the share of posts they control, even when they do not coincide with the leader's ethnic group[8]. We show how these findings are consistent with large overhanging coup threats and large private gains from leadership. Large ruling coalitions (often more than 80 percent of the population are ethnically represented in the cabinet) also suggest looming threats of revolutions for African leaders. We also formally reject alternative models not relying on such mechanisms.

We do not take these findings to imply that proportionality in government reflects equality of political benefits trickling down to common members of all ethnic groups. African societies are hugely unequal and usually deeply fragmented. Our findings imply that a certain fraction of each ethnic group's upper echelon is able to systematically gain access to political power

[8] While these results are new, this observation has been occasionally made in the literature. Contrasting precisely the degree of perceived ethnic favoritism for the Bemba group in Zambia and the ethnic composition of Zambian cabinets, Posner (2005, p.127) reports "*...the average proportions of cabinet ministers that are Bemba by tribe are well below the percentages of Bemba tribespeople in the country as a whole, and the proportion of Bemba-speakers in the cabinet is fairly close to this group's share in the national population. Part of the reason for this is that President Kaunda, whose cabinets comprise twelve of the seventeen in the sample, took great care to balance his cabinet appointments across ethnic groups.*"

and the benefits that follow. The level of proportionality in ethnic representation seems to suggest that the support of critical members of a large set of ethnic groups is sought by the leader. There is no guarantee, however, that such groups' non-elite members receive significant benefits stemming from this patronage, and they often do not. Padro-i-Miquel (2007) explains theoretically how ethnic loyalties by followers may be cultivated at extremely low cost by ethnic leaders in power. We also explore this theme theoretically.

This last point highlights an important consideration. There is overwhelming empirical evidence in support of the view of a negative effect of ethnic divisions on economic and political outcomes in Africa[9]. The question is whether at the core of these political and economic failures lays a conflict between ethnic groups in their quest for control, or it is the result of internal struggles between elites and non-elites that arise within ethnic enclaves. Our data show that almost all ethnic groups have access to a certain measure of political power at the elite level. This finding provides indirect evidence that frictions *within ethnic groups* may be playing a larger role than previously assessed vis-à-vis frictions *between groups*.

Finally, by emphasizing the presence of non trivial intra-elite heterogeneity and redistribution, our findings support fundamental assumptions made in the theory of the selectorate (Bueno de Mesquita, et al. (2003)), the contestable political market hypothesis[10], and in theories of autocratic inefficiency (Wittman (1995)).

The rest of the paper is organized as follows. Section 2 presents our model of coalition formation and ministerial allocations and Section 3 presents our econometric setup. Section 4 describes the data. Section 5 reports the main empirical evidence on the allocation of cabinet posts at the group level. Section 6 presents our counterfactuals. Section 7 compares our model to alternative modes of power sharing. Section 8 discusses some relevant theoretical extensions and Section 9 presents our conclusions.

[9] See Easterly and Levine (1997), Posner (2004), Michalopoulos and Papaioannou (2011).

[10] Mulligan and Tsui, (2005) in an adaptation of the original idea in product markets by Baumol et al. (1982).

2 Model

Consider an infinite horizon, discrete time economy, with per period discount rate δ. There are N ethnicities in the population. Denote the set of ethnicities $\mathcal{N} = \{1, ..., N\}$. Each ethnicity is comprised of two types of individuals: elites, denoted by e, and non-elites, denoted by n. Ethnic group j has a corresponding elite size e_j and non-elite size n_j, with $e_j = \lambda n_j$ and $\lambda \in (0, 1)$. The population of non-elites is of size P, so that $\Sigma_{i=1}^{N} n_i = P$. Let $\mathbf{N} = \{n_{1,}..., n_N\}$. Without loss of generality we order ethnicities from largest to smallest $e_1 > e_2 > ... > e_{N-1} > e_N$. Elites decide whether non-elites support a government or not. Each elite decides support of λ non-elite from its own ethnicity.

At time 0 a leader from ethnic group $j \in \mathcal{N}$ is selected with probability proportional to group size

$$p_j(\mathbf{N}) = \frac{\exp(\alpha e_j)}{\Sigma_{i=1}^{N} \exp(\alpha e_i)}. \tag{1}$$

Let $l \in \mathcal{N}$ indicate the ethnic identity of the selected leader and $\mathcal{O}$ the set of subsets of $\mathcal{N}$. The leader chooses how to allocate leadership posts (i.e., cabinet positions or ministries), which generate patronage to post holders, across the elites of the various ethnic groups. Let us indicate by Ω^l the set of ethnic groups in the cabinet other than the leader's group, implying the country is ruled by an ethnic coalition $\left(\Omega^l \cup l\right) \in \mathcal{O}$. Elite members included in the cabinet are supporters of the leader. This means that, in the event of a revolution against the leader, the λ non-elite controlled by each one of these 'insiders' necessarily supports the leader against the revolutionaries.

Let the per-member amount of patronage value the leader transfers to elite from group j in his governing coalition be denoted x_j[11]. The total value of all posts is normalized to 1 per period, and these are infinitely divisible, so total patronage transferred to elite

[11] This notation implicitly assumes elite from the same ethnicity receive an equal patronage allocation if they are included in the government. This is for notational simplicity and not a restriction of the model. In principle we allow leaders to offer elites from the same ethnicity differing allocations; an option that we shall demonstrate is never optimally taken.

j, if all of j's elite are in government is $x_j e_j \in [0,1]$. Let $V_j\left(\Omega^l\right)$ denote the value of being in the government coalition to an elite from ethnicity j, conditional on the leader being from ethnicity l. Note that, by suppressing time subscripts, our notation imposes stationarity in the definition of the value function V_j, as our focus will be on stationary equilibria throughout. Importantly, the assumption of stationarity, a common restriction, can be empirically assessed, a task we undertake in Section 4.

Leaders are also able to split ethnic groups in their offers of patronage and hence government inclusion, that is:

Assumption 1: *Leaders can split ethnic groups in their offers of patronage. Specifically, leaders can offer patronage to a subset $e'_j < e_j$ of group j, and exclude the remaining $e_j - e'_j$ from their governing coalition. A leader cannot exclude elites from his own ethnicity.*

Ethnic ties bind leaders. Though leaders can pick and choose cabinet ministers from across the ethnic spectrum, they cannot exclude the elite from their own ethnic group from a share of the patronage that remains. Moreover, they must share this patronage equally with their co-ethnic elites. We view the necessity of such sharing between leaders and elites from their own ethnicity as a minimum cohesion requirement for an ethnic group. The leader can split and break any group, but he is bound to defer to his own. Of course, their own elite, like all other insiders, will also support the leader's side in a revolution.

Cabinet positions not allocated to other ethnicities remain with the leader's ethnic group, and, due to such non-exclusion are shared equally amongst e_l. Specifically, we indicate

$$\bar{x}_l = \left(1 - \Sigma_{i \in \Omega^l} x_i e'_i(l)\right)/e_l, \quad (2)$$

where $e'_i(l) \leq e_i$ is the numer of elite from group i chosen by a leader of ethnicity l in his optimal governing coalition.

The leader also obtains a non-transferrable personal premium to holding office, denoted by amount F. F may be interpreted as capturing the personalistic nature of autocratic rents.

Let $\bar{V}_j(\Omega)$ denote the value of being in the government coalition to an elite member from ethnicity j conditional on the leader being from ethnicity j (and the member not being the leader himself).

Leaders lose power or are deposed for different reasons. Leaders can lose power due to events partially outside their control (e.g. they may die or a friendly superpower may change its regional policy). We will refer to these events as 'exogenous' transitions. Alternatively, leaders can be deposed by government insiders via a coup d'état or by outsiders via a revolution; which are both events we consider endogenous to the model. In particular we will search for an equilibrium in which a leader constructs a stable government by providing patronage to elites from other ethnicities in order to head-off such endogenous challenges.[12] Two factors guide the allocation of patronage by the leader: 1. The leader must bring in enough insiders to ensure his government dissuades revolution attempts by any subset of outsiders. 2. He must allocate enough patronage to insiders to ensure they will not stage a coup against him.

2.1 Revolutions

Revolutions are value reducing. They lower the patronage value of the machine of government, but can yield material improvements to revolutionaries if they succeed in deposing the leader. The probability of revolution success depends on the relative sizes of government supporters versus revolutionaries fighting against them. With N_I insiders supporting the government and, for example, $N_O = P - N_I$ outsiders fighting the revolution, the revolutionaries succeed with probability $\frac{N_O}{N_I+N_O}$. A successful revolution deposes the current leader. A new leader is then drawn according to the same process used at time 0, i.e., according to (1), and this leader then chooses his optimal governing coalition. Losing a revolution leads to no change in the status of the government. Revolutionary conflicts drive away investors,

[12] As will be seen, coups and revolutions are extremely rare events, so that we focus on equilibrium coalitions where leaders are optimally at a 'corner' where these do not occur endogenously, i.e., along the equilibrium path. The parametric restrictions necessary for this are explored in greater detail in the appendix.

lower economic activity, and reduce government coffers independently of their final outcome. Consequently, the total value of all posts – normalized to 1 already – is permanently reduced to the amount $r < 1$ after a revolution.

Let V_j^0 denote the value function for an elite of ethnicity j who is excluded from the current government's stream of patronage rents, and $V_j^{transition}$ denote the net present value of elite j in the transition state; i.e., before a new leader has been chosen according to (1). A group of potential elite revolutionaries who are excluded from the patronage benefits of the current government has incentive to incite the non-elite they control to revolt and cause a civil war if this is value increasing for them. Specifically an excluded elite of ethnicity j has incentive to instigate a revolution if and only if:

$$\frac{N_O}{N_I + N_O} r V_j^{transition} + \left(1 - \frac{N_O}{N_I + N_O}\right) r V_j^0 \geq V_j^0.$$

Leaders allocate patronage to insiders to buy their loyalty and hence reduce the impetus for outsiders to foment revolution. In deciding on whether to start a revolution, elites act non-cooperatively using Nash conjectures. That is, when an elite from an outsider group triggers a revolution, he uses Nash conjectures to determine the number of other elites that will join in (and hence the total revolutionary force and the probability of success) in the ensuing civil war. Under these conjectures, once a revolution is started and all valuations are reduced $1 - r$ proportionately, it follows immediately that all outsiders will also have incentive to join the revolution. If the revolution succeeds, outsiders receive $rV_j^{transition}$ which strictly exceeds rV_j^0 when the leader's group wins. In short, outsiders can do no worse than suffering exclusion from the government, their current fate, by joining a revolution once already started.

Thus, for a revolution to not ensue, necessarily, each outsider must find it not worthwhile to trigger a revolution. Since $N_O + N_I \equiv P$, it is necessary that:

$$\text{(3)} \qquad \frac{N_O}{P} r V_j^{transition} \leq \left(1 - \left(1 - \frac{N_O}{P}\right) r\right) V_j^0, \quad \forall j \notin \Omega^l.$$

It is immediate to see that this condition is easier to satisfy the greater is the size of the ruling coalition[13].

We assume that the leader suffers $\psi \leq 0$ after a revolution attempt. We shall assume throughout that ψ is large enough to always make it optimal for leaders to want to dissuade revolutions. This assumption aims at capturing the extremely high cost of revolution for the rulers, in a fashion similar to Acemoglu and Robinson (2001, 2005) and will make it optimal for a leader to completely avoid revolutions.

We finally allow a similar unilateral deviation by a group of insiders from a single ethnic elite to trigger a revolution from within the governing coalition. A group of insiders from a single ethnicity can choose to leave the cabinet and mount a revolution with their own non-elite against the government. Again, the group make their decisicion under Nash conjectures, with the group deviating from the ruling government unilaterally. However, as in all revolutions, they know that in the revolution sub-game triggered by their deviation they will be joined by all excluded outsiders against the leader. For a leader to ensure no such insider deviations from any of the included ethnicities, j, yields an additional condition:

$$\text{(4)} \qquad \frac{N_O + n_j}{P} r V_j^{transition} + \left(1 - \frac{N_O + n_j}{P}\right) r V_j^0 \leq V_j\left(\Omega^l\right), \quad \forall j \in \Omega^l.$$

That is, a group that is currently an insider and receiving $V_j\left(\Omega^l\right)$ (the right hand side of the expression) does not want to join a revolution with the remaining outsiders that succeeds with probability $\frac{N_O+n_j}{P}$ and precipitates a transition of leader yielding $rV_j^{transition}$ (the left hand side of the expression). If the revolution fails, with probability $\left(1 - \frac{N_O+n_j}{P}\right)$, the

[13] Provided that $V_j^{transition}/V_j^0 > 1$, and this ratio is unaffected by the size of the ruling coalition, which we shall demonstrate subsequently.

previously insider group is banished and receives rV_j^0.

We can now define the leader's utility from coalition Ω:

$$
\begin{aligned}
W_l(\Omega) &= \psi * \Re(\Omega) \\
&\quad + V_l^{leader}(\Omega) * (1 - \Re(\Omega))
\end{aligned}
$$

and the revolution indicator is defined as:

$$
\Re(\Omega) = \begin{cases} 0 \text{ if both (3) and (4) hold,} \\ 1 \text{ otherwise.} \end{cases} \tag{5}
$$

$\Re(\Omega)$ takes value 1 if either the opposition is large enough to gain in expectation from a revolution or there exists at least one group from within that would want to trigger a revolution by joining with the outsiders. Let $V_l^{leader}(\Omega)$ denote the value of being the leader, if from ethnicity l and absent revolutions on the equilibrium path.[14] The optimal coalition selected by a leader with ethnic affiliation l is then:

$$
\Omega^l = \arg \max_{(\Omega \cup l) \in \mathcal{O}} \{W_l(\Omega)\}. \tag{6}
$$

In the appendix we derive a sufficient condition on the size of ψ so that leaders do not risk revolutions along the equilibrium path. Under this condition, we will characterize an equilibrium that admits a unique optimal coalition for leaders from any ethnicity l. Moreover, we will also show this equilibrium is unique.

[14] The coalition Ω will deterministically trigger a revolution or not. If the choice of Ω does not trigger a revolution in one period, it never will.

2.2 Transitions and Coups

2.2.1 Exogenous Transitions

Suppose that with probability ε something exogenous to the model happens to the leader, meaning that he cannot lead any more. We can think of any one of a number of events happening, including a negative health shock or an arrest mandate from the International Criminal Court. This will also lead to a 'transition' state, with value function $V_j^{transition}$ as defined previously. As at time 0, not all ethnicities are necessarily equal in such a transition state as the probability having the next leader is given by $p_j(\mathbf{N})$. The value of being in the transition state is

$$(7) \quad V_j^{transition} = p_j(\mathbf{N})\,\bar{V}_j\left(\Omega^j\right) + \sum_{l=1,l\neq j}^{N} p_l(\mathbf{N})\left[I\left(j\in\Omega^l\right)V_j\left(\Omega^l\right) + \left(1 - I\left(j\in\Omega^l\right)\right)V_j^0\right],$$

where $I(.)$ is the indicator function denoting a member of j being in leader l's optimal coalition.[15] Notice that we ignore here the small probability event that individual j actually becomes the leader after a transition. It can be included without effect. The interpretation of equation (7) is that after an exogenous shock terminating the current leader, j can either become a member of the ruling coalition of a co-ethnic of his, with probability $p_j(\mathbf{N})$, or with probability $p_l(\mathbf{N})$ he obtains value $V_j\left(\Omega^l\right)$ under leader of ethnicity l.

2.2.2 Coups

Coups do not destroy patronage value, and the success chance of a coup is independent of the size of the group of insiders (i.e. anyone can have the opportunity of slipping cyanide in the leader's cup). Assume – in the spirit of Baron and Ferejohn's (1989) proposer power – that each period one member of the ruling coalition has the opportunity to attempt a coup and the coup is costless. If the coup is attempted, it succeeds with probability γ, and the

[15] We slightly abuse notation by not considering that individuals of group j could potentially suffer a different destiny in case the group were split. We precisely characterize this when we explicitly represent $V_j^{transition}$ below.

coup leader becomes the new leader. If challenger j loses, he suffers permanent exclusion from this specific leader's patronage allocation V_j^0. That is:

$$V_j^0 = 0 + \delta\left((1-\varepsilon) V_j^0 + \varepsilon V_j^{transition}\right).$$

Leaders transfer sufficient patronage to the elite they include from group j to ensure that these included elite will not exercise a coup opportunity. Since the returns from a coup are the gains from future leadership, a successful coup leader of ethnicity j also knows he must pay an x_i to each included elite $i \in \Omega^j$, were he to win power and become the next leader. Here, we impose sub-game perfection. This ensures that the conjectured alternative leader is also computing an optimal set of patronage transfers to his optimally chosen coalition. In computing his optimal x_i this coup leader also must dissuade his own coalition members from mounting coups against him, and so on. This leads to a recursive problem, which is relatively simple because of our focus on stationary outcomes. The current leader's optimal transfers x_i will be the same as the optimal transfers that a coup leader would also make to an elite member of group i if he were to become leader and try to avoid coups. Hence, to ensure no coups arise, for each insider of ethnicity j, necessarily:

$$\begin{aligned}
(8)\qquad & x_j + \delta\left((1-\varepsilon) V_j\left(\Omega^l\right) + \varepsilon V_j^{transition}\right) \geq \\
& \gamma\left(\bar{x}_j + F + \delta\left((1-\varepsilon) V_j^{leader}\left(\Omega^j\right) + \varepsilon V_j^{transition}\right)\right) \\
& + (1-\gamma)\left(0 + \delta\left((1-\varepsilon) V_j^0 + \varepsilon V_j^{transition}\right)\right).
\end{aligned}$$

The left hand side of (8) is straightforward. As part of the ruling government an elite stays in power as before with probability $1-\varepsilon$. With probability ε a transition occurs and then its fate is governed by equation (7). The first term on the right hand side of (8) indicates the value of a successful coup. The coup succeeds with probability γ, paying the new leader a flow value $\bar{x}_j + F$ plus the continuation value of being in the leadership position next period, as long as nothing unforeseen realizes, which may happen with probability ε. If an ε

shock hits, the newly minted leader moves into the transition state too. The second term on the right hand side of (8) indicates the value of an unsuccessful coup. The coup fails with probability $1-\gamma$. In that case the coup plotter gets zero forever conditional on the same leader staying in power. He will likely be in jail or dead (if elites are dead, then this must be a dynastic valuation). However, the unsuccessful coup instigator may still get lucky, as the old leader may turn over with ε probability, hence moving into the transition state. In order to minimize payments to coalition members, the leader will make sure (8) binds. (8) simplifies to:

$$\begin{aligned} (9) \qquad & x_j + \delta(1-\varepsilon) V_j\left(\Omega^l\right) \\ = \; & \gamma\left(\bar{x}_j + F + \delta\left((1-\varepsilon) V_j^{leader}\left(\Omega^j\right)\right)\right) + (1-\gamma)\,\delta(1-\varepsilon) V_j^0. \end{aligned}$$

To see the form of this expression we need to explicitly derive the terms $V_j\left(\Omega^l\right)$ and $V_j^{leader}\left(\Omega^j\right)$:

$$V_j\left(\Omega^l\right) = x_j + \delta\left((1-\varepsilon) V_j\left(\Omega^l\right) + \varepsilon V_j^{transition}\right),$$

and

$$V_j^{leader}\left(\Omega^j\right) = \bar{x}_j + F + \delta\left((1-\varepsilon) V_j^{leader}\left(\Omega^j\right) + \varepsilon V_j^{transition}\right).$$

By exploiting stationarity, we can be explicit: $V_j\left(\Omega^l\right) = \frac{x_j + \delta\varepsilon V_j^{transition}}{1-\delta(1-\varepsilon)}$, $V_j^{leader}\left(\Omega^j\right) = \frac{\bar{x}_j + F + \delta\varepsilon V_j^{transition}}{1-\delta(1-\varepsilon)}$, and $V_j^0 = \frac{\delta\varepsilon V_j^{transition}}{1-\delta(1-\varepsilon)}$. Substituting these three expressions into equation (9) yields the binding (and hence optimal) patronage allocation for group j:

$$(10) \qquad x_j = \gamma\left(\overline{x}_j + F\right).$$

where x_j is that level of per-person patronage that a leader from ethnicity $l \neq j$ must grant to the elite of group j to just dissuade each member of $j's$ elite from mounting a coup if the opportunity arises, and $\overline{x}_j$ was defined in (2). Notice that this amount depends upon the member of $j's$ optimally chosen coalition, Ω^j, to be determined in the next section, but is independent of the leader's ethnicity l. Any leader wanting to enlist an elite member from group j needs to pay him at least x_j, or risk a coup from a non-l ethnicity member of his cabinet. Additionally, the leader must have sufficient residual remaining to share with his own co-ethnics, so that none of them pursues a coup against him. Specifically, it must be the case that $x_l \leq \bar{x}_l$ where x_l is computed using (10).

2.3 The optimal coalition

Equation (6) defines the optimal coalition Ω^l for a leader from group l. In this section we demonstrate the existence and uniqueness of such an optimal coalition for each ethnicity.

2.3.1 Optimal Size

From equation (3), substituting for $V_j^0 = \frac{\delta\varepsilon V_j^{transition}}{1-\delta(1-\varepsilon)}$ and rearranging, we have:

$$N_O \leq \frac{\delta\varepsilon\left(1-r\right)}{r\left[1-\delta\right]}P.$$

This implies that there exists a maximal number of individuals excluded from the government such that these outsiders are just indifferent to undertaking a revolution, that is $N_O = \frac{\delta\varepsilon(1-r)}{r[1-\delta]}P$. Define n^* as the minimal size of the forces mustered by the governing coalition, i.e. $N_O + n_l$, such that a revolution will not be triggered:

$$\begin{aligned} n^* &\equiv P - \frac{\delta\varepsilon\left(1-r\right)}{r\left[1-\delta\right]}P \\ &= P\left(1 - \frac{\delta\varepsilon\left(1-r\right)}{r\left[1-\delta\right]}\right). \end{aligned}$$

n^* is the smallest number of individuals supporting the government such that the remaining $P - n^*$ do not find it worthwhile to undertake a revolution. Note that n^* is independent of the leader's ethnicity. Also let $e^* \equiv \lambda n^*$. e^* is the corresponding smallest number of elite (in control of n^* non-elite) such that with these e^* loyal to the government, the remaining elite will not find it worthwhile to mount a revolution.

There are many different combinations of ethnic elites that could be combined to ensure at least e^* government supporters. For what follows it proves useful to define notation for the set of groups required to sum up to e^* if larger groups are included in that set ahead of smaller ones. To do this, use the ordering of groups by size to define j^* as:

$$\sum_{i=1}^{j^*-1} n_i/P < 1 - \frac{\delta\varepsilon\,(1-r)}{r\,[1-\delta]} < \sum_{i=1}^{j^*} n_i/P. \tag{11}$$

With all ethnicities up to and including the j^* largest included in a leader's governing group, the remaining ethnicities would not find it worthwhile to mount a revolution.[16]

As stated earlier, we shall look for optimal leadership coalitions sufficiently large to dissuade revolution attempts. Under this assumption, the lowest cost means for a leader to construct his governing coalition is to do so by including the smallest number of elite, e^*. Since ethnic groups can be split in offers of patronage, it is always possible for a leader to exactly meet the constraint e^*.

2.3.2 Optimal Composition

We proceed by noting that every leader faces a similar problem. That is, how to ensure the loyalty of at least e^* elite, thus dissuading revolution attempts, in the cheapest way possible. Since he cannot exclude his own co-ethnic elite, these e_l individuals for a leader of ethnicity l, are already on board. The remaining $e^* - e_l$ have their loyalty bought by patronage, and equation (10) tells us how much has to be paid in patronage for an elite of each ethnicity in order to dissuade them from attempting a coup. Clearly, in any equilibrium, these patronage allocations will bind. Paying more to an elite members brings with it no

[16] Note that in order to rule out revolutions we have only considered the constraint coming from dissuading outsiders, i.e., equation (3). However since the constraint arising from dissuading revolutions triggered by defecting insiders, equation (4) is not necessarily weaker, and generally yields a different optimal size, it cannot be ignored. We do so here for brevity of exposition. The insider constraint is fully considered in the algorithm implementing our structural estimation, and turns out to be always weaker than the outsider one. We do not waste space considering its implications further.

greater support in the event of a revolution, and is more than sufficient to ensure he will not mount a coup.

Since each leader will choose the 'cheapest' elite for whom loyalty can be assured, and since the patronage allocations required to ensure no coups are independent of the identity of the leader, these cheapest co-governing elite will be common across all leaders, unless there are a large number of elite receiving the same patronage transfers in an equilibrium. The following lemma shows that this cannot be the case, and the core set of included elite is in fact common across leaders.

Lemma 1. *In any equilibrium in which there are no coups, there exists a 'core' set of governing elite which every leader includes in their governing coalition. If they are not from the leader's own group, the leader transfers patronage according to* (10). *That is,* $\exists$ $\mathcal{C} \subseteq \mathcal{N} : j \in \Omega^l \; \forall \; j \in \mathcal{C}$ *and* $\forall \; l$.

The core group are the ethnicities who are 'cheapest' to buy loyalty from. Since the transfers required to ensure loyalty are independent of the leader's identity in any equilibrium, it then follows that leaders of all ethnicities will, in general, fill their government with the same 'core' set of ethnicities. An implication of this lemma is that, with a single exception, ethnic elites will be included en masse in each leader's governing coalition. That is, if a member of elite j is in this cheapest set of size $e^* - e_l$ from leader l, then all other members of elite j will also be in this cheapest set. A leader will, at most, split the elite of a single ethnic group, and that being the ethnic group that is the most expensive (per elite) of those he chooses to include. Thus elite from this 'marginal' (i.e., $l's$ most expensive included) group will be the only ones not included wholly and hence denoted by a prime ($'$). The notation $e'(l)$, without a subscript identifying the ethnicity of the group, thus refers to the number from the marginal group included by l, and the payments to $l's$ marginal group can similarly be denoted $x'(l)$.

The allocations determined in (10) thus describe a system of equations that determine a set of equilibrium 'prices'. The core governing elite are paid these prices whenever a leader is not from their own group. The non-core governing elite may be paid this price if they are included in the government of a particular leader, and if not, then equation (10) determines a shadow price that would have to be paid by the leader if he did want to include them and ensure their loyalty.

We now show that it is possible to order groups by the patronage required to ensure ethnic elites will not mount coups.

Lemma 2. *Larger groups in the core receive less patronage per member than smaller ones: for $e_j > e_k$, $x_j < x_k, \forall j, k \in \mathcal{C}$.*

Proof. In appendix.

Lemma 2 demonstrates that larger groups in the core group of governing elite are paid less, per-elite member, than smaller ones. Intuitively, members of larger groups are 'cheaper' to buy off than members of smaller ones because members of larger groups have less to gain from mounting a coup. The leader of a larger group must share the residual leadership spoils (i.e., the patronage left after sufficiently many other groups have been bought off to dissuade a revolution) amongst more co-ethnic elite. Consequently, smaller patronage transfers are sufficient to dissuade elites from larger groups from mounting coups.

Since the payments to an elite from j are given by $x_j = \gamma(\overline{x}_j + F)$. These x_j depend only on the composition of $j's$ optimal leadership group, Ω^j and the payments j makes to $i \in \Omega^j$, x_i. But neither Ω^j nor x_i depend on whether any leader l is including group j in his optimal coalition. The payments required to ensure elites of any group j do not undertake a coup are independent of whether group j is in the core group of elite. Moreover, these 'incentive compatible' payments are independent of whether the ethnic group would be split by a leader or not because, as a leader, he must govern with his whole ethnic group. This implies that equation (10) can be used to compute minimal payments required for incentive compatibility of each ethnicity independently of whether they are in the conjectured core group, and independently of whether the ethnic elites are included as a whole by any leader.

These N conditions are:

$$\begin{aligned} x_1 &= \gamma\left(\overline{x}_1 + F\right) \\ &\vdots \\ x_j &= \gamma\left(\overline{x}_j + F\right) \\ &\vdots \\ x_N &= \gamma\left(\overline{x}_N + F\right). \end{aligned} \tag{12}$$

We now characterize the solution to this system:

Proposition 1. *In any equilibrium without coups, i.e. with patronage transfers satisfying conditions (10), if a leader includes any elite of ethnicity j in his governing coaltion, then all elite of ethnicity $i < j$ are included as well.*

The proposition implies that in any equilibrium satisfying the no coup condition (10), leaders construct governing coalitions to comprise elites from larger ethnicities ahead of smaller ones. Since a leader of any ethnicity l finds it optimal to satisfy the same no coup condition for any admitted ethnic group, given by x_j satisfying (10) and they first fill their government with elites from larger ethnicities, and since each one has to buy off $e^* - e_l$ elite from other ethnicities we have:

Lemma 3. *The core group of ethnicities is $\mathcal{C} \equiv \{1, ..., j^* - 2\}$ included whole in the optimal governing coalition of any leader $l \in \mathcal{N}$.*

Proof. In appendix.

It now remains to characterize the remaining $e^* - \sum_{i=2}^{j^*-2} e_i - e_l$ ethnicities for each leader l.

Proposition 2. *The optimal governing coalition for leader of ethnicity l, Ω^l is as follows:*

$$e \in \Omega^l \equiv \begin{cases} e_1 ... e_{j \neq l}, ... e_{j^*-1}, e'_{j^*} & \text{for } l \leq j^* - 1 \\ e_1 ... e_{j^*-2}, e'_{j*-1}(l) & \text{for } l \in [j^*, j^+] \\ e_1 ... e_{j^*-1}, e'_{j^*}(l) & \text{for } l > j^+ \end{cases}$$

where $j^+ < N$ if $\exists j^+ : e^* < \sum_{i=1}^{j^*-1} e_i + e_{j^+}$ and $e^* > \sum_{i=1}^{j^*-1} e_i + e_{j^+ +1}$, otherwise $j^+ = N$; and where $e'_{j^*} = e^* - \sum_{i=1}^{j^*-1} e_i$ of group j^*, $e'_{j*-1}(l) = e^* - \sum_{i=1}^{j^*-2} e_i - e_l$ of group $j^* - 1$, and $e'_{j^*}(l) = e^* - \sum_{i=1}^{j^*-1} e_i - e_l$ of group j^*.

Proof. In appendix.

Intuitively, all leaders agree on the composition of their core coalition of members, but sometimes differ in how they choose to round off the remainder of their cabinet. Differences stem from the size of their own ethnic group. A leader from a small group will generally need to choose a larger split than a leader from a large group since the core members added to his own co-ethnics sum to a smaller number, leaving him to include more insiders in order to make his coalition sum up to e^*. The proposition defines the optimal coalition, Ω^l, for any l as defined in (6).

The nature of payments accruing under optimal coalitions also has the following general features:

Proposition 3. *1. Larger ethnicities receive more total patronage than smaller ones. That is, for $n_i > n_j$, $x_i e_i > x_j e_j$. 2. The leadership premium accruing to the elite of a leader's own ethnic group, if in the core, is independent of that group's size.*

Proof. In appendix.

Point 1 of the proposition and Lemma 1 jointly imply that patronage increases with group size, but less than proportionately.

We have so far described features of the optimal payments and optimal coalitions that necessarily must hold in any equilibrium satisfying stationarity, no coups, and no revolutions.

We now show that, if the patronage value of government is sufficiently high, an equilibrium with these features exists, and moreover generates a unique patronage transfer.

Proposition 4. *Provided the patronage value of government is sufficiently high, the patronage transfers just sufficient to dissuade members of each ethnic elite from mounting a coup; i.e. x_q for $q \in [1, j_* - 1]$ are:*

$$x_q e_q = \frac{\gamma \left[1 - x_{j_*} e'_{j_*} - \frac{\gamma F}{1-\gamma} \Sigma_{i=1}^{j_*-1} e_i\right]}{1 + \gamma(j_* - 2)} + \frac{\gamma F}{1-\gamma} e_q,$$

where

$$\begin{aligned} x_{j_*} e'_{j_*} \quad = \quad & \left(1 - \frac{e'_{j_*}}{e_{j_*}} \frac{\gamma^2 (j_* - 2 + \frac{e'_{j_*-1}}{e_{j_*-1}})}{1 + \gamma(j_* - 2)}\right)^{-1} \quad * \\ & \gamma \left(\left(1 - (j_* - 2 + \frac{e'_{j_*-1}}{e_{j_*-1}}) \frac{\gamma \left[1 - \frac{\gamma F}{1-\gamma} \Sigma_{i=1}^{j_*-1} e_i\right]}{1 + \gamma(j_* - 2)} - \frac{\gamma F}{1-\gamma} \left(\Sigma_{i=1}^{j_*-2} e_i + e'_{j_*-1}\right) \right) \frac{e'_{j_*}}{e_{j_*}} + e'_{j_*} F \right), \end{aligned}$$

and

$$\begin{aligned} e'_{j_*} &= \lambda P \left(1 - r - \sum_{i=1}^{j_*-2} n_i/P - n_{j_*-1}/P\right) \\ e'_{j_*-1} &= \lambda P \left(1 - r - \sum_{i=1}^{j_*-2} n_i/P - n_{j_*}/P\right). \end{aligned}$$

These leaders' coalitions, and supporting transfers are the unique sub-game perfect stationary equilibrium of the model in which there are no endogenous coups or revolutions.

Proof. In appendix.

With the optimal coalitions now defined, we can explicitly specify the value function $V_j^{transition}$ defined in section 2.2. Recall that this value function depends on the probability of an elite in j being selected into a governing coalition by a new leader which we can, using Proposition 2, now define.

Specifically, from equation (7) we have

$$V_j^{transition} = p_j(\mathbf{N})\bar{V}_j\left(\Omega^j\right) + \sum_{l=1,l\neq j}^{N} p_l(\mathbf{N})\left[I\left(j\in\Omega^l\right)V_j\left(\Omega^l\right) + \left(1 - I\left(j\in\Omega^l\right)\right)V_j^0\right].$$

This value varies depending on whether an ethnicity is in the core group of larger ethnicities (and thus always included in leader's optimal coalitions), or a smaller group (whose inclusion in government only arises when one of their own is the leader), or one of the groups j^* and j^*-1 (whose inclusion in government depends on the size of the particular leader's ethnicity at the time). Specifically, from Proposition 2 it follows that:

For $j < j^* - 1$:

$$V_j^{transition} = p_j(\mathbf{N})\bar{V}_j\left(\Omega^j\right) + \left(1 - p_j(\mathbf{N})\right)V_j\left(\Omega^l\right).$$

For $j = j^* - 1$:

$$\begin{aligned} V_{j^*-1}^{transition} &= p_{j^*-1}(\mathbf{N})\bar{V}_{j^*-1}\left(\Omega^{j^*-1}\right) + \sum_{l=1,l\neq[j^*,j^+]}^{N} p_l(\mathbf{N})V_{j^*-1}\left(\Omega^l\right) + \\ &\sum_{l=j^*}^{j^+} p_l(\mathbf{N})\left(\frac{e'_{j^*-1}(l)}{e_{j^*-1}}V_{j^*-1}\left(\Omega^l\right) + \left(1 - \frac{e'_{j^*-1}(l)}{e_{j^*-1}}\right)V_{j^*-1}^0\right). \end{aligned}$$

For $j = j^*$:

$$\begin{aligned} V_{j^*}^{transition} &= p_{j^*}(\mathbf{N})\bar{V}_{j^*}\left(\Omega^{j^*}\right) + \sum_{l=1}^{j^*-1} p_l(\mathbf{N})\left(\frac{e'_{j^*}}{e_{j^*}}V_{j^*}\left(\Omega^l\right) + \left(1 - \frac{e'_{j^*}}{e_{j^*}}\right)V_{j^*}^0\right) + \\ &\sum_{l=j^+}^{N} p_l(\mathbf{N})\left(\frac{e'_{j^*}(l)}{e_{j^*}}V_{j^*}\left(\Omega^l\right) + \left(1 - \frac{e'_{j^*}(l)}{e_{j^*}}\right)V_{j^*}^0\right) + \sum_{l=j^*+1}^{j^+-1} p_l(\mathbf{N})V_{j^*}^0. \end{aligned}$$

For $j > j^*$:

$$V_j^{transition} = p_j(\mathbf{N})\bar{V}_j\left(\Omega^j\right) + \left(1 - p_j(\mathbf{N})\right)V_j^0.$$

The characterization of the uniquely optimal coalition for each leader, and of the patronage shares, are both features extremely valuable to the structural estimation of the model, to which we proceed below.

3 Econometric Specification and Estimation

To operationalize the solution in Proposition 4 additional assumptions are necessary. We assume that the allocated shares of patronage are only partially observable due to a group-specific error ν_{jt}. We imperfectly observe $\{x_i e_i\}_{i\in\Omega^l}$, the vector of the shares of patronage allocated to ethnic groups in the ruling coalition (and consequently we also imperfectly observe the leader group's share $1 - \Sigma_{i\in\Omega^l} x_i e_i$). Every player in the game observes such shares exactly, but not us (the econometrician). For excluded groups $j \notin \Omega^l$ and $j \neq l$ we also assume the possibility of error to occur. For instance, consider the case of erroneously assigning a minister to an ethnic group that is actually excluded from the ruling coalition.

At time t, let us indicate $\hat{x}_{jt} = x_j$ if $j \in \Omega^l$ and $\hat{x}_{jt} = 0$ if $j \notin \Omega^l$ and $j \neq l$. Note that the time dimension in $\hat{x}_{jt}$ arises from the identity of the leader l shifting over time due to transitions. We define the latent variable $X^*_{jt} = \hat{x}_{jt} e'_j + \nu_{jt}$ and specify:

$$X_{jt} = \begin{cases} X^*_{jt} & \text{if } X^*_{jt} \geq 0 \\ 0 & \text{if } X^*_{jt} < 0 \end{cases} \tag{13}$$

where X_{jt} indicates the realized cabinet post shares to group $j \in \mathcal{N}$, hence $X_{jt} \in [0, 1]$ with allocation vector $\mathbf{X}_t = \{X_{1t,}..., X_{Nt}\}$. Note that (13) ignores right-censoring for $X^*_{jt} \geq 1$, as $X_{jt} = 1$ never occurs in the data.

The error term ν is assumed mean zero and identically distributed across time and ethnic groups. The distribution of ν with density function $\beta(.)$ and cumulative function $B(.)$ is limited to a bounded support $[-1, 1]$ and $\nu \sim Beta\,(-1, 1, \xi, \xi)$ with identical shape parameters ξ, a particularly suited distribution function[17].

As noted in Adachi and Watanabe (2007), the condition $\Sigma_{i\in\mathcal{N}} X_{it} = 1$ can induce ν to be

[17] For a discussion see Merlo (1997), Diermeier, Eraslan, and Merlo (2003), and Adachi and Watanabe (2007).

not independently distributed across groups. Generally, independence of the vector $\{\upsilon_{it}\}_{i\in\mathcal{N}}$ is preserved since $\Sigma_{i\in\mathcal{N}}X_{it} = 1 \neq \Sigma_{i\in\mathcal{N}}X^*_{it}$ due to censoring, but not for all realizations of the random shock vector $\{\nu_{it}\}_{i\in\mathcal{N}}$. To see this, notice that if all the observations happen to be uncensored, then $\Sigma_{i\in\mathcal{N}}X_{it} = \Sigma_{i\in\mathcal{N}}X^*_{it} = 1$, implying that $\Sigma_i\nu_{it} = 0$, which would give to the vector $\{\nu_{it}\}_{i\in\mathcal{N}}$ a correlation of -1. In this instance we would only have $N-1$ independent draws of υ but N equations. A solution to this problem is to systematically employ only $N-1$ independent equations for each observed cabinet. Conservatively we always exclude the smallest group's share equation from estimation.

Absent any information on λ, the model can still be estimated and one is able to identify the product λPF (but not λ and F separately). We follow this approach, set in the estimation $\lambda P = 1$, and rescale F when we discuss our results[18]. We also calibrate $\delta = .95$.

Given the vector of model parameters $\theta = (\gamma, F, r, \xi, \alpha, \varepsilon)$, conditional on the vector of exogenous characteristics $\mathbf{Z} = (\mathbf{N}, \lambda, \delta)$ and leader's identity l, coalition Ω^l can be computed by the econometrician. This implies that we can partition the set of ethnic groups in a country in four groups for given vector $\mathbf{X}_t$: the set of predicted coalition members that receive cabinet seats $G_1 = \left(j \in \Omega^l \wedge X_{jt} > 0\right)$; the set of predicted coalition members that do not receive cabinet seats $G_2 = \left(j \in \Omega^l \wedge X_{jt} = 0\right)$; the set of outsider groups that are misallocated posts $G_3 = \left(j \notin \Omega^l \wedge X_{jt} > 0\right)$; the set of outsider groups that receive no post $G_4 = \left(j \notin \Omega^l \wedge X_{jt} = 0\right)$. We call a partition of $\mathcal{N} \setminus l$ $\rho = \{G_1, G_2, G_3, G_4\}$ a regime. Given $\mathbf{Z}$ and l, the likelihood contribution of the observed cabinet allocation is $\mathbf{X}_t$ in regime ρ is

$$\mathcal{L}_\rho\left(\mathbf{X}_t|\mathbf{Z},l;\theta\right) = \prod_{i\neq l}^{N} \beta(X_{it} - \hat{x}_{it}e_i)^{I(i\in G_1,G_3)} B(-\hat{x}_{it}e_i)^{I(i\in G_2,G_4)},$$

where $I(.)$ is the indicator function. Notice that this likelihood contribution is similar in spirit

[18] Although systematic studies of African elites are rare, survey evidence in Kotzé and Steyn (2003) indicates λ to be possibly approximated by population shares of individuals with tertiary education in the country. Any bias introduced by employing tertiary education shares as proxies for λ can be, in theory, assessed by comparing estimates of the other parameters of interest relative to our baseline which operates without any assumption on the size of λ. For space limitations we do not explore this avenue here.

to a type I Tobit model and the estimator shares its consistency and asymptotic efficiency properties.

Define for time period τ an indicator function for $I_\tau(\rho)$ taking value 1 if observed allocation $\mathbf{X}_\tau$ and optimal coalition Ω^l fall in regime ρ and 0 otherwise. Define a leadership spell as the period a country is ruled by a specific leader y of ethnicity l_y starting to rule at year t_y and ending at T_y. Define for each country the sequence $\mathbf{Y} = \{l_1, t_1, T_1; ...l_y, t_y, T_y; ...; l_Y, t_Y, T_Y\}$. Given $\mathbf{Z}$ and the sequence of coalitions observed in a country $\{\mathbf{X}_\tau\}$ the sample likelihood function under a leadership y with a leadership spell of duration T_y is

$$\mathcal{L}\left(\{\mathbf{X}_\tau\}_{\tau=t_y}^{T_y}|\mathbf{Z}, y; \theta\right) = \prod_{\tau=t_y}^{T_y} \prod_{\rho} \left[\mathcal{L}_\rho\left(\mathbf{X}_\tau|\mathbf{Z}, l_y; \theta\right)\right]^{I_\tau(\rho)}.$$

The likelihood function for each country in our sample is

$$\mathcal{L}\left(\mathbf{Y}, \{\mathbf{X}_\tau\}_{\tau=t_1}^{T_Y}|\mathbf{Z}; \theta\right) = \prod_{y=1}^{Y} p_{l_y}\left(\mathbf{N}\right)(1-\varepsilon)^{T_y - t_y}\,\varepsilon\left[\mathcal{L}\left(\{\mathbf{X}_\tau\}_{\tau=t_y}^{T_y}|\mathbf{Z}, y; \theta\right)\right].$$

In principle, each country in our sample can be employed to estimate a vector $(\gamma, F, r, \xi, \alpha, \varepsilon)$ independently from other countries. However, the identification of the parameters (α, ε) relies on variations of leaders within countries, which are rare in some political systems (e.g. Kenya, Cameroon, etc.). The maximum likelihood estimation we employ will therefore allow for country-specific coup, revolution, and measurement parameters (γ, F, r, ξ), but employ the full sample of countries to estimate a single vector (α, ε). The identification of the model is further assessed through several rounds of Montecarlo simulations. For given parameter values, we made sure the estimation based on the simulated data converged on the given structural values.

Given the parsimony of our model, the likelihood function depends on a relatively small number of parameters. This allows for a fairly extensive search for global optima over the parametric space. In particular, we first employ a genetic algorithm (GA) global optimizer with a large initial population of $10,000$ values and then employ a simplex search method using the GA values as initial values for the local optimizer. This approach combines the global properties of the GA optimizer with the proven theoretical convergence properties of the simplex method. Repeating the optimization procedure consistently delivers identical global optima.

4 Data and Descriptive Statistics

In order to operationalize the allocation of patronage shares we rely on data on the ethnicity of each cabinet member for our sample of fifteen African countries at yearly frequency from independence to 2004. The full data description and the construction of ethnicity and ministerial data, as long as evidence in support of the importance of this executive branch data, is available in Rainer and Trebbi (2011). Here we will illustrate briefly the process of data collection for each country. We devised a protocol involving four stages.

First, we recorded the names and positions of all the members of government that appear in the annual publications of Africa South of the Sahara or The Europa World Year Book between 1960 and 2004. Although their official titles vary, for simplicity we refer to all the cabinet members as "ministers" in what follows.

Second, for each minister on our list, we searched the World Biographical Information System (WBIS) database for explicit information on his/her ethnicity. Whenever we could not find explicit information on the minister's ethnicity, we recorded his or her place of birth and any additional information that could shed light on his/her ethnic or regional origin (e.g., the cities or regions in which he or she was politically active, ethnic or regional organizations he/she was a member of, languages spoken, ethnic groups he/she wrote about, etc.).

Third, for each minister whose ethnicity was not found in the WBIS database, we conducted an online search in Google.com, Google books, and Google Scholar. Again, we primarily looked for explicit information on the minister's ethnicity, but also collected data on his/her place of birth and other information that may indicate ethnic affiliation. In addition to the online searching, we sometimes also employed country-specific library materials, local experts (mostly former African politicians and journalists with political expertise), and the LexisNexis online database as alternative data sources.

Fourth, we created a complete list of the country's ethnic groups based on ethnic categories listed by Alesina, et al. (2003) and Fearon (2003), and attempted to assign every minister to one of these groups using the data collected in the second and third stages. When our sources explicitly mentioned the minister's ethnicity, we simply matched that ethnicity to one of the ethnic groups on our list. Even when the explicit information on the minister's ethnicity was missing, we could often assign the minister to an ethnic group based on his or her place of birth or other available information. Whenever we lacked sufficient evidence to determine the minister's ethnic group after this procedure, we coded it as "missing". The exact ethnic mappings are available in Rainer and Trebbi (2011).

This paper employs completed data since independence from colonization on Benin, Cameroon, Cote d'Ivoire, Democratic Republic of Congo, Gabon, Ghana, Guinea, Liberia, Nigeria, Republic of Congo, Sierra Leone, Tanzania, Togo, Kenya, and Uganda. In these countries we were able to identify the ethnic group of more than 90 percent of the ministers between 1960 and 2004. Our cross-sectional sample size exceeds that of most studies in government coalition bargaining for parliamentary democracies.[19]

Table 1 presents the basic summary statistics by country for our sample, while Table 2 presents summary statistics further disaggregated at the ethnic group level.

4.1 Stylized Facts

An informative descriptive statistic is the share of the population not represented in the cabinet for our African sample. Figure 1 reports the share of the population belonging to ethnic groups for which there is no minister of that ethnicity in government that year.

[19] See for instance Diermeier,Eraslan, and Merlo (2003), Ansolabehere, Snyder, Strauss, and Ting (2005) and Snyder, Ting and Ansolabehere (2005).

Table 3 reports country averages. African ruling coalitions are often in the 80 percent range. Just as comparison, in parliamentary democracies typically only 50 percent of the voters find their party represented in the cabinet due to simple majoritarian incentives (arguably not the relevant dimension for African autocracies). Given no ethnic group in our sample represents more than 39 percent of the population, and in no country in our sample does any leader's group represent more than 30 percent of the population, Figure 1 implies that at least some members of non-leader ethnic groups are always brought in the cabinet.

To further illustrate this feature, Table 4 reports a reduced-form specification with c indicating a specific country, j the ethnic group, and t the year of the likelihood of inclusion in a coalition:

$$M_{cjt} = \alpha_1^M \frac{n_{jc}}{P_c} + \gamma_c^M + \delta_t^M + \eta_{cjt}^M$$

and with M_{cjt} indicator for ethnicity j at time t belonging to the cabinet. In a Probit specification in Column (1), the marginal effect on the ethnic group share of the population, α_1^M, is positive and statistically significant. An extra 1 percent increase in the share of the population of a group increases its likelihood of inclusion by 6.6%. This underlines a strong relationship between size and inclusion in government. It is easy to see why. 94.5% of all group-year observations representing 10% of the population or more hold at least a position. 83.7% of those with 5% population or more hold at least a position. Column (2) adds a control for the party/group being the largest in terms of size, in order to capture additional nonlinearities, with similar results. Repeating the same exercise, but with respect to the likelihood of a group holding the leadership, reveals an important role for size as well. Table 4 Column (3) reports a marginal effect on the likelihood of leadership of .54 percent per extra 1 percent increase in the share of the population of a group. This stylized fact supports our assumption in (1).

We can also assess the overall degree of proportionality of African cabinets. The issue of disproportionality is the subject of a substantial literature in political economics and political science as a feature of electoral rules[20]. Some Africanists have discussed the issue of cabinet disproportionality in detail (Posner, 2005), emphasizing how for countries with few reliable elections, cabinet disproportionality might be a revealing statistic. Recalling that X_j indicates the realized cabinet post shares to group j, a first operational concept is the degree of proportionality of the cabinet. A perfectly proportionally apportioned cabinet is one for which for every $j \in \mathcal{N}$, $n_j/P = X_j$. Governments, particularly in autocracies, are considered to operate under substantial overweighting ($n_j/P < X_j$) of certain factions and underweighting ($n_j/P > X_j$) of other ethnic groups. As discussed in Gallagher (1991), deviations from proportionality can be differentially weighted, with more weight given to large deviations than small ones or employing measures focused on relative versus absolute deviations. Following Gallagher's discussion of different measures, we focus on his preferred measure of disproportionality:

Definition 1. *The least squares degree of government disproportionality at time t is given by* $\pi_t^{LSq} = \sqrt{\frac{1}{2}\sum_{i=1}^{N}\left(100 * (X_{it} - n_i/P)\right)^2}$

We report the time series for π^{LSq} for each country in Figure 2. The average levels of disproportionality for the elites in each country are reported in Table 5, with larger values indicating less proportionality and an average level of 16.72. As a reference, using party vote shares and party cabinet post shares in the sample of democracies of Ansolabehere et al. (2005) $\pi^{LSq} = 33.97$ on average. Notice that π^{LSq} captures well-known features of the data, for example, the political monopoly of the Liberian-American minority in Liberia until the 1980's. Overall, African cabinet allocations tend to closely match population shares with cabinet seat shares and disproportionality is low.

To further illustrate this feature of the data Table 6 reports a straightforward reduced-

[20] In particular seat-votes differences. Gallagher (1991) explores the issue in detail and Carey and Hix (2011) offer a recent discussion.

form regression of cabinet shares on population shares:

$$X_{cjt} = \alpha_1^X \frac{n_{jc}}{P_c} + \alpha_2^X L_{cjt} + \gamma_c^X + \delta_t^X + \eta_{cjt}^X$$

with L_{cjt} an indicator function for the country leader belonging to ethnicity j at time t. L_{cjt} captures the straightforward nonlinearity stemming from leadership premia. Column (1) in Table 6 shows two striking features. First, the coefficient on the ethnic group share of the population α_1^X is positive and statistically significant, indicating a non trivial degree of proportionality between population shares and cabinet allocations, around .77. This rejects clearly the hypothesis of cabinet posts being allocated independently of the population strength of a group and at the whim of the leader. Second, the leader's seat premium in the cabinet is precisely estimated, positive, but not excessively large: around 11 percent. Given an average cabinet size of 25 posts in our African sample, the leadership premium can be assessed as an additional $1.75 = 25 * (.11 - 1/25)$ ministerial positions on top of the leadership itself. Column (2) adds the square of the group size and a control for the largest ethnicity in terms of size in order to capture additional nonlinearities, with similar results. Incidentally, the negative coefficient on the squared group size is significant at the 10 percent confidence level and is significant at 5 percent when removing the dummy for largest group. This reduced-form finding supports the view of large groups being relatively less well represented than small ones, a specific type of nonlinearity implied by Lemma 1.

The allocation of top positions in African cabinets is explored in Column (3). We include as top ministerial posts: the Presidency/Premiership, Defense, Budget, Commerce, Finance, Treasury, Economy, Agriculture, Justice, Foreign Affairs. Both size and leadership status are positive and significant. Quantitatively, it is surprising that α_1^X remains sizable in Column (3), close to what estimated in Column (1). Notice also how the effect of leadership increases for top ministerial appointments, this is however the result of the leader representing a larger share of a smaller set of posts. Given an average top cabinet size of 9 posts, the leadership premium can be assessed as an additional $.87 = 9 * (.208 - 1/9)$ ministerial positions on top of the leadership itself.

Not only do African cabinet allocations tend to mirror population shares closely, but they do so consistently over time. As an illustration, we report the time series of $(X_{it} - n_i/P)$ across all ethnic groups in Guinea (Figure 3) and in Kenya (Figure 4)[21]. All the time series hover around zero, unless the leader is from that specific ethnicity (in which case there is a positive gap). As predicated by our model there appear to be leadership premia. In Guinea the shift in power between Malinke and Susu in 1984 at the death of Ahmed Sékou Touré, a Malinke, produced a visible drop in overweighting of that group and a jump for the Susu, the new leader's group. Similar dynamics are evident under Moi in Kenya. Overall these stylized facts strongly justify our focus on stationary equilibria.

5 Results

5.1 MLE Results

Table 7 presents our maximum likelihood estimates of the model. We report the full vector of model parameters $\boldsymbol{\theta} = (\alpha, \varepsilon, \boldsymbol{\gamma}, \mathbf{F}, \mathbf{r}, \boldsymbol{\xi})$ where we use the notation $\boldsymbol{\gamma} = \left(\gamma^{BEN}, \gamma^{CMR}, ..., \gamma^{UGA}\right)$, $\mathbf{F} = \left(F^{BEN}, F^{CMR}, ..., F^{UGA}\right)$, and so on, for country-specific parameters.

Beginning from the common parameters governing the leadership transitions, we find immediate support for the view that larger groups are more likely to produce leaders, i.e. $\alpha > 0$. In addition, α is precisely estimated at $11.5 > \exp(1)$, implying that large groups are substantially overweighted relative to small groups. This finding highlights increasing returns to scale in terms of likelihood of leadership appointment for ethnic groups, an important incentive in favor of ethnic cohesion, as two different ethnic groups can gain in terms of likelihood of generating a leader by merging. Regarding the likelihood of exogenous breakdowns in power, inclusive of uninsurable coups or other shocks, we estimate an ε around 11.5%, again

[21] Similar patterns recur across the other countries.

very statistically significant[22]. This indicates a fairly high likelihood of per-period breakdown and translates into an effective per period discount rate[23] of $\delta(1-\varepsilon) = .95 * .905 = 84\%$.

Concerning the country-specific parameters, let us begin from the revolution technology parameter r, where $1-r$ is the share of value destroyed by the revolution. For virtually every country, r is precisely estimated. In a fashion completely consistent with the large ruling coalitions highlighted in Figure 1, Table 7 reports values of r generally above 80%. Larger values of r imply cheap, less destructive revolutions. Cheap revolutions, in turn, imply larger threats to the leader from outsiders, pushing him toward more inclusive governments. It is not surprising, then, that we estimate $r = .99$ for Guinea, a country with average observed coalitions around 92% of the population (the highest of all 15 countries). There are only 9 ethnicities in Guinea and the top 7 by size all have nontrivial observed cabinet shares, while the bottom two groups are only 1% each. So, one could imagine the estimator trying to include at least the top 7.

The precision parameter ξ governing the Beta distribution of the error terms is generally quite high. Larger values of ξ imply tighter distributions of the ν's in (13) and underline a good fit of the model (further explored below). The country with the lowest precision is Liberia, with a fit $\xi = 24.5$.

Indeed Liberia requires a short diversion. One can recall that the stylized facts reported in Figure 2 present a clear outlier, Liberia during the 1960-1980 period, a period of American-Liberian rule. During the Americo-Liberian era, the country was essentially ruled by a small minority of freed American slaves who had repatriated to this particular area since the 1820s under the auspices of the United States government. On average the Americo-Liberian regime concentrated around 50% of cabinet seats into a 4% population minority. The international economic and political support for the Americo-Liberians sustained their

[22] Note also that our assumption about i.i.d. ε transitions is valid. A diagnostic Breusch and Pagan (1980) LM test for cross-country dependence of ε cannot reject independence with a p-value of .84 and an Arellano-Bond panel model of a leader transition on its lag cannot reject serial independence with a p-value of .95.

[23] It should also be clear from this calculation why we calibrate $\delta = .95$ as it cannot be separately identified from ε.

central rule, but waned over time. A coup in 1980 ended the regime. The Americo-Liberian period clearly clashes with our model's assumptions and one could readily see how Liberia should be considered in much of the discussion below a falsification case. Liberia is a clear instance where our model does not fit the data as we are omitting important dimensions of the problem (the vast military-economic advantage and international support with which the Americo-Liberians were endowed).

The coup technology parameter, i.e. the likelihood of coup success γ, and the private returns to leadership F (expressed as share of total transferable patronage) are of particular interest for understanding the allocation of seats. Increasing γ for given F makes coups more threatening for a leader because of their higher success rate, and induces a more proportional allocation of seats. Increasing F for given γ makes coups more threatening for a leader as well, because of the higher value of taking over if the coup is successful, and this again induces a more proportional allocation of seats in order to avoid coups. Both parameters are generally precisely estimated in Table 7. For Benin, Cameroon, and Gabon the model does not pin down γ and F precisely, pushing γ toward a corner of 0 and F toward very large valuations. Uganda instead displays an imprecise, low γ. As we will show below, the fit for these countries is not particularly poor. Simply the estimates do not appear sufficiently precise to assess the role of γ and F independently. Only Liberia, and for the reasons stated before, seems to reject the model.

Averaging the estimates of γ in the ten countries for which we have interior estimates and excluding Liberia, one can notice the importance of the coup threat in driving the allocation of cabinet posts. The average likelihood of coup success γ is fairly large, about 35%. This is a very realistic estimate. Using data on actual coups from SystemicPeace.org for the countries and periods in our sample the success rate of coups appears very close: 31.9%. The quantitative interpretation of the reported F, which averages at 2.5, is harder. First of all, we need to scale by λP the estimates of F reported in Table 7. This delivers private rents to the leader as a share of total value of patronage in the country. Using as benchmark for the elite share of the population $1/1000$ gives us a scaling factor $1/\lambda P = (.001 * P)^{-1}$. Averaging the estimates of the rescaled F, implies that yearly private rents as share of total patronage allocated in a country of 20 million people are around $2.5/(.001 * 20M)$, probably not an unrealistic figure when multiplied by total value of government patronage in the country[24].

Table 8 reports two additional statistics and their standard errors. First we compute the structural slope of cabinet allocations as function of size of the ethnic group $\gamma F/(1-\gamma)$. These estimates are positive and statistically significant with the exception of Liberia, which is negative, implying over-representation of small groups (an unsurprising fact given the pre-1980 era). Positive slopes imply that a larger group size predicts a larger share of posts (and patronage), as implied by point 1 of Proposition 3. For the ten countries for which we have interior estimates of γ and F and excluding Liberia, the slope is also statistically smaller than 1 implying under-representation of non-leader groups and positive leadership premia, which we verify in the second column of Table 8. For Benin, Cameroon, Gabon, and Uganda point 1 of Proposition 3 is also verified, as the estimated slope is positive and significant. Concerning the estimated leadership premia accruing to a member of the core coalition, typically the estimates are precise and positive, consistently with our theoretical setup. We find average leadership premia across our countries around $9-12$ percent share of the cabinet seats. Notice also that a leadership premium of about 12 percent is a figure similar to that which was estimated in Section 3 in the reduced-form relationship.

An important check comes from the analysis of top cabinet positions, like defense or finances. Our results are not just an artifact of the leadership allocating minor cabinet roles to ethnicities different from the leader's own, while reserving the central nodes of power to the leader's co-ethnics. The results hold true even when restricting the analysis to the subsample of the most powerful ministerial posts. In Tables 9-10 we report ML estimates for a model

[24] As an hypothetical benchmark one can consider a country with a GDP of \$30 Billion and government spending/GDP of 30% (similar to current Kenya or Cameroon in our sample). This would deliver yearly private rents from office around \$1.4 million. Such estimates, however, have to be considered with extreme caution, as it is particularly complex to exactly quantify the absolute size of both ethnic elites and government patronage.

that gives weight 1 to the top posts and 0 to all other cabinet appointments. Proportionality and leadership premia appear remarkably stable across the top position model and the full sample model, although the estimated precision parameters ξ governing the Beta distribution are now lower, a natural consequence of the coarser nature of the allocated top shares. Given the precision of our ML estimates, we can typically reject equality of the estimates across the two models, but quantitatively the magnitudes appear similar. Given the crucial strategic role of some of these cabinet positions within autocratic regimes (e.g. ministry of defense), it appears natural to infer that some real power is actually allocated from the leadership to other ethnic factions.

5.2 In-Sample and Out-of-Sample Goodness of Fit

Our model predicts that ruling coalitions should include first and foremost large groups, that the share allocated to such groups should be stable over time, and that cabinet posts should be allocated proportionally to group size. Failing to match any of these moments in the data will deliver poor fit of the model. We now illustrate the goodness of fit of our model by focusing on a set of characteristics of African coalitions.

In Sample

We begin by checking the in-sample fit over the entire 1960-2004 period using the estimates of Table 7 and the implied optimal coalitions. Figure 5 reports the observed coalition sizes in terms of share of population represented by each group in government. This means that an observed average coalition of .7 in Ghana indicates that summing up the ethnic shares of the population of every ethnicity with at least a minister covers 70% of the population on average each year over the 1960-2004 period. Our model predicts a very similar coalition size, about 73%. With the exception of Liberia and Tanzania our model fares very well in predicting the size of the coalitions as fractions of the population. On average we are able to correctly predict around 80% of the population based on the assignment to government insiders or outsiders, as reported in Figure 6. This means that our model accurately predicts the membership of the cabinet in terms of relevant groups in the population. Even considering simple counts of groups correctly predicted in or out of government, i.e. equally weighing very large and very tiny ethnicities, we observe a high success rate, often correctly assigning more than 2/3 of the ethnic groups in our sample. Excluding Liberia, the observed coalitions cover on average 79.4% of the population based on ministerial ethnic affiliations, while our in-sample prediction is 84.4%.

Concerning how we fit government shares, and not just government participation, it would be cumbersome to report shares for every group across 15 countries. Instead, we focus on two specific typologies of groups which are of paramount relevance. We fit the cabinet shares of the ethnic group of the leader in Figure 7 and the cabinet shares of the largest ethnic group in the country in Figure 8. These two ethnic groups do not overlap substantially (78% of the leader's group observations are not from the largest ethnicity). Once again, inspection of the figures reveals a very good match of the theoretical allocations and the allocations observed in the data. Excluding Liberia, observed cabinet posts shares to leaders are 20.2% on average, while our model predicts 22%. Excluding Liberia, observed cabinet posts shares to the largest ethnicity are 21.6% on average, while our model predicts 23.8%.

Out of Sample

So far the analysis has focused on the in-sample fit of the model. In structural estimation a good in-sample fit may be occasionally achieved through parameter proliferation in the model. Sufficiently many degrees of freedom can fit almost any type of data generating process. Our model is extremely parsimonious in its parametric choices, so this should not appear a major concern, but still we wish to push this assessment further with a demanding set of checks.

We present in Figures 9-12 the out-of-sample fit of our model based on the following design. We begin by restricting the estimation of the model to the 1960-1980 sample[25] and then try to match, based on the ML estimates from this early period, the coalition size,

[25] These estimates are available from the authors upon request.

coalition membership, and seat share allocations of cabinets for the 1980-2004 period. With the exception of Liberia, which is clearly even more penalized by the focus on its Americo-Liberian phase, the out-of-sample fit is precise. Our model correctly predicts the share of the population with and without representation in the government and the overall population share of the included ethnic groups with a very high success rate (Figures 9-10). Excluding Liberia, the observed coalitions cover on average 82.5% of the population based on ministerial ethnic affiliations, while our out-of-sample prediction is 76.3%. Predicted leadership shares from the model are generally accurate as well (see Figure 11). Excluding Liberia, observed cabinet posts shares to leaders are 19.1% on average, while our model predicts 24.1%. Note that this is true even if almost systematically the ethnicities ruling these African countries in the 1980-2004 differ from those ruling in 1960-80. Shares of cabinet seats to the largest ethnicity are also correctly predicted out of sample. Excluding Liberia, observed cabinet posts shares to the largest ethnicity are 21.1% on average, while our model predicts 23.5%. Overall, this precise out-of-sample goodness of fit not only reinforces the empirical value of our analysis, but also strongly supports our assumption on the stationarity of the coalition formation equilibrium[26].

5.3 Fit Along Additional Dimensions

By considering the relative fit of the model over different subsamples, some of the institutional and political details, deliberately omitted from the model, can be assessed. Were the model missing relevant institutional dimensions, this approach would reveal it.

Informally, we can observe that in Table 6 fit and precision of our estimates are consistent across English and French colonial origin countries and East and West African countries. Our model seems to capture allocation mechanisms of historically different regimes, occasionally even delivering quantitatively similar outcomes (e.g. Guinea and Kenya's estimates in Table 6).

[26] The same quality of fit is also displayed in the top positions sample as well, as produced by Tables 9 and 10. We do not report the figures for brevity, but are available upon request.

More formally, we can evaluate different subsamples separately, assessing whether the main results are dominated by any specific dimension of the data and fit is consistently accurate across samples. We chose two important dimensions here: military nature of the regime and form of government. For military versus civilian rule, about 58% of our country-year observations fall in the latter category based on a classification that incorporates both Archigos and the Europa Year Book (Rainer and Trebbi, 2011). With regard to autocratic versus democratic forms of government, about 14% of our country-year observations fall in the latter category based on the Polity2 score of the country (we define a democracy as Polity2 score > 5, as standard in the literature). We do not report the ML estimates for the separate subsamples[27], but only focus on the predictions of our model for coalition size and leader group's share.

The fit is consistently good. For military regimes, the predicted average coalition size pooling all countries and time periods is .83 versus an actual size of .78 and the predicted leader's share is .20 versus an actual share of .19. For civilian regimes, the predicted average coalition size is .88 versus an actual size of .77, while the predicted leader's share is .26 versus an actual share of .24. For autocratic regimes, the predicted average coalition size is .83 versus an actual size of .77, while the predicted leader's share is .24 versus an actual share of .22. For democratic periods, the predicted average coalition size is .77 versus an actual size of .80, while the predicted leader's share is .25 versus an actual share of .22. Surprisingly, even though there are few democratic regimes and our model is clearly not apt to describe modern democratic power sharing, the model's fit is still very good. A conjecture would be that democratic transitions do not completely make *tabula rasa* of the power structure in place during autocracies.

[27] All results available from the authors upon request.

6 Counterfactuals

We now investigate a set of counterfactual experiments based on our structural estimates. Concerning the role of the revolution and coup technologies in the allocation of ministerial posts in Africa, we focus on three counterfactuals: i) an increase the cost of the revolution parameter, $1 - r$; ii) a reduction in the likelihood of success of coups, γ; and iii) a reduction of the size of the private benefits from leadership, F. Lowering r produces more exclusive coalitions by increasing the cost of revolt against the leader and hence makes revolutions less threatening. Drops in γ and F make coups less threatening for the leader as well. As leadership becomes safer to maintain, lower γ and F induce a less proportional allocation of seats relative to group size and more rents for the leader's ethnic group. Stemming not from the love for democracy of African leaders, large coalitions and close-to-proportional patronage allocations are indeed a result of the fragility of the institutional structure of Sub-Saharan countries. Finally, we explore the effects of counterfactual ethnic group distributions within countries. In particular, we show how an increase in ethnic fractionalization can translate in larger coalitions and seats losses to the leadership.

We begin by estimating the model for the 1960-1980 sample. We then modify only one parameter at a time and observe how the model predictions change in the 1980-2004 sample. One could potentially simulate the counterfactuals using the entire 1960-2004 sample as well. We opt for the former approach in order to show how different the out-of-sample predictions would be in presence of structural breaks in each of the main parameters of the model.

A. Reducing the Threat of Revolutions

Figures 13-15 present the counterfactual coalitions in presence of a 10% drop in r vis-à-vis the baseline predicted coalition, shares allocated to leaders, and shares allocated to the largest group. In Figure 13 the population share with at least one minister represented in the coalition falls substantially when lowering r. The threat of revolutions is so reduced by the increase in their cost that coalitions drop in size from 76.3% in the baseline to 48.3% of the population in the counterfactual (on average across all countries, excluding Liberia).

Concerning allocated shares within these smaller coalitions, we notice that leader's groups now enjoy substantially higher shares of cabinet seats, going from 24.1% to 56.2% on average across all countries (Figure 14). In Figure 15 the largest group also gains seat shares, moving from 23.5% to 37.8%.

B. Reducing the Threat of Coups

Figures 16-18 present the counterfactual coalitions and allocations in presence of a 25% relative drop in γ. Similarly, Figures 19-21 present the same counterfactuals in presence of a 25% relative reduction in F. Notice that changing γ and F does not necessarily affect the optimal coalition unless constraint (4) begins to bind. However, changing γ and F always affects how much a member of the coalition is paid.

The difference between modifying the coup technology and modifying the revolution technology is substantial. In both Figure 16 and Figure 19 we notice that even a drastic drop in γ or F does not affect the optimal coalition, leaving the insider constraint (4) slack. Insiders are paid less when they are less dangerous (as they have lower incentives to stage a coup), but they do not appear to have incentive to abandon the ruling coalition and hence the leader does not change the composition of Ω^l. Counterfactual coalitions under the new γ and F have the same membership as the baseline in Figures 16 and 19. Notice that this is true even if in relative terms the drops in γ or F are much higher than the relative drop in r we have considered above.

Reducing the threat of coups does have an effect on allocations within the coalition. When reducing γ, the leader's group gets to enjoy a higher seat share, going from 24.1% to 34% on average across all countries excluding Liberia (Figure 17). Interestingly, the largest group is less of threat now and therefore the leader assures its loyalty more cheaply. In Figure 18 the largest group loses seat shares, moving from 23.5% to 21.6% when γ drops. In the counterfactual reducing F, the leader's group again enjoys higher shares of seats, up from 24.1% to 30% on average across all countries excluding Liberia (Figure 20). In Figure 21 the largest group again loses seat shares, moving down from 23.5% to 21.5%.

C. Increasing Ethnic Fractionalization

A standard index of ethnic fractionalization considered here is the Herfindahl concentration[28] $ELF = 1 - \Sigma_{i=1}^{N} (n_i/P)^2$. Typically an increase in ELF will require a shift towards a more equal distribution of population across groups. Insider groups, the large ones according to our model, should lose clout vis-à-vis outsiders, which are typically small[29].

As an example, let us impose a reduction of 1 percent of the population to any group above the median group size, while adding 1 percent to any group below the median (the median group is left unchanged). This modification essentially tilts the distribution towards equal shares of $1/N$, which maximizes ELF. It also unambiguously strengthens small groups on the outside of the government and weakens government insiders. The endogenous response predicted by our model is a more inclusive coalition, which is what we observe across the board in the counterfactuals of Figure 22. The increase in ethnic fractionalization has the effect of increasing the average coalition size from 75.5 percent of the population to 76.9 percent. Interestingly, both the allocations to the leader's own group and to the largest group in the country decrease in Figures 23-24. By reducing the inequality in group size, an increase in ELF makes challengers to the leadership more threatening and induces more redistribution of the leadership and insiders' spoils. The average share to the leader's group across the countries in our sample drops from 25.9 to 24.1 percent, while the largest group's share drops from 22.3 to 20 percent. The latter is a more than proportional reduction given the 1 percent fall in the largest group population shares.

[28] See Alesina et al. (2003); Fearon (2003), but also Posner (2004) for a criticism and an alternative measure. For an analysis of the determinants of ethnolinguistic diversity see Michalopoulos (2012).

[29] This intuition is generally correct. However, the specific effect of ELF on post allocations needs to be studied on an case-by-case basis within our framework. The reason is that there are multiple ways an ethnic group distribution $\mathbf{N} = \{n_1, ..., n_N\}$ can be modified to increase ELF. Carefully shifting mass across groups may produce no change in the balance of strength between insiders and outsiders, while still increasing ELF. This ambiguity is the result of the large amount of degrees of freedom allowed when the full vector of group sizes $\mathbf{N}$ is modified. The following example clarifies how our model captures distributional changes in a straightforward case.

7 Alternative Models of Allocation

We now assess the relative performance of our model versus two relevant alternative hypotheses. A first model of allocation, which could challenge our theoretical interpretation, is one of pure window dressing on the part of the leader. One could reasonably conjecture a proportional mechanism of cabinet allocation simply based on random sampling from the population of elites. Were the leader only concerned with giving an appearance of fair representation of ethnic interests, he could just pick political pawns at random (plus or minus a statistical error ν). Censoring should be allowed in such alternative setup as well, but only due to the coarseness of the cabinet allocation process (e.g. a group with 1/30 of the population can not be proportionally represented in a cabinet of 20 seats) and not because of revolution constraints. Formally, this would imply:

$$\hat{x}_{jt} e_j = e_j \text{ for any } j$$

and latent shares equal to:

$$X_{jt}^{*} = \hat{x}_{jt} e_j + \nu_{jt}.$$

Although relying on somewhat arbitrary assumptions about the lack of rationality of non-elites (systematically fooled by window dressing), this alternative model would appear a strong challenger to our baseline. It embeds an assumption of proportionality of seat allocation and has the ability to accommodate censoring.

A second alternative model of allocation that we explore here is a strong version of the "big man" autocratic model. We wish to reject starkly a pure interpretation of ethnic favoritism on the part of the ruler, a winner-take-all specification of the form:

$$\begin{aligned} \hat{x}_{jt} e_j &= 0 \text{ for any } j \neq l \\ &= 1 \text{ for } l \end{aligned}$$

and latent shares equal to:

$$X_{jt}^{*} = \hat{x}_{jt} e_j + \nu_{jt}.$$

We already have a sense that such degree of disproportionality might be rejected by the data in light of the evidence above. However, the alternative models presented here are much more parametrically parsimonious than the model of Section 2, by 45 parameters, a factor which weighs against our baseline in model selection tests.

Since all models are non-nested, a standard econometric approach is to run generalized likelihood ratio tests of model selection. We employ the Vuong (1989) and Clarke (2003) model selection tests. The null hypothesis for both the Vuong and Clarke tests is that the baseline and the alternative model are both true against a two-sided alternative that only one of the two models is true. The former test has better power properties when the density of the likelihood ratios of the baseline and the alternative is normal, while the latter is a more powerful test when this condition is violated. The baseline specification is always our main model from Table 6, and it is tested against the random allocation model, first, and the "big man" model, next. Table 11 reports all test statistics and p-values.

Our model fares substantially better than the proposed alternatives according to the Vuong test for non-nested models. The test statistic of the baseline against the random allocation model is 19 and we reject the null of equivalent fit with a p value of < 0.001 based on a difference of 45 degrees of freedom (r, F, γ for 15 countries)[30]. Our model appears closer to the actual data generating model. The rejection of the the "big man" autocratic model is even starker, with a test statistic of 60.1 in favor of the baseline. Employing the Clarke (2003) test we reject the null of equal fit for the random coalition model with a p-value of 0. We reject the null of equal fit for the "big man" model with a p-value of 0.0002. Interestingly the "big man" model fares slightly better using the Clarke test, as the statistic is based on the number of positive differences between individual loglikelihoods, independently on the actual size of those differences.

[30] The Vuong test statistic is asymptotically distributed as a standard normal.

Table 11 reports the Vuong and Clarke tests for four subsamples considered in Section 5.3 (military, civilian, autocracies, democracies). In all subsamples the baseline model trumps both alternative models, indicating that our theoretical setup is not dominated by alternative mechanisms that may be at work within these specific subsets. The only exception is the case of democratic regimes for the random allocation model. Here we see that, although the loglikelihood for the baseline model is higher than the loglikelihood for the random allocation model, still the tests reject the baseline in favor of the random model. The reason is the relative lack of parsimony of the baseline model relative to the random model, which spares 45 parameters. Both Vuong and Clarke statistics penalize lack of parsimony, especially with small samples like for this case (only 722 out of 11749 group-country-year observations). Due to the small sample of democratic regimes, we would not venture in asserting that democratic periods present radical breaks from our baseline allocation model, but do note that additional research on the specific power-sharing dynamics of new African democracies would be clearly of further interest.

8 Theory Extensions: Elite – Non-Elite Divisions

A final issue worth addressing concerns the clientelistic microfoundations of the within-ethnic group organization[31]. In this section we answer the following questions: Why do non-elites support a leader who allocates a patronage position to their representative elite? How much of the value generated by such a patronage position does an elite keep, and how much does he have to share with his non-elite? Why do elites have incentives to organize their non-elites in support of a leader?

[31] We follow the intuition in Jackson and Roseberg (1982, p.40): "*The arrangements by which regimes of personal rule are able to secure a modicum of stability and predictability have come to be spoken of as "clientilism".....The image of clientilism is one of extensive patron-client ties. The substance and the conditions of such ties can be conceived of as the intermingling of two factors: first, the resources of patronage (and the interests in such resources, which can be used to satisfy wants and needs) may be regarded as the motivation for the personal contracts and agreements of which patron-client ties consist; and second the loyalty which transcends mere interests and is the social 'cement' that permits such ties to endure in the face of resource fluctuations. Both of these factors are important as an explanation for some of the stable elements in African personal rule.*"

We define the patronage value of a government post (i.e., the dollar amount that a minister gets from controlling appointments, apportionment, acquisitions in his ministry) as V. V was normalized to 1 in Section 2, but we will keep it unnormalized here to focus on its explicit division between elite and non-elite. An elite member controlling x government posts controls a flow of resources xV. We still assume x is continuous and abstract from the discreteness of post allocations.

Assume the use value of a government post to a member of the non-elite is U in total if it is controlled by their own elite. If my group controls a ministry, I benefit by being more likely to be able to get benefits from this ministry. If it is education, for instance, my children will be more likely to access good schools. If it is public works, our people will be more likely to get jobs in the sector and the benefits of good infrastructure. If it is the army, our men will be more likely to get commands. An empirical illustration of this logic for road building in Kenya is given by Burgess et al. (2010).

The use value of a post to the non-elite if it is controlled by someone else is ϕU. Let $\phi \leq 1$ be related to the degree of ethnic harmony. If $\phi = 1$ non-elites do not care about the identity of the minister, they get as much out of the ministry no matter who controls it. If $\phi = 0$, society is extremely ethnically polarized. A ministry controlled by someone else is of no use to me.

8.1 Nash Bargaining

The elite obtains posts in return for delivering support. The non-elites give support in return for having the control of posts in the hands of their own ethnic elites. We assume that these two parties bargain over the allocation of the patronage value of the posts that the elite receive from the leader, xV. We also assume that they can commit to agreements ex ante. That is, if the non-elites withdraw support, a post will revert to some other ethnic elite member, with the consequent loss of value $(1 - \phi)\, xU$ for them. If the elite loses the patronage value of the post, he loses xV. This implies a Nash bargain, with κ denoting the share of V going to the elite, as follows:

$$\max_{\kappa}\left\{\left(\frac{\kappa xV-0}{1}\right)\left(\frac{(1-\kappa)\,xV+(1-\phi)\,xU}{1/\lambda}\right)\right\}$$

and implying that $\kappa=\frac{1+(1-\phi)U}{2V}$. So that the value to an elite of controlling x posts is:

$$\kappa Vx=\frac{1+(1-\phi)\,U}{2}x.$$

This result has several important implications. First of all, the greater the degree of ethnic tension in a country (i.e. the lower ϕ), the greater the share of the value going to the elite of each group is. Clearly, ethnic group leaders have incentive to incite ethnic tensions in this setting in a fashion similar to Padro-i-Miquel (2007). High levels of ethnic tensions can produce substantial inequality between the elite and the non-elite of ethnic groups. Secondly, the larger the use value of a government post to a member of the non-elite, U, the greater the share of the value going to the elite of each group.

Finally, suppose that the cost to an elite of organizing his $1/\lambda$ non-elite in support of the leader are $c\geq 0$. For an elite from ethnicity j receiving x_j posts for participating in the government to be willing to participate in the government we have the following individual rationality constraint:

$$\kappa Vx_j=\frac{1+(1-\phi)\,U}{2}x_j\geq c.$$

This must be satisfied for all groups in government. Let $x^{IR}\equiv c/\frac{1+(1-\phi)U}{2}$. Since x_j is smaller for larger groups, it implies that if there exists some groups for whom $x_j<x^{IR}$ then these will be paid x^{IR}. This does not upset the ordering determined in Section 2, but does require a re-calculation of the equilibrium patronage values. More interestingly, κ does affect the share of post values accruing to the elite members, but does not affect the total number of posts elites must receive from the leader, unless the participation constraint binds. Hence, particularly if ϕ affects ε adversely, country leaders will have strictly lower incentives to incite

ethnic tension than ethnic group elites have. It is important to underscore the asymmetry between the incentives of leaders and ethnic group elites along this dimension.

9 Conclusions

This paper presents a model of the allocation of power within African polities and estimates it employing a novel data set of the ethnic composition of Africa ministerial cabinets since independence. Our data offer new insight into the internal mechanics of autocracies, otherwise particularly opaque government forms, and their diverse upper echelons.

The data reject strongly the view of African autocracies as being run as "one man shows" by a single leader and his ethnic group, with the sole exception of Liberia. The data display inclusive coalitions and a positive and highly statistically significant degree of proportionality of ministerial positions to ethnic group size in the population, suggesting a substantial degree of political bargaining occurring within these polities. These findings are confirmed when limiting the analysis to top cabinet posts alone.

Through the lens of our model these empirical regularities conform to a view of large threats from revolutions and internal coups, which push African leaders towards inclusiveness. Our parsimonious model displays an excellent fit of the data in and out of sample and can be considered a useful stepping stone for the analysis of African politico-economic dynamics. We also perform new counterfactual experiments by modifying the revolution and coup technologies in each country.

Finally, our model is extended to highlight the connection between within-ethnic group frictions and between-ethnic group tensions. We discuss how proportionality in the allocation of cabinet posts to elites from each group does not necessarily trickle down to the non-elites of each group.

Future research should address the determinants of relative power among ethnic groups besides sheer population size, the consequences of shocks to specific ethnic groups, including climatic or terms of trade shocks to local resources, and should employ group-level information for non-elites to further analyze the process of within-group political bargaining. The data employed in this paper will also aide future research on the internal organization of autocracies, especially with regard to the dynamics of turnover of ministers and members of the autocratic inner circle (Rainer, Francois, and Trebbi, 2012).

10 Appendix

Proof of Lemma 1:

Consider a hypothetical equilibrium that does not have a core coalition $\mathcal{C}$. Denote the equilibrium payments to elites of ethnicity j by x_j^e in such an equilibrium. Moreover, assume that $x_k^e = \inf \{x_1^e..x_N^e\}$ and suppose this infimum is unique. Since there are no core ethnicities in this equilibrium, for any such ethnicity k, there exists at least one leader $l \neq j$ who optimally chooses not to include k in his governing coalition. But this implies that l cannot be optimally choosing his coalition, as he is excluding support from the elite of an ethnicity who will provide it at a price lower than those in his chosen coalition. So $\inf \{x_1^e..x_N^e\}$ being unique is inconsistent with the non-existence of a core coaltion.

It now remains to show what happens if $\inf \{x_1^e..x_N^e\}$ is not unique. There must now be at least two infima, and denote these two k and j with $x_k^e = x_j^e$. Since there is no core coalition, there exists at least one leader $l \neq k, j$ who optimally chooses not to include k and/or j in his governing coalition. If not, either k or j would constitute a 'core' set of ethnicities $\mathcal{C}$, violating the supposition. But for both k, j to not be included in all other leaders' optimal coalitions, i.e. for a core group of ethnicities not to exist, this must imply that there exists at least one more group m for whom $x_m^e = x_j^e = x_k^e$. Without at least one alternative group m, it would be impossible for leaders to not choose either k or j when choosing their optimal coalition. Applying the same reasoning to group m, the only way that there cannot exist a core group of ethnicities is if there exists a set of groups whose elites sum to a number strictly larger than e^* in total and whose equilibrium x^e values are all equal to the lowest equilibrium payment $\inf \{x_1^e..x_N^e\}$. Without this, different leaders would be forced to choose at least some members of the same ethnicities when constructing optimal coalitions. Only if there exist an amount strictly greater than e^* of ethnicities all equally receiving the lowest values of x can a leader from m choose an ethnicity not included in a leader from $l's$ optimal coalition, so that a core coalition may not exist.

So it remains possible that the per-elite member cost of buying support is identical for all leaders, but comprised of differing sets of elite. Denote such per elite member costs x^e. The total payment of patronage required to buy support is thus $(e^* - e_l)\, x^e$, for a leader of ethnicity l, implying per period returns of $\frac{1-(e^*-e_l)x^e}{e_l} + F$. But for this to be consistent with equivalent values (x^e) for each leader, necessarily for two leaders m and l, where m denotes the larger of the two so that $e_m = we_l$ and $w > 1$, we have:

$$
\begin{aligned}
x^e \equiv x_l = \gamma \left(\frac{1-(e^*-e_l)\,x^e}{e_l} + F \right) &= \gamma \left(\frac{1-(e^*-e_m)\,x^e}{e_m} + F \right) = x_m \equiv x^e \\
\Longrightarrow \frac{1-(e^*-e_l)\,x^e}{e_l} &= \frac{1-(e^*-we_l)\,x^e}{we_l} \\
\Longrightarrow (1-(e^*-e_l)\,x^e)\,w &= 1-(e^*-we_l)\,x^e \\
\Longrightarrow w\,(1-e^*x^e) &= 1-e^*x^e \\
\Longrightarrow w &= 1.
\end{aligned}
$$

But this is a contradiction, so it is not possible that the amount required to buy support of ethnicities of different sizes is equivalent.

Given this, necessarily there must exist a core group of ethnicities included in all leaders' coalitions. ■

Proof of Lemma 2: Consider the payments required for members of two distinct elites, j and k in the core group that are being bought off by the coalition being formed by a leader from group l, denoted Ω^l, and suppose that $e_j > e_k$. Using (10) and (2) and the fact that at most there is a unique included ethnicity that will be split, these are given by:

$$\begin{aligned} x_j e_j &= \gamma \left(1 - \Sigma_{i \neq k, i \in \Omega^j} x_i e_i - x^{'}(j) e^{'}(j) - x_k e_k + e_j F\right) \\ x_k e_k &= \gamma \left(1 - \Sigma_{i \neq j, i \in \Omega^k} x_i e_i - x^{'}(k) e^{'}(k) - x_j e_j + e_k F\right). \end{aligned} \tag{14}$$

We explicitly denote the split group seperately with a $'$. Since both j and k are in the core coalition they both have identically comprised governing coalitions: when a j is leader, all elites from k are included and paid x_k when a k is leader, all elites from j are included and paid x_j. This implies that for the remainder, there is equivalence: $\Sigma_{i \neq k, i \in \Omega^j} x_i e_i = \Sigma_{i \neq j, i \in \Omega^k} x_i e_i$. Also both types of leader will have identically sized split groups, comprising the cheapest non-core elites available so that $x^{'}(j)e^{'}(j) = x^{'}(k)e^{'}(k)$. Consequently, subtracting the second from the first equation above leaves:

$$\begin{aligned} x_j e_j - x_k e_k &= \gamma \left(x_j e_j - x_k e_k\right) + \left(e_j - e_k\right) \gamma F \\ \therefore \frac{\left(x_j e_j - x_k e_k\right)}{\left(e_j - e_k\right)} &= \frac{\gamma F}{(1-\gamma)}. \end{aligned} \tag{15}$$

Let $w > 1$ denote the ratio of elite sizes, j and k so that $e_j = w e_k$. Rewriting (15) using this notation yields:

$$\begin{aligned} \frac{w x_j - x_k}{w - 1} &= \frac{\gamma F}{(1-\gamma)} \\ \therefore x_k &= w x_j + \frac{(1-w)\gamma F}{(1-\gamma)}. \end{aligned} \tag{16}$$

To prove the claim it is necessary to show that since $e_j > e_k$ necessarily $x_k > x_j$. Using (16), $x_k > x_j$ if and only if:

$$\begin{aligned} w x_j + \frac{(1-w)\gamma F}{(1-\gamma)} &> x_j \\ x_j &> \frac{\gamma F}{(1-\gamma)} \\ \text{or } \gamma x_j &< x_j - \gamma F. \end{aligned}$$

But we know from (14) that,

$$x_j - \gamma F = \frac{\gamma \left(1 - \Sigma_{i \neq k, i \in \Omega^j} x_i e_i - x'(j) e'(j) - x_k e_k\right)}{e_j} \equiv \gamma \overline{x}_j.$$

So we need to show that:

$$\begin{aligned} \gamma x_j &< \gamma \overline{x}_j \\ &\Leftrightarrow \\ x_j &< \overline{x}_j. \end{aligned}$$

Since we only consider equilibria without coups or revolutions, a necessary condition is that elite from any governing ethnicity, including the leader's own, have no incentive to mount a coup. Thus, necessarily for an equilibrium of this form to exist $x_j < \bar{x}_j$, we ignore the zero measure parameter configuration where the residual left after paying off all other ethnicities just equals the incentive compatible amount for co-ethnics (i.e., ignoring $x_j e_j = \bar{x}_j e_j$). If this condition were violated leader $j's$ co-ethnic elite would have incentive to mount a coup. Which thus proves the claim.■

Proof of Proposition 1: Since any candidate equilibrium has payments determined by (10) we know that, for an elite of group j the payment is $x_j = \gamma\left(\left(1 - \Sigma_{i\in\Omega^j} x_i e_i - x^{'}(j)e^{'}(j)\right)/e_j + F\right)$ and for elite $j+1$ it is $x_{j+1} = \gamma\left(\left(1 - \Sigma_{i\in\Omega^{j+1}} x_i e_i - x^{'}(j+1)e^{'}(j+1)\right)/e_{j+1} + F\right)$. The difference $x_j - x_{j+1}$ can be expressed as:

$$\begin{aligned} &\gamma\left(\left(1 - \Sigma_{i\in\Omega^j} x_i e_i - x^{'}(j)e^{'}(j)\right)/e_j + F\right) - \gamma\left(\left(1 - \Sigma_{i\in\Omega^{j+1}} x_i e_i - x^{'}(j+1)e^{'}(j+1)\right)/e_{j+1} + F\right) \\ \equiv\ &\frac{\gamma}{e_j e_{j+1}}\left[\left(1 - \Sigma_{i\in\Omega^j} x_i e_i - x^{'}(j)e^{'}(j)\right)e_{j+1} - \left(1 - \Sigma_{i\in\Omega^{j+1}} x_i e_i - x^{'}(j+1)e^{'}(j+1)\right)e_j\right] \end{aligned} \tag{17}$$

where $x'(j+1)$ is the per elite payment to the highest paid group for leader $j+1$. Now note that since $e_j > e_{j+1}$ a leader of ethnicity $j+1$ must buy the support of a strictly larger number of elite than does a leader of j and therefore includes all elite included by j and some additional ones to whom he pays $x'(j+1)(e_j - e_{j+1})$. Consequently, since all included elite other than the split group are common so that $\Sigma_{i\in\Omega^j} x_i e_i = \Sigma_{i\in\Omega^{j+1}} x_i e_i$ and for the split groups: $x^{'}(j+1)e^{'}(j+1) = x^{'}(j)e^{'}(j) + \left(e^{'}(j+1) - e^{'}(j)\right)x^{'}(j+1)$. Substituting these into (17) we have $x_j - x_{j+1}$:

$$\begin{aligned} &\equiv \frac{\gamma}{e_j e_{j+1}}\left[\left(1 - \Sigma_{i\in\Omega^j} x_i e_i\right)(e_{j+1} - e_j) - x^{'}(j)e^{'}(j)e_{j+1} + x'(j+1)e'(j+1)e_j\right] \\ &\equiv \frac{\gamma}{e_j e_{j+1}}\left[\begin{array}{c} \left(1 - \Sigma_{i\in\Omega^j} x_i e_i\right)(e_{j+1} - e_j) - x^{'}(j)e^{'}(j)e_{j+1} + x'(j+1)e'(j)e_j \\ +x'(j+1)\left(e'(j+1) - e'(j)\right)e_j \end{array}\right] \\ &\equiv \frac{\gamma}{e_j e_{j+1}}\left[\begin{array}{c} \left(1 - \Sigma_{i\in\Omega^j} x_i e_i\right)(e_{j+1} - e_j) - x^{'}(j)e^{'}(j)e_j + x'(j)e'(j)(e_j - e_{j+1}) \\ +x'(j+1)e'(j)e_j + x'(j+1)\left(e'(j+1) - e'(j)\right)e_j \end{array}\right] \end{aligned}$$

Since for the group $e'(j)$, $x^{'}(j)e^{'}(j) = x'(j+1)e'(j)$

$$\equiv \frac{\gamma}{e_j e_{j+1}}\left[\left(1 - \Sigma_{i\in\Omega^j} x_i e_i\right)(e_{j+1} - e_j) + x'(j)e'(j)(e_j - e_{j+1}) + x'(j+1)\left(e'(j+1) - e'(j)\right)e_j\right]$$

and since $e'(j+1) - e'(j) = e_j - e_{j+1}$, we have

$$\equiv \frac{\gamma}{e_j e_{j+1}} \left[(x'(j+1)e_j - (1 - \Sigma_{i \in \Omega^j} x_i e_i - x'(j)e'(j)))\,(e_j - e_{j+1}) \right].$$

The term $(1 - \Sigma_{i \in \Omega^j} x_i e_i - x'(j)e'(j))/e_j \equiv \bar{x}_j$, i.e. the share of patronage received by a member $j's$ own ethnicity if j is leader.

$$x_j - x_{j+1} \equiv \frac{\gamma}{e_j e_{j+1}} (e_j - e_{j+1}) e_j \left[x'(j+1) - \overline{x}_j \right]. \tag{18}$$

Necessarily, $\bar{x}_j \geq x_j$ or else $j's$ own elite would mount a coup against him, violating our supposition. So provided $\bar{x}_j > x'(j+1)$ then it follows immediately from (18) that $x_{j+1} > x_j$. Suppose the contrary: $\bar{x}_j \leq x'(j+1)$. Then since $x_j < \bar{x}_j$ necessarily $x_j < x'(j+1)$. But since $x'(j+1)$ are the highest payments $j+1$ makes, necessarily $j \in \Omega^{j+1}$. But if $j \in \Omega^{j+1}$ then $j \in \Omega^{j+2}$ as $j+2$ must include a strictly larger number of elite from other ethnicities to attain e^*. Consequently, if there exist two groups j and $j+1$ such that $x_j > x_{j+1}$ necessarily the elite of j are included in the government of a leader of any ethnicity $i > j$.

Now consider any $z < j$, so that $e_z > e_j$. The same reasoning implies that either $x_z < x_j$ in which case since j is included by leaders of all ethnicities $j+1...N$, i.e., $z \in \Omega^i \forall i > j$. Or if $x_z \geq x_j$ then as in the comparison between j and $j+1$, it follows from the analog of (18) for z that $\bar{x}_z < x'(j)$ and therefore that $x_z < x'(j)$ so that $z \in \Omega^j$ which also implies that $z \in \Omega^i \forall i > j$.

So, if there exist two groups for which $x_j > x_{j+1}$ then j and all groups $i < j$ must also be included in the government of all groups $j+1$ to N. But if $j+1$ is such that $\Sigma_{i=1}^{j} e_i > e^*$ then we have a contradiction, since including all groups from 1 to $j+1$ yields a coaltion size exceeding e^*. So it is only possible that if there exists $j : x_j > x_{j+1}$ that j is such that $\Sigma_{i=1}^{j} e_i \leq e^*$ implying that j is in the core group. Thus any leader's optimal coalition includes j and all groups larger than j, i.e., $1...j-1$. It also follows that for all ethnicities $z > j+1$ then $x_z < x_{z+1}$. Because either these are in the core group, and they are ordered from Lemma 2, or if they are not in the core group they cannot violate this ordering without including all groups above them in the core group, in which case core groups would exceed e^* in size.

Consequently, either the ordering is $x_j < x_{j+1} \forall j$ implying that larger groups are preferred in the governing coalition as they are uniformly cheaper. Or if there exists a j for which $x_j > x_{j+1}$ then j and $j+1$ are in the core group, as are all $i < j$, and for all $z > j+1, x_z < z_{z+1}$. This also implies that larger groups are preferred in the governing coalition. ■

Proof of Lemma 3: It is optimal for any leader to ensure that there are no revolutions. The cheapest way for any leader to ensure no revolutions is to have a total of $e^* = n^*/\lambda$ elite members in their government – including their own elite e_l. Since $e_1 + \sum_{i=2}^{j^*-2} e_i < e^*$, and since e_1 is the largest ethnicity, it then follows that $e_l + \sum_{i=1, i \neq l}^{j^*-2} e_i < e^*$. Moreover, since for any leader $x_j < x_{j+1}$, all leaders will find it optimal to include groups 1 to $j^* - 2$ in their governing coalition. ■

Proof of Proposition 2: It is already shown that any leader from ethnicity l optimally includes $\sum_{i=1}^{j^*-2} e_i$ in Ω^l. Since any leader must reach e^* ethnic elites in total in his government, for leader l the remaining number to be included is given by:

$$e^{gap}(l) = e^* - \sum_{i=1, i \neq l}^{j^*-2} e_i + e_l.$$

Consider leader $l \leq j^* - 1$. For such a leader $e^{gap}(l) = e^* - \sum_{i=1}^{j^*-1} e_i$. Since $x_j < x_k$ for $k > j$ and $e_{j^*} > e^{gap}(l)$ from the definition of j^*. It then follows immediately that the cheapest $e^{gap}(l)$ elites to include are from group j, thus $e^{gap}(l) = e'_{j^*} = e^* - \sum_{i=1}^{j^*-1} e_i$, for $l < j^* - 1$.

Consider a leader $l > j^* - 1$. For such a leader, either: $e^{gap}(l) = e^* - \sum_{i=1}^{j^*-1} e_i + e_l < 0$ or $e^* - \sum_{i=1}^{j^*-1} e_i + e_l \geq 0$. Consider the former first, this corresponds to an $l < j^+$, as defined in the statement of the proposition. For such an l :

$$e^{gap}(l) = e^* - \sum_{i=1}^{j^*-2} e_i + e_l,$$

since including all of the elite from $j-1$ would exceed e^* and ethnicity $j-1$ is the cheapest remaining ethnicity not included in the coalition, the leader optimally sets $e^{gap}(l) = e'_{j-1}(l) \equiv e^* - \sum_{i=1}^{j^*-2} e_i + e_l$. Now consider the latter, i.e., $l \geq j^+ : e^{gap}(l) = e^* - \sum_{i=1}^{j^*-1} e_i + e_l \geq 0$. By definition, for such a leader, only including ethnicities up to and including $j^* - 1$ in Ω^l is insufficient to achieve e^* elite. So for such an l :

$$e^{gap}(l) = e^* - \sum_{i=1}^{j^*-1} e_i + e_l.$$

Clearly, from the definition of j^* in equation (11), $e_{j^*} > e^{gap}(l) = e^* - \sum_{i=1}^{j^*-1} e_i + e_l$, and since j^* is the cheapest remaining ethnicity not in the included coalition, leader l sets $e'_{j^*} = e^{gap}(l) = e^* - \sum_{i=1}^{j^*-1} e_i + e_l$.

Finally, note that $j^* \leq j^+$. However, if the smallest ethnicity, e_N is sufficiently large that $e^* < \sum_{i=1}^{j^*-1} e_i + e_N$, then set $j^+ = N$.■

Proof of Proposition 3: Statement 1. Since γ denotes the probability of a coup being successful, $\gamma < 1$, and $F > 0$ is the non-divisible office rent, the RHS of (15) > 0. Since $e_j > e_k$ it then follows directly that $(x_j e_j - x_k e_k) > 0$, thus proving statement 1 in the proposition. It is also immediate that any solution to these equations is unique.

Statement 2. Here we suppress the $'$ notation for split groups, as these are of equivalent size for core groups. Consider the leadership premia accruing to members of two distinct elites, j and $k \in \mathcal{C}$ in case the leader belongs to their groups respectively and suppose that $e_j > e_k$:

$$\begin{aligned} (1 - \Sigma_{i \in \Omega^j} x_i e_i - x'(j) e'(j)) - x_j e_j &= premium_j \\ (1 - \Sigma_{i \in \Omega^k} x_i e_i - x'(k) e'(k)) - x_k e_k &= premium_k. \end{aligned} \quad (19)$$

We can rewrite (19):

$$\begin{aligned}\left(1-\Sigma_{i\neq k,i\in\Omega^j}x_ie_i-x_ke_k-x'(j)e'(j)\right)-x_je_j &= premium_j\\ \left(1-\Sigma_{i\neq j,i\in\Omega^k}x_ie_i-x_je_j-x'(k)e'(k)\right)-x_ke_k &= premium_k\end{aligned}$$

and noticing that $\Sigma_{i\neq k,i\in\Omega^j}x_ie_i-x'(j)e'(j)=\Sigma_{i\neq j,i\in\Omega^k}x_ie_i-x'(k)e'(k)$, as both are in the core group, this implies $premium_j = premium_k$. This further implies the leadership premium per elite member is higher in small groups $premium_k/e_k > premium_j/e_j$. ■

Proof of Proposition 4:

Define $\widetilde{x}_q \equiv e_q x_q$, so that the system for all groups q in the core coalition is:

$$\widetilde{x}_q=\gamma\left(1-\Sigma_{i=1,i\neq q}^{j_*-1}\tilde{x}_i-x_{j_*}e'_{j_*}+e_qF\right), \tag{20}$$

where e'_{j_*} is defined in proposition 2. From (15) we know $\widetilde{x}_i=\widetilde{x}_q+\frac{\gamma F}{(1-\gamma)}\left(e_i-e_q\right)$. Repeatedly substituting for each i in (20) yields:

$$\begin{aligned}\widetilde{x}_q &= \gamma\left(1-\Sigma_{i=1,i\neq q}^{j_*-1}\left[\widetilde{x}_q+\frac{\gamma F}{(1-\gamma)}\left(e_i-e_q\right)\right]-x_{j_*}e'_{j_*}+e_qF\right)\\ &\qquad (21)\\ \widetilde{x}_q &= \gamma\left(1-(j-2)\widetilde{x}_q-\frac{\gamma F}{(1-\gamma)}\left[\Sigma_{i=1,i\neq q}^{j_*-1}e_i-(j_*-2)e_q\right]-x_{j_*}e'_{j_*}+e_qF\right)\\ \widetilde{x}_q &= \frac{\gamma}{(1-\gamma)}\left[1-\gamma-(1-\gamma)(j-2)\widetilde{x}_q-\gamma F\left[\Sigma_{i=1}^{j_*-1}e_i-(j_*-1)e_q\right]+(1-\gamma)\left(e_qF-x_{j_*}e'_{j_*}\right)\right]\\ \widetilde{x}_q &= \frac{\gamma\left[(1-\gamma)\left(1-x_{j_*}e'_{j_*}\right)-F\left(\Sigma_{i=1}^{j_*-1}e_i\gamma-e_q\left(1+\gamma\left(j_*-2\right)\right)\right)\right]}{(1-\gamma)\left[1+\gamma(j_*-2)\right]}\\ &= \frac{\gamma\left[(1-\gamma)\left(1-x_{j_*}e'_{j_*}\right)-\gamma F\left(\Sigma_{i=1}^{j_*-1}e_i\right)\right]}{(1-\gamma)\left[1+\gamma(j_*-2)\right]}+\frac{\gamma F}{(1-\gamma)}e_q.\end{aligned}$$

These are the optimal payments to any nonleader group $q=1,...,j_*-2$ of the core coalition independently from the identity of the leader. It also identifies the payment to group $q=j_*-1$ whenever part of the optimal coalition. Also notice that per capita cost is determined by:

$$x_q=\frac{\gamma\left[\left(1-x_{j_*}e'_{j_*}\right)-\frac{\gamma F}{(1-\gamma)}\left(\Sigma_{i=1}^{j_*-1}e_i\right)\right]}{\left[1+\gamma(j_*-2)\right]}\frac{1}{e_q}+\frac{\gamma F}{(1-\gamma)}.$$

For group j_* we have:

$$\begin{aligned}
x_{j_*} &= \gamma\left(\left(1-\Sigma_{i\in\Omega^{j_*}}x_ie_i\right)/e_{j_*}+F\right)\\
&= \gamma\left(\left(1-\Sigma_{i=1}^{j_*-2}x_ie_i-e'_{j_*-1}(j_*)x_{j_*-1}\right)/e_{j_*}+F\right)\\
\text{with } e'_{j_*-1}(j_*) &= \lambda P\left(1-r-\sum_{i=1}^{j_*-2}n_i/P-n_{j_*}/P\right)\\
\text{and } e'_{j_*}(j_*-1) &= \lambda P\left(1-r-\sum_{i=1}^{j_*-2}n_i/P-n_{j_*-1}/P\right)\\
\text{and } x_{j_*-1} &= \gamma\left(\left(1-\Sigma_{i=1}^{j_*-2}x_ie_i-e'_{j_*}(j_*-1)x_{j_*}\right)/e_{j_*-1}+F\right),
\end{aligned}$$

which jointly imply

$$\begin{aligned}
x_{j_*} &= \gamma\left(\left(1-\Sigma_{i=1}^{j_*-2}x_ie_i-e'_{j_*-1}(j_*)x_{j_*-1}\right)/e_{j_*}+F\right)\\
&= \gamma\left(\left(1-\Sigma_{i=1}^{j_*-2}x_ie_i-e'_{j_*-1}(j_*)\gamma\left(\left(1-\Sigma_{i=1}^{j_*-2}x_ie_i-e_{j_*}x_{j_*}\right)/e_{j_*-1}+F\right)\right)/e_{j_*}+F\right)
\end{aligned}$$

or simplifying:

$$x_{j_*}=\frac{\gamma}{1-\gamma^2\frac{e'_{j_*}(j_*-1)e'_{j_*-1}(j_*)}{e_{j_*}e_{j_*-1}}}\left(\frac{1-\Sigma_{i=1}^{j_*-2}x_ie_i}{e_{j_*}}\left(1-\gamma e'_{j_*-1}(j_*)/e_{j_*-1}\right)+F\left(1-\gamma e'_{j_*-1}(j_*)/e_{j_*}\right)\right).$$

We can compute $\Sigma_{i=1}^{j_*-2}x_ie_i$ from (21) and it is a linear function of x_{j_*}:

$$\Sigma_{i=1}^{j_*-2}x_ie_i=\frac{\gamma\left[1-x_{j_*}e'_{j_*}(j_*-1)-\frac{\gamma F}{1-\gamma}\Sigma_{i=1}^{j-1}e_i\right]\Sigma_{i=1}^{j_*-2}e_i}{1+\gamma(j_*-2)}+\frac{\gamma F(j_*-2)}{1-\gamma}.$$

This implies:

$$\begin{aligned}
x_{j_*} &= \left(1-\frac{\gamma\left(1-\gamma e'_{j_*-1}(j_*)/e_{j_*-1}\right)\frac{\gamma}{1+\gamma(j_*-2)}\frac{e'_{j_*}(j_*-1)}{e_{j_*}}\Sigma_{i=1}^{j_*-2}e_i}{1-\gamma^2\frac{e'_{j_*}(j_*-1)e'_{j_*-1}(j_*)}{e_{j_*}e_{j_*-1}}}\right)^{-1}\\
&\quad *\frac{\gamma}{1-\gamma^2\frac{e'_{j_*}(j_*-1)e'_{j_*-1}(j_*)}{e_{j_*}e_{j_*-1}}}\\
&\quad *\left(\frac{1-\frac{\gamma\left[1-\frac{\gamma F}{1-\gamma}\Sigma_{i=1}^{j-1}e_i\right]\Sigma_{i=1}^{j_*-2}e_i}{1+\gamma(j_*-2)}-\frac{\gamma F(j_*-2)}{1-\gamma}}{e_{j_*}}\left(1-\gamma e'_{j_*-1}(j_*)/e_{j_*-1}\right)+F\left(1-\gamma e'_{j_*-1}(j_*)/e_{j_*}\right)\right).
\end{aligned}$$

For existence of an equilibrium without coups or revolutions it is necessary that for a leader randomly drawn from any group the value of patronage is large enough to ensure that after incentive compatible payments are made to elites required to ensure no revolutions, there still remains sufficient residual patronage for elites from the leader's own ethnic group to dissuade them mounting coups. A sufficient condition is that:

$$x_1 = \frac{\gamma\left[\left(1 - x_{j_*}e'_{j_*}\right) - \frac{\gamma F}{(1-\gamma)}\left(\Sigma_{i=1}^{j_*-1}e_i\right)\right]}{[1+\gamma(j_*-2)]}\frac{1}{e_1} + \frac{\gamma F}{(1-\gamma)} > 0.$$

This condition is sufficient, because if this holds for group 1 then it necessarily holds for all other groups as well since $x_1 < x_i$ for all $i > 1$.

To prove uniqueness, we know that our equilibrium set of optimal transfers must satisfy x: $x_j e_j = \gamma\left(1 - \Sigma_{i\in\Omega^j} x_i e_i - x'(j)e'(j) + e_j F\right)$. Consider an alternative equilibrium denoted by $''$ for which $x_j^{''} > x_j$.It follows from the equation immediately above that there must exist at least one coalition member, $k \in \Omega_j$ for which $x_k^{''} < x_k$.But this violates equation (16)above.

Since the solution to the set of equations (12) is unique, and these equations determine the payments in equilibria consisting of a core set of ethnicities chosen by any leader, the optimal coalitions defined in Proposition (2) will also apply whenever there exists a core set of ethnicities included in all governing coalitions. An alternative equilibrium set of payments and optimal coalition can only arise were there to be equilibria where there does not exist a 'core' set of ethnicities chosen by all leaders. We have already shown in Lemma 1 that this cannot occur. ■

No revolutions along the equilibrium path condition

If (3)or (4)fails, then the indicator variable, $\Re(\Omega) = 1$always so that the government faces a constant revolution. We thus have:

$$W_l(\Omega) = \psi\frac{\Sigma_{i\notin\Omega^l} n_i}{P} * + V_l^{leader}(\Omega) * \left(1 - \frac{\Sigma_{i\notin\Omega^l} n_i}{P}\right).$$

Note that we do not have to consider a leader constructing a coalition that included an insider mounting revolutions against the government each period. If such a group would revolt as insiders, they would also, at worse, revolt as outsiders, and they do not cost the leader patronage in that case, so they would not be included. A sufficient condition to rule out constant revolutions is that it is not worthwhile for the leader to tolerate such revolutions from even the smallest group of outsiders, n_N. This group represents the lowest chance of revolution success, so a leader unwilling to bear this risk, will not bear it from any larger excluded group. Let Ω' denote the coalition formed by including all groups $i \neq N$. Thus we have as a sufficient condition for no revolutions along the equilibrium path:

$$\psi\frac{n_N}{P} * + V_l^{leader}(\Omega') * \left(1 - \frac{n_n}{P}\right) < V_l^{leader}(\Omega),$$

This is satisfied for sufficiently low ψ, and we assume that ψ is sufficiently low so that this condition never binds.

No coups along the equilibrium path condition.

We will now derive and discuss a sufficient condition for the leader's choice of completely ensuring against coups from any group $j \in \Omega^l$.

Under x_j solving (8) it is never worthwhile for an elite included in the coalition to exercise his coup option. We now show the condition under which the leader will choose to give transfers solving (8). What is the alternative to solving this condition? It may be better for a leader to include a group so that it will not be willing to walk out and join a revolution against the leader, but that it would still exercise a coup option if one arose. Under this condition, the x_j given to it can be lower, denote it x_j'. This x_j' has to be high enough that the group j does not simply walk straight out and start a revolution, but not high enough so that j will be loyal if he has a coup chance. This is solved as follows. Let $V_j'\left(\Omega^l\right)$ denote the value to a member of group j in leader $l's$ coalition if he is receiving $x_j' < x_j$. The amount that is just sufficient to stop a member of j forming a coalition against him is given by:

$$\left(\frac{\sum_{i\notin\Omega^l} n_i + n_j}{P}\right) rV_j^{transition} + \left(1 - \frac{\sum_{i\notin\Omega^l} n_i + n_j}{P}\right) rV_j^0 = V_j'\left(\Omega^l\right).$$

Since $V_j'\left(\Omega^l\right) = \frac{x_j' + \delta\varepsilon V^{transition}}{1-\delta(1-\varepsilon)}$, $V_j^0 = \frac{0+\delta\varepsilon V^{transition}}{1-\delta(1-\varepsilon)}$ and this implies

$$x_j' = V_j^{transition}\left[(1-\delta(1-\varepsilon))\left(\frac{\sum_{i\notin\Omega^l} n_i + n_j}{P}\right) r + \left(1 - \frac{\sum_{i\notin\Omega^l} n_i + n_j}{P}\right) r\delta\varepsilon - \delta\varepsilon\right]$$

The trade off faced by the leader is between personally saving $\left(x_j - x_j'\right)\frac{e_j}{e_l}$ and facing a possible coup if the opportunity arises for any member of group j. Notice that the trade off is in theory ambiguous with respect to which size group should be paid below x_j. A large group allows large savings, but it is also a very likely source of coups.

Similarly to the case of revolutions, we assume there is a personal cost $\omega > 0$ associated to the leader falling victim of a coup (independently of winning or losing, as for revolutions). A sufficiently high loss ω will rule out any willingness by the leader of taking chances with coups. The condition for the leader to exclude coups from group j is:

$$\begin{aligned}
&\bar{x}_l + \delta\left((1-\varepsilon) V_l^{leader}\left(\Omega^l\right) + \varepsilon V_l^{transition}\right) \geq \\
&\left(1 - \gamma\frac{e_j}{\sum_{i\in\Omega^l} e_i}\right)\left(\bar{x}_l + \frac{e_j}{e_l}\left(x_j - x_j'\right) + F + \delta\left((1-\varepsilon) V_l^{leader}\left(\Omega^l\right) + \varepsilon V_l^{transition}\right)\right) \\
&+\gamma\frac{e_j}{\sum_{i\in\Omega^l} e_i}\left(0 + \delta\left((1-\varepsilon) V_l^{loss} + \varepsilon V_l^{transition}\right)\right) - \omega\frac{e_j}{\sum_{i\in\Omega^l} e_i}.
\end{aligned}$$

Notice that this condition is monotonic in the loss ω, hence there is always a sufficiently high cost of a coup so that the leader chooses to fully insure against it.

The rationale behind this sufficient condition is parsimony in the number of model parameters to be estimated from the data. The advantage of this treatment is that since cost ω is not incurred on the equilibrium path, and we assume it is large enough so that the leader's no coup condition never binds, ω will not enter into the estimating equations.

A final comment is in order. If a leader is victim of a coup, then he suffers a large one period cost $\omega > 0$. This is asymmetric in that such cost is not also incurred by the failed coup leader, who only gets 0 upon failure in (8). We think of ω as the counterpart of the leadership premium F that the leader also receives asymmetrically. Leaders are different from other elites: when you become a leader you obtain personal rents, but you also face a risk of a large negative cost if you are deposed.

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Table 1: African Cabinets - Summary Statistics by Country

Country	Time Period Covered	Years Missing	Years with Two Governments	Number of Governments	Number of Leaders in Power	Number of Government-Ministers	Average Size of Government (# posts)	Total Number of Unique Ministers	Average Number of Governments per Minister	Number of Ethnic Groups	Number of Government-Ministers with Missing Ethnicity	Percent of Government-Ministers with Missing Ethnicity
Benin	1960-2004	1969, 1975	1968, 1970	45	10	730	16.22	209	3.49	15	1	0.14%
Cameroon	1960-2004	1969, 1975	1968	44	2	1445	32.84	262	5.52	21	43	2.98%
Congo-Brazzaville	1960-2004	1969, 1975	1968, 1970	45	7	918	20.40	239	3.84	10	9	0.98%
Cote d'Ivoire	1960-2004	1975	1970	45	4	1256	27.91	233	5.39	17	0	0%
Dem. Rep. of Congo	1961-2004	1972, 1974	1970, 1973	44	4	1352	30.73	515	2.63	30	5	0.37%
Gabon	1960-2004	1975		44	2	1173	26.66	185	6.34	10	6	0.51%
Ghana	1960-2004	1975	1970	45	9	1140	25.33	362	3.15	22	0	0%
Guinea	1960-2004	1975	1969	45	2	1213	26.96	244	4.97	9	4	0.33%
Kenya	1964-2004	1975	1970	41	3	1010	24.63	155	6.52	16	2	0.20%
Liberia	1960-2004	1975	1970	45	10	938	20.84	272	3.45	15	9	0.96%
Nigeria	1961-2004	1975	1970	44	11	1499	34.07	473	3.17	17	13	0.87%
Sierra Leone	1960-2004	1972, 1975	1970, 1973	45	9	1109	24.64	288	3.85	14	0	0%
Tanzania	1965-2004	1972, 1974	1970, 1973	40	3	1016	25.40	158	6.43	37	0	0%
Togo	1960-2004	1975	1970	45	3	757	16.82	199	3.80	20	0	0%
Uganda	1963-2004	1972, 1974	1970, 1973	42	6	1037	24.69	205	5.06	26	3	0.29%

Notes: In the "Number of Leaders in Power" column, we count a new nonconsecutive term in office of the same leader as a new leader. Source: Rainer and Trebbi (2011).

Table 2: Summary Statistics by Group

Variable	Obs	Mean	Std. Dev.	Min	Max
	Africa				
Group's Share of Cabinet Posts	11749	0.054	0.083	0	0.882
Group's Share of Population	11749	0.054	0.062	0.004	0.39
Leader’s Ethnic Group Indicator	11749	0.061	0.24	0	1
Largest Ethnic Group Indicator	11749	0.058	0.234	0	1
Coalition Member Indicator	11749	0.552	0.497	0	1

Table 3: Elite Inclusiveness in Africa.

Country	**Average Share of the Population Not Represented in Government**
Benin	28.23
Cameroon	17.64
Cote d'Ivoire	13.93
Dem. Rep. Congo	28.17
Gabon	13.72
Ghana	29.84
Guinea	7.54
Kenya	9.21
Liberia	50.38
Nigeria	12.02
Rep. of Congo	11.13
Sierra Leone	15.92
Tanzania	42.87
Togo	31.95
Uganda	27.91
Average	***22.70***

Table 4: Group Size, Leadership, and Cabinet Membership, 1960-2004. All Ethnic Groups

	In Government? (1)	*In Government?* (2)	*Leader Group?* (3)	*Leader Group?* (4)
Group Size	6.5887	8.0741	0.5353	0.5807
	(1.0925)	(0.6245)	(0.0871)	(0.1540)
Largest Group		-0.5702		-0.0125
		(0.0593)		(0.0356)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	11,749	11,749	11,749	11,749

Notes: Dep. Var. (1), (2) = Dummy for membership of the ruling coalition. Dep. Var. Cols. (3), (4) = Dummy for the group being the ethnicity of the leader. Group Size = Ethnic Share of Population. Largest Group = Largest Ethnic Group. Probit marginal effects and standard errors clustered at the country level in parentheses below.

Table 5: Elite Disproportionality in Africa.

Country	Disproportionality Mean
Benin	16.59
Cameroon	11.35
Cote d'Ivoire	13.48
Dem. Rep. Congo	12.96
Gabon	15.64
Ghana	16.39
Guinea	16.60
Kenya	11.06
Liberia	38.01
Nigeria	14.24
Rep. of Congo	19.62
Sierra Leone	17.03
Tanzania	16.06
Togo	17.43
Uganda	14.32
Average	***16.72***

Note: Gallagher (1991) least squares disproportionality measure reported.

Table 6: Leadership in Cabinet Formation, Group Size, and Allocation of Cabinet Seats, 1960-2004. All Ethnic Groups

	Share of All Cabinet Seats (1)	*Share of All Cabinet Seats* (2)	*Share of Top Cabinet Seats* (3)	*Share of Top Cabinet Seats* (4)
Group Size	0.7740	1.0142	0.7649	0.8976
	(0.0755)	(0.1437)	(0.0713)	(0.1644)
Group Size^2		-0.885		-0.631
		(0.496)		(0.604)
Leader Group	0.1126	0.1110	0.2084	0.2071
	(0.0270)	(0.0275)	(0.0257)	(0.0259)
Largest Group		-0.0044		0.0105
		(0.0249)		(0.0331)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	0.55	0.55	0.49	0.49
N	11,749	11,749	11,749	11,749

Notes: Dep. Var. Cols. (1), (3) = Share of All Cabinet Posts Reported. Dep. Var. (2), (4) = Share of Top Cabinet Posts (Presidency/Premiership, Defense, Budget, Commerce, Finance, Treasury, Economy, Agriculture, Justice, Foreign). Standard errors clustered at the country level in parentheses. Group Size = Ethnic Share of Population. Largest Group = Largest Ethnic Group. Group size squared coefficient and standard errors are x10,000.

Table 7: Full Cabinet - Maximum Likelihood Estimates

α	11.5					
	(1.4)					
ε	0.115					
	(0.012)					
δ	0.95					
Country	ξ	***r***	γ	***F***	***logLL***	**Insider IC constraint violated?**
Benin	63.5	0.893	1.0e-13	1.2e+13	106.8494	no
	(5.0)	(0.011)	(0.018)	(2.1e24)		
Cameroon	254.5	0.9692	3.8e-13	2.6e+12	589.6414	no
	(15.3)	(0.0047)	(0.0083)	(5.5e+23)		
Congo	178.8	0.886	0.200	3.99	514.6169	no
	(10.3)	(0.011)	(0.034)	(0.95)		
Cote d'Ivoire	172.7	0.9209	0.381	0.33	418.7874	no
	(11.8)	(0.0076)	(0.016)	(0.12)		
Gabon	72.9	0.9847	3.8e-11	2.5e+10	201.4787	no
	(6.8)	(0.0092)	(0.081)	(5.3e+19)		
Ghana	79.6	0.854	0.77	0.41	150.2744	no
	(4.8)	(0.013)	(0.38)	(0.89)		
Guinea	126.7	0.9909	0.089	6.9	270.5889	no
	(10.5)	(0.0035)	(0.021)	(2.1)		
Kenya	250.9	0.9667	0.107	6.9	562.5347	no
	(14.5)	(0.0042)	(0.025)	(2.0)		
Liberia	24.5	0.894	0.233	-2.26	-67.6506	yes
	(2.0)	(0.014)	(0.056)	(0.23)		
Nigeria	139.9	0.9577	0.385	1.03	521.5482	no
	(7.3)	(0.0046)	(0.045)	(0.22)		
Rep. of Congo	76.0	0.9317	0.498	0.000	261.4404	no
	(5.2)	(0.0071)	(0.033)	(0.086)		
Sierra Leone	69.8	0.9010	0.574	0.262	180.2609	no
	(5.2)	0.0092)	(0.034)	(0.051)		
Tanzania	142.8	1.0000	0.112	4.84	337.3617	no
	(7.2)	(0.0058)	(0.040)	(2.56)		
Togo	53.6	0.840	0.582	0.34	45.4974	no
	(4.2)	(0.014)	(0.060)	(0.17)		
Uganda	134.3	0.929	1.0000	1.5e-12	273.8432	no
	(8.5)	(0.016)	(8.1e-8)	(1.4e-7)		

Notes: Asymptotic Standard Errors in Parentheses. The *logLL* reported is specific to the contribution of each country. The insider constraint of a unilateral deviation of a coalition member is checked ex post in the last column. This is constraint (3) in the text.

Table 8: Full Cabinet - Slopes and Leadership Premia

Country	***Slope: $F\gamma/(1-\gamma)$***	**Leadership Premium**
Benin	1.26	0.120
	(0.034)	(0.025)
Cameroon	0.98	0.086
	(0.016)	(0.008)
Congo	1.00	0.074
	(0.040)	(0.009)
Cote d'Ivoire	0.20	0.148
	(0.066)	(0.008)
Gabon	0.93	0.100
	(0.058)	(0.020)
Ghana	1.36	0.016
	(0.120)	(0.021)
Guinea	0.67	0.199
	(0.032)	(0.010)
Kenya	0.82	0.105
	(0.029)	(0.006)
Liberia	-0.69	0.430
	(0.260)	(0.041)
Nigeria	0.64	0.058
	(0.035)	(0.008)
Rep. of Congo	0.00	0.270
	(0.085)	(0.009)
Sierra Leone	0.35	0.198
	(0.055)	(0.016)
Tanzania	0.60	0.070
	(0.095)	(0.015)
Togo	0.48	0.234
	(0.140)	(0.013)
Uganda	1.68	-2.7e-14
	(0.053)	(2.1e-9)
Average (excluding LIB)	0.78	0.12

Notes: Asymptotic Standard Errors in Parentheses.

Table 9: Top Cabinet Posts Only - Maximum Likelihood Estimates

α	11.5					
	(1.4)					
ε	0.115					
	(0.012)					
δ	0.95					
Country	ξ	***r***	γ	***F***	***logLL***	**Insider IC constraint violated?**
Benin	18.6	0.821	0.35	2.0	-209.9855	no
	(2.1)	(0.016)	(0.18)	(2.1)		
Cameroon	40.1	0.837	0.443	0.27	-259.4370	no
	(3.9)	(0.014)	(0.067)	(0.41)		
Congo	29.3	0.853	0.053	20.4	-485.2384	no
	(2.9)	(0.014)	(0.056)	(25.5)		
Cote d'Ivoire	22.9	0.910	0.116	1.59	-281.0537	no
	(2.9)	(0.015)	(0.041)	(2.21)		
Gabon	18.9	0.815	5.6e-13	2.5e+12	-57.2651	no
	(2.1)	(0.017)	(0.33)	(1.6e+24)		
Ghana	10.4	0.816	0.29	1.36	-488.0237	no
	(1.0)	(0.016)	(0.18)	(2.91)		
Guinea	25.9	0.919	0.405	0.43	-19.3376	no
	(2.9)	(0.008)	(0.079)	(0.32)		
Kenya	23.4	0.907	6.2e-15	6.0e+14	-152.3001	no
	(2.5)	(0.016)	(0.004)	(1.1e+26)		
Liberia	10.8	1.000	0.071	-3.0121	-282.3815	yes
	(1.6)	(0.023)	(0.029)	(1.3e-5)		
Nigeria	27.6	0.9218	0.275	1.47	-180.0479	no
	(2.7)	(0.0085)	(0.071)	(0.83)		
Rep. of Congo	19.7	0.9057	0.583	-0.48	-75.7406	no
	(2.2)	(0.0093)	(0.058)	(0.10)		
Sierra Leone	16.6	0.897	0.36	1.35	-205.9451	no
	(1.3)	0.012)	(0.10)	(0.79)		
Tanzania	43.0	0.876	0.249	0.18	-403.8598	no
	(4.0)	(0.012)	(0.042)	(0.55)		
Togo	15.8	0.836	0.411	0.36	-382.4744	no
	(2.1)	(0.014)	(0.082)	(0.45)		
Uganda	24.5	0.832	9.8e-14	1.5e+13	-439.4047	no
	(2.5)	(0.015)	(0.03)	(4.7e+24)		

Notes: Asymptotic Standard Errors in Parentheses. The *logLL* reported is specific to the contribution of each country. The insider constraint of a unilateral deviation of a coalition member is checked ex post in the last column. This is constraint (3) in the text.

Table 10: Top Cabinet Posts Only - Slopes and Leadership Premia

Country	***Slope:*** $F\gamma/(1-\gamma)$	**Leadership Premium**
Benin	1.06	0.282
	(0.31)	(0.030)
Cameroon	0.22	0.312
	(0.27)	(0.018)
Congo	1.13	0.207
	(0.15)	(0.028)
Cote d'Ivoire	0.21	0.436
	(0.21)	(0.031)
Gabon	1.44	0.347
	(0.34)	(0.026)
Ghana	0.57	0.346
	(0.74)	(0.044)
Guinea	0.30	0.293
	(0.13)	(0.026)
Kenya	0.989	0.282
	(0.058)	(0.023)
Liberia	-0.23	0.572
	(0.10)	(0.074)
Nigeria	0.56	0.209
	(0.13)	(0.033)
Rep. of Congo	-0.67	0.319
	(0.22)	(0.028)
Sierra Leone	0.68	0.223
	(0.14)	(0.037)
Tanzania	0.06	0.152
	(0.17)	(0.020)
Togo	0.25	0.341
	(0.25)	(0.030)
Uganda	1.483	0.243
	(0.086)	(0.026)
Average (excluding LIB)	0.59	0.28

Notes: Asymptotic Standard Errors in Parentheses.

Table 11: Specification Tests

Full Sample. Generalized likelihood ratio tests: Null is equivalent fit between the specified model and the Baseline model

Model	**Log-likelihood**	**Vuong statistic**	**p-value**	**Clarke statistic**	**p-value**
Baseline	4367.1	-	-	-	-
Random Allocation	3136.7	**19.0**	**0.000**	**7478**	**0.000**
Big Man Allocation	-5134.2	**60.1**	**0.000**	**6070**	**0.000**
Observations	11749				

Note: Clarke statistic corresponds to number of positive differences between log likelihoods. The null corresponds to Observations/2=5875 positive differences. Vuong test statistic is distributed N(0,1).

Military Regimes Only. Generalized likelihood ratio tests: Null is equivalent fit between the specified model and the Baseline model

Model	**Log-likelihood**	**Vuong statistic**	**p-value**	**Clarke statistic**	**p-value**
Baseline	2099.2	-	-	-	-
Random Allocation	1400.1	**13.7**	**0.000**	**3270**	**0.000**
Big Man Allocation	-2282.1	**40.1**	**0.000**	**2699**	**0.000**
Observations	5156				

Note: Clarke statistic corresponds to number of positive differences between log likelihoods. The null corresponds to Observations/2=2578 positive differences. Vuong test statistic is distributed N(0,1).

Civilian Regimes Only. Generalized likelihood ratio tests: Null is equivalent fit between the specified model and the Baseline model

Model	**Log-likelihood**	**Vuong statistic**	**p-value**	**Clarke statistic**	**p-value**
Baseline	2552.7	-	-	-	-
Random Allocation	1880.1	**12.4**	**0.000**	**3976**	**0.000**
Big Man Allocation	-2832.2	**44.5**	**0.000**	**3381**	**0.036**
Observations	6593				

Note: Clarke statistic corresponds to number of positive differences between log likelihoods. The null corresponds to Observations/2=3297 positive differences. Vuong test statistic is distributed N(0,1).

Table 11: Specification Tests (cont.)

Autocratic Regimes Only. Generalized likelihood ratio tests: Null is equivalent fit between the specified model and the Baseline model

Model	**Log-likelihood**	**Vuong statistic**	**p-value**	**Clarke statistic**	**p-value**
Baseline	4173.6	-	-	-	-
Random Allocation	2986.3	**18.8**	**0.000**	**6910**	**0.000**
Big Man Allocation	-4799.0	**58.2**	**0.000**	**5699**	**0.000**
Observations	11013				

Note: Clarke statistic corresponds to number of positive differences between log likelihoods. The null corresponds to Observations/2=5507 positive differences. Vuong test statistic is distributed N(0,1).

Democratic Regimes Only. Generalized likelihood ratio tests: Null is equivalent fit between the specified model and the Baseline model

Model	**Log-likelihood**	**Vuong statistic**	**p-value**	**Clarke statistic**	**p-value**
Baseline Model	278.8	**-**	**-**	-	-
Random Allocation	183.1	-3.5	0.000	234	0.000
Big Man Allocation	-318.9	**12.7**	**0.000**	**366**	**0.682**
Observations	722				

Note: Clarke statistic corresponds to number of positive differences between log likelihoods. The null corresponds to Observations/2=361 positive differences. Vuong test statistic is distributed N(0,1).

Note: Values in bold indicate the test rejects equal fit of the models in favor of the main baseline model against the alternative model. Positive log-likelihood values are a natural occurrence in censored models.

Figure 1: Pop. Share of Ethnicities Not Represented in Cabinet, African Sample, 1960-2004

Figure 2: Disproportionality in Cabinet Allocation, African Sample, 1960-2004

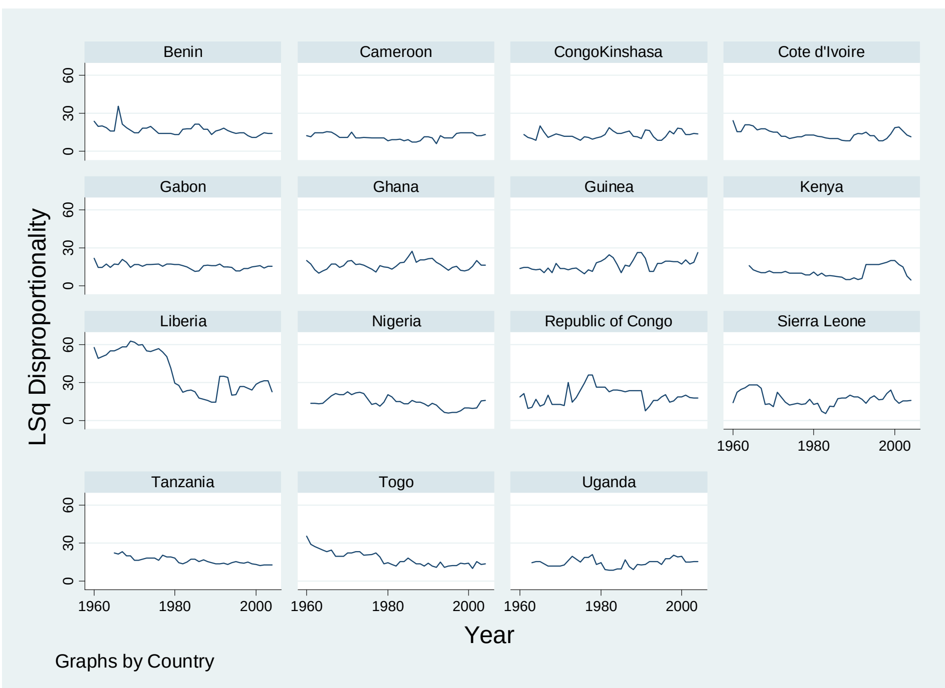

Figure 3: Difference between Cabinet Shares and Population Shares. Guinea, 1960-2004

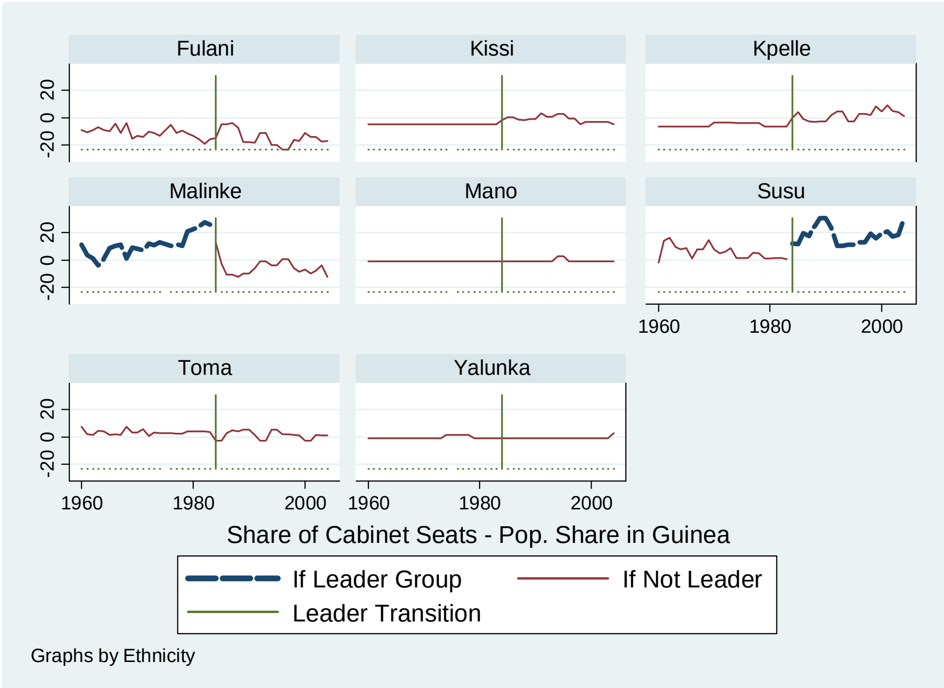

Figure 4: Difference between Cabinet Shares and Population Shares. Kenya, 1960-2004

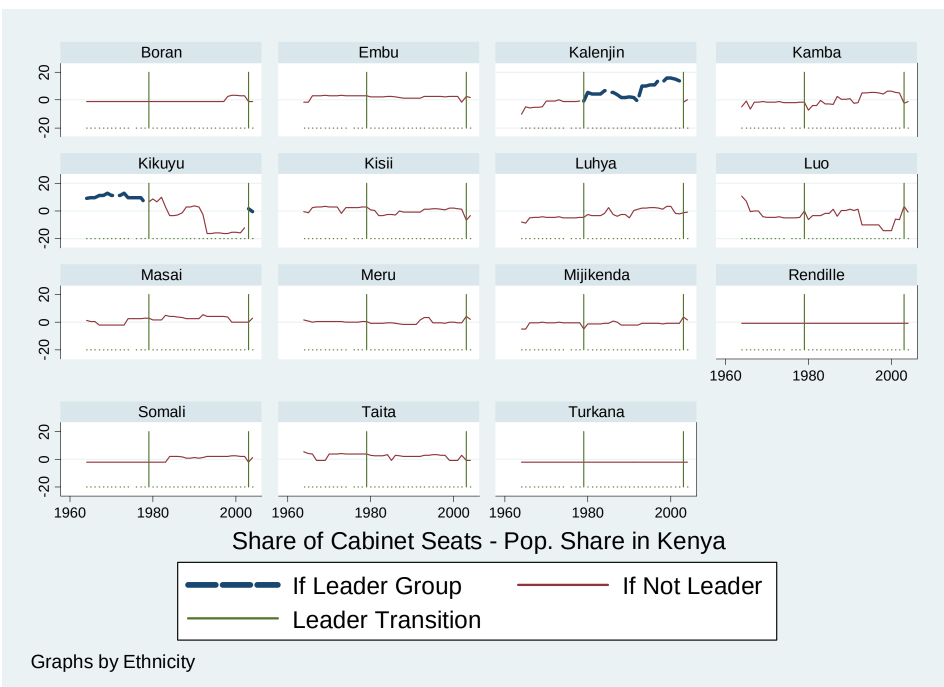

Figure 5: In-Sample Fit of Coalition Size

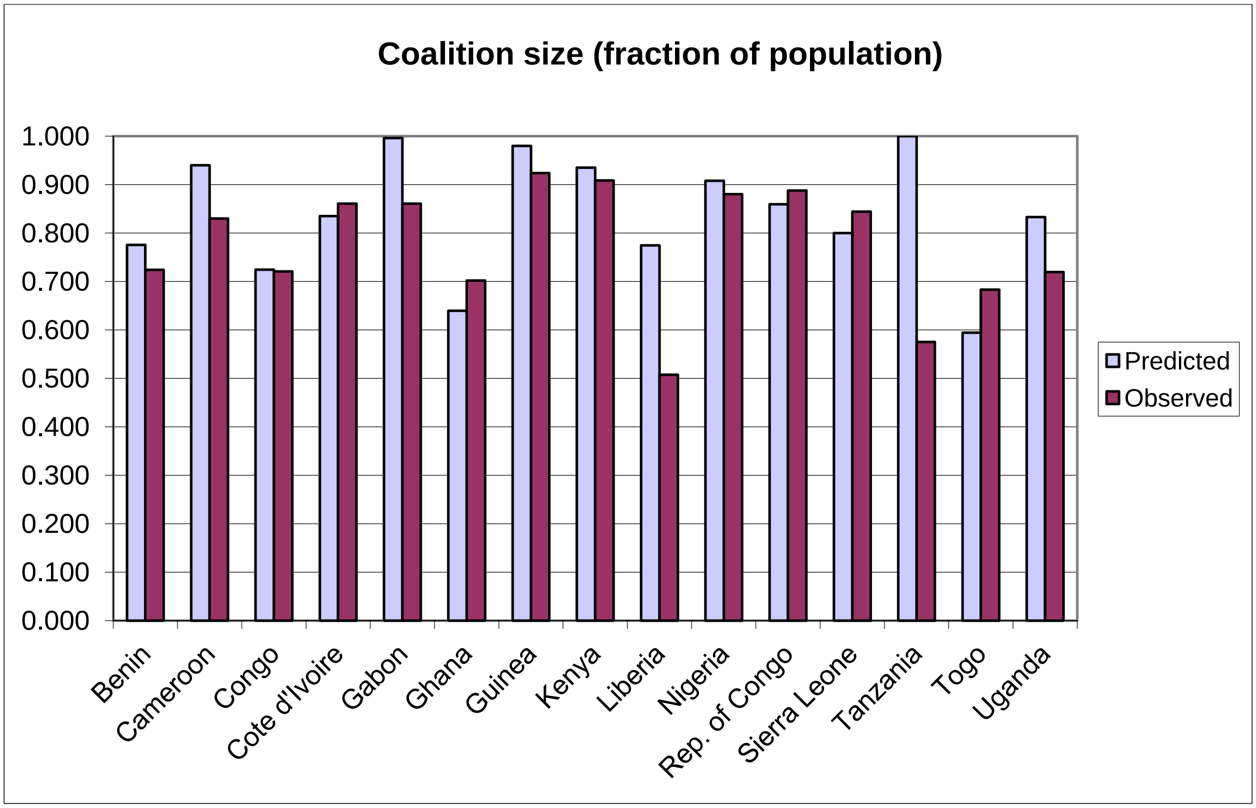

Figure 6: In-Sample Successfully Predicted Groups in % of Population

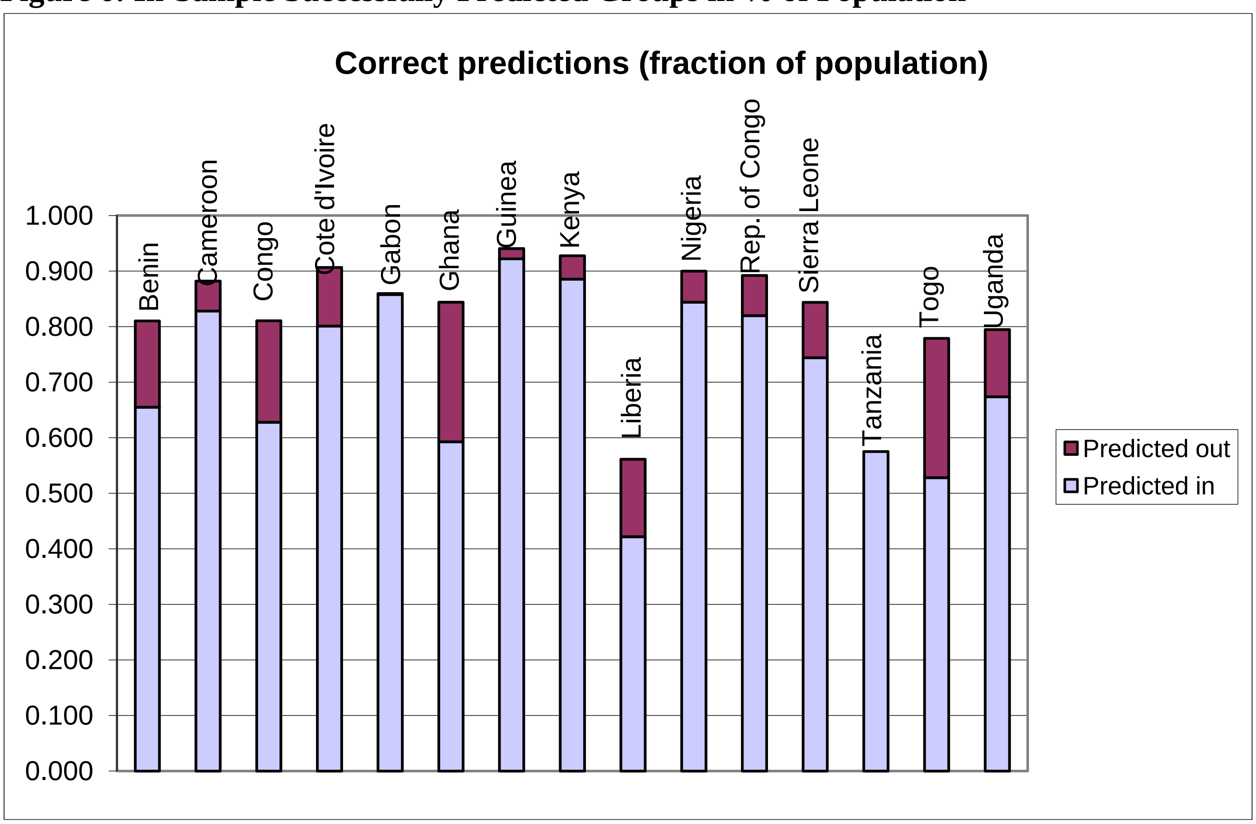

Figure 7: In-Sample Leadership Shares

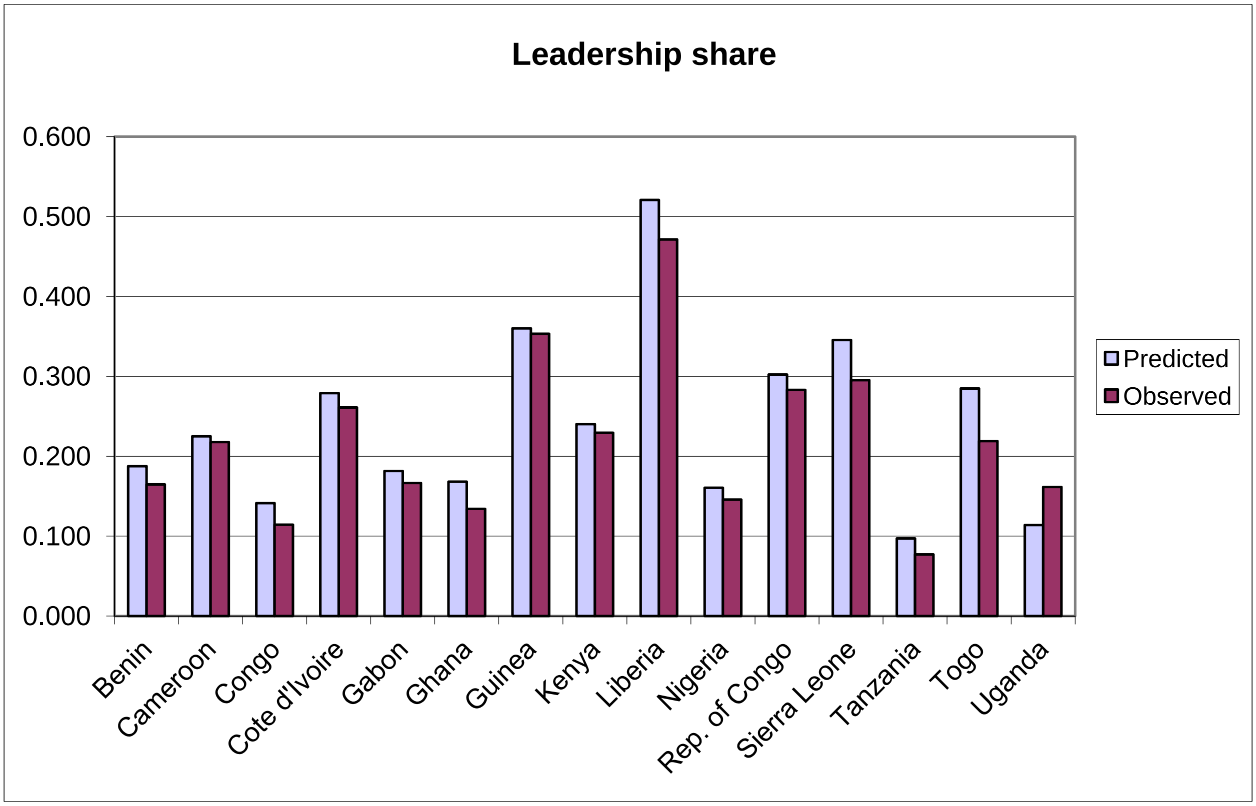

Figure 8: In-Sample Shares to Largest Group

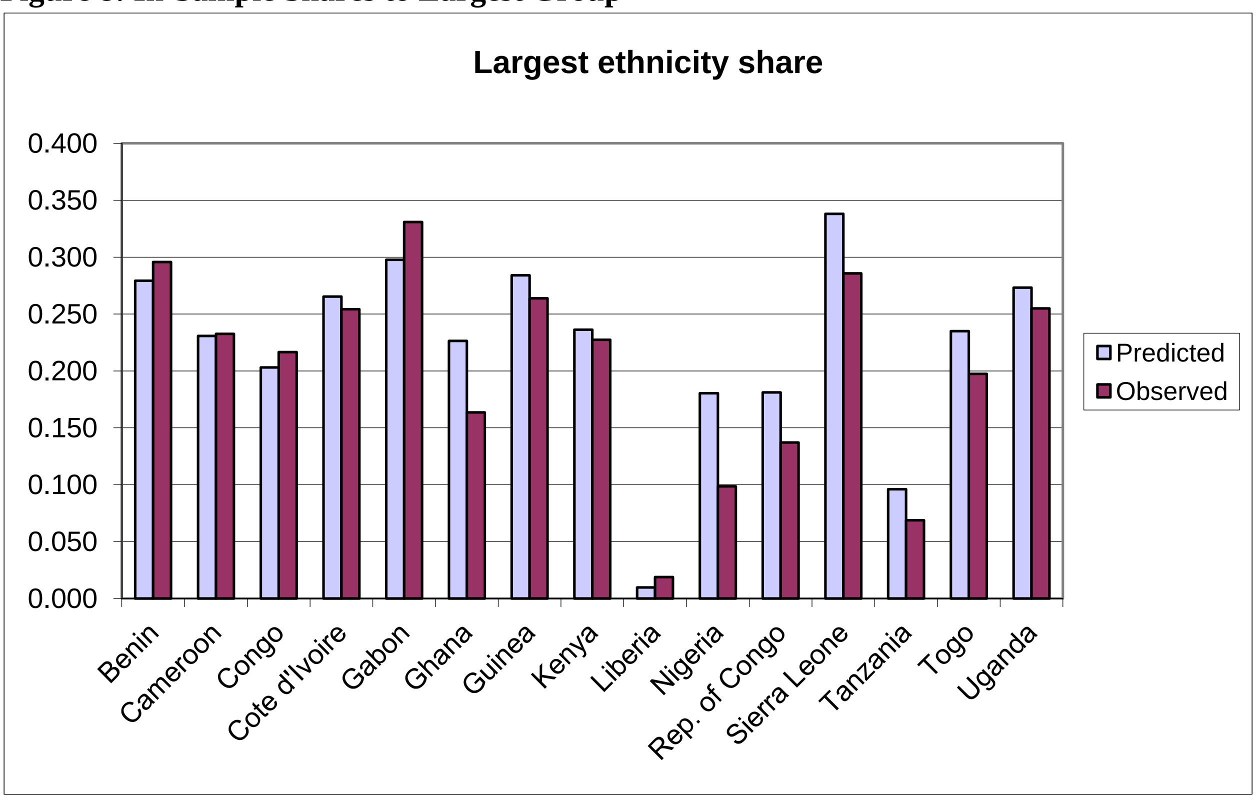

Figure 9: Out-of-Sample Fit of Coalition Size (1980-2004 predicted based on estimation of 1960-80 sample)

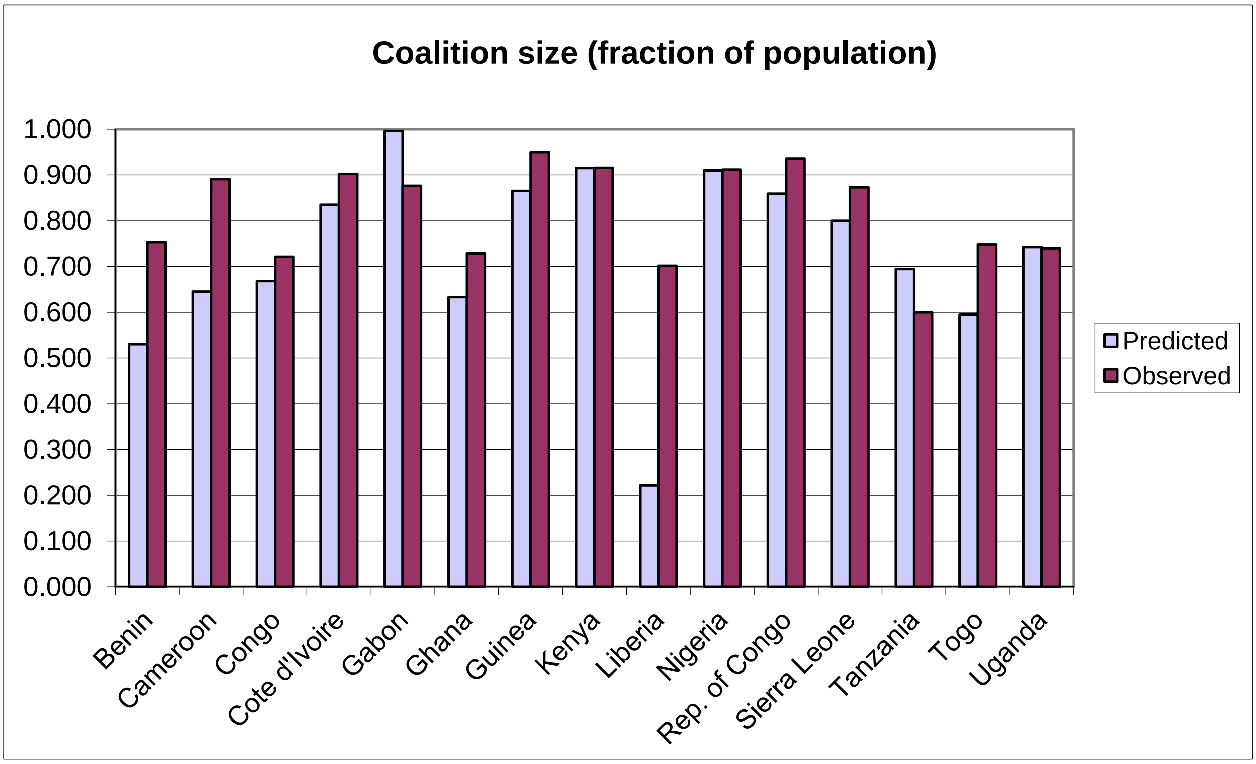

Figure 10: Out-of-Sample Fit, Successfully Predicted Groups in % of Population (1980-2004 predicted based on estimation of 1960-80 sample)

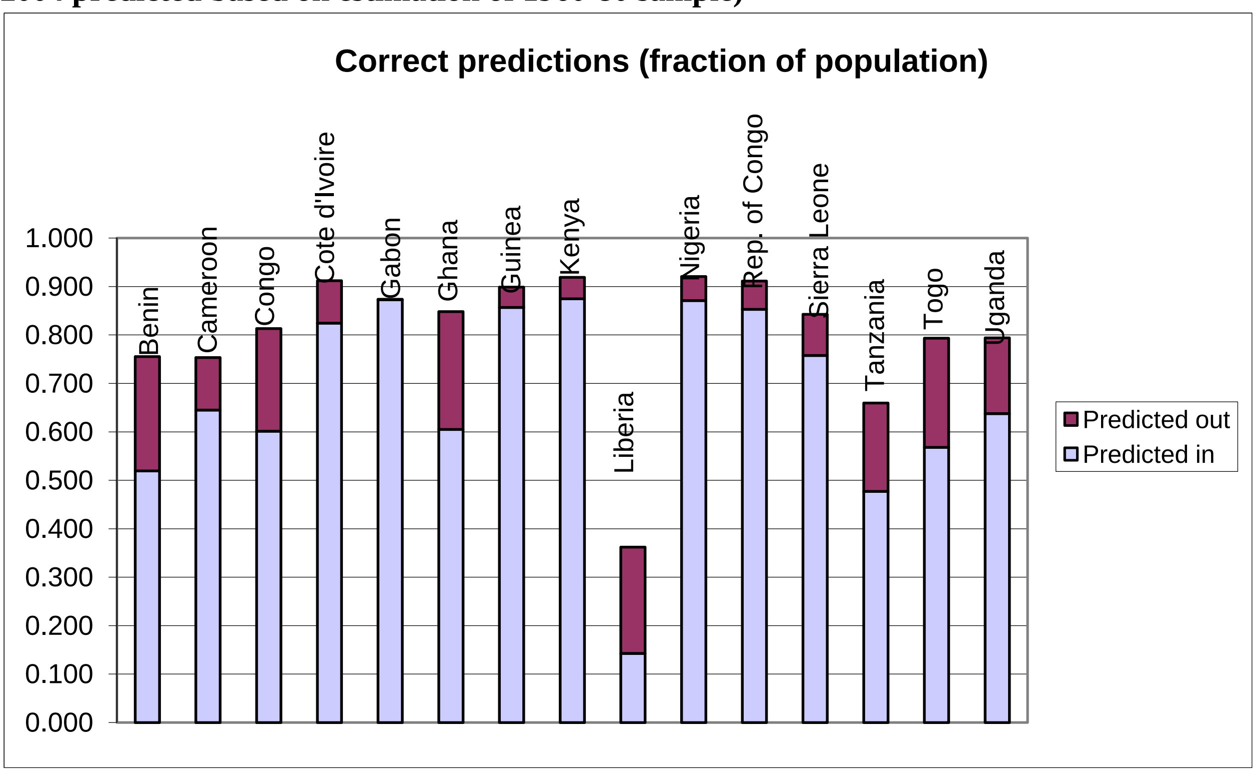

Figure 11: Out-of-Sample Fit of Leadership Shares (1980-2004 predicted based on estimation of 1960-80 sample)

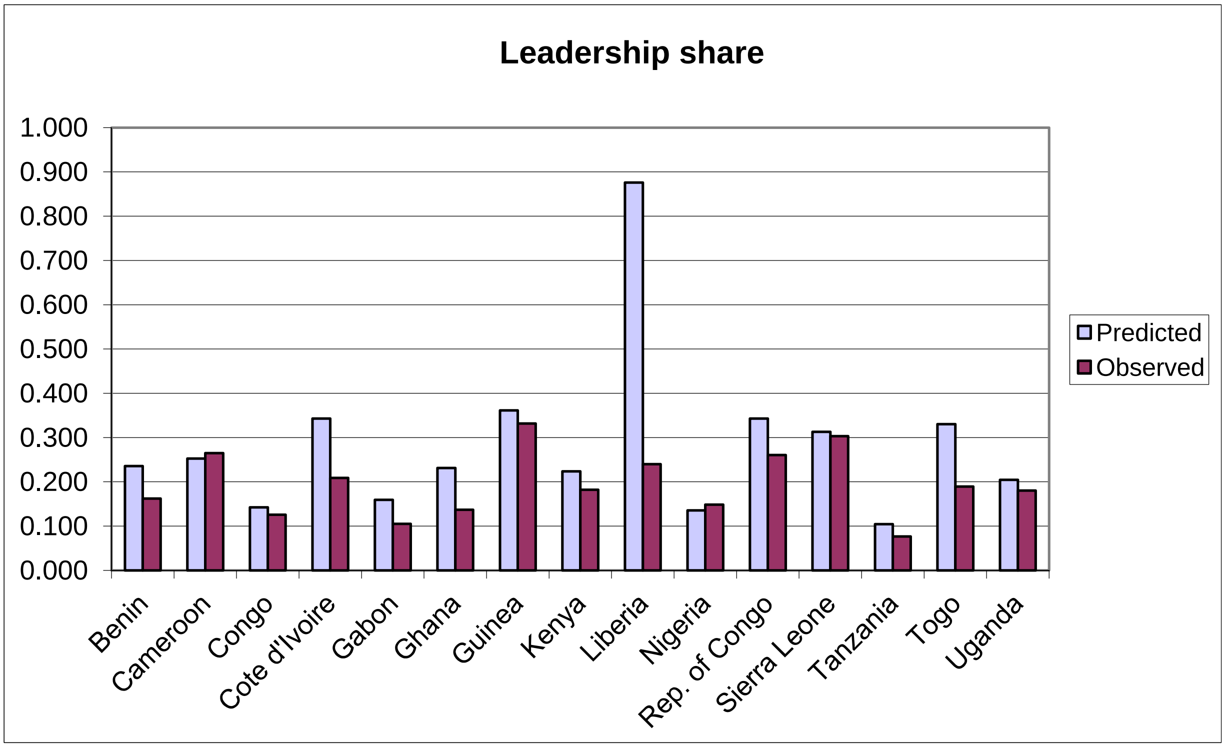

Figure 12: Out-of-Sample Fit, Shares to Largest Group (1980-2004 predicted based on estimation of 1960-80 sample)

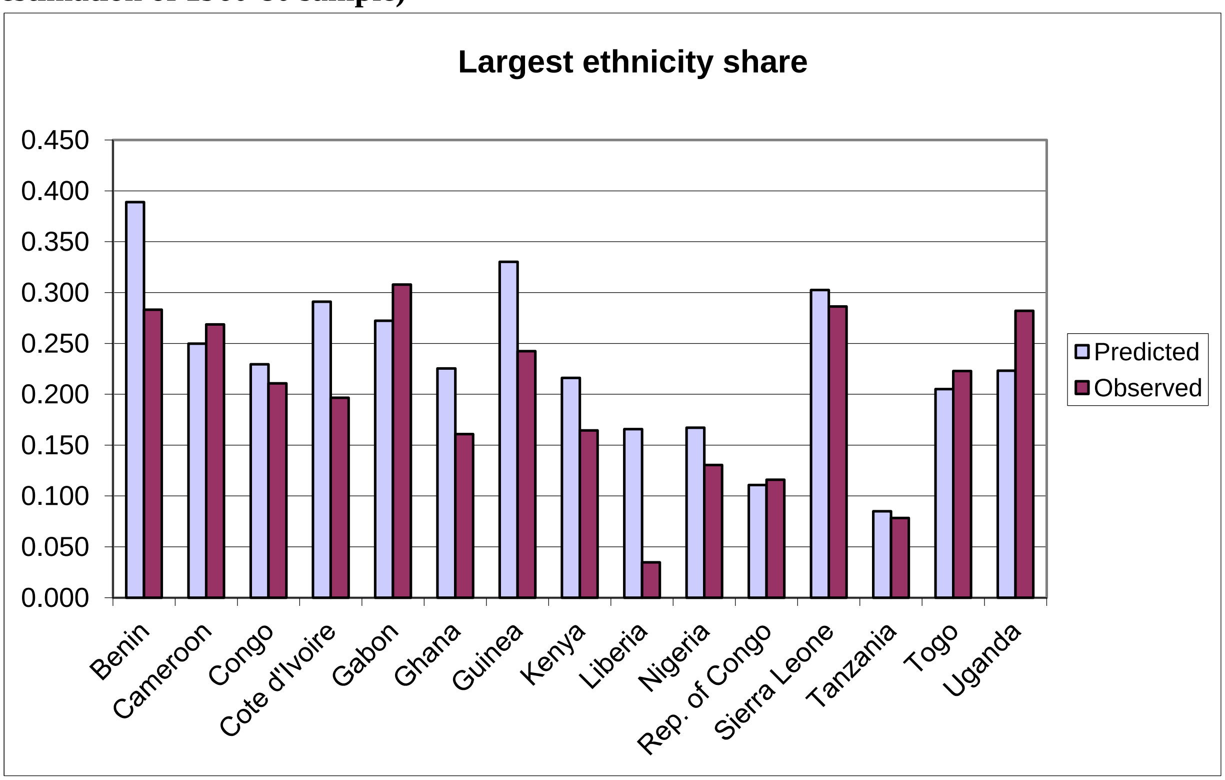

Figure 13: Counterfactual Coalition Size (1980-2004 predicted based on estimation of 1960-80 sample). Δ*r/r* = -.1

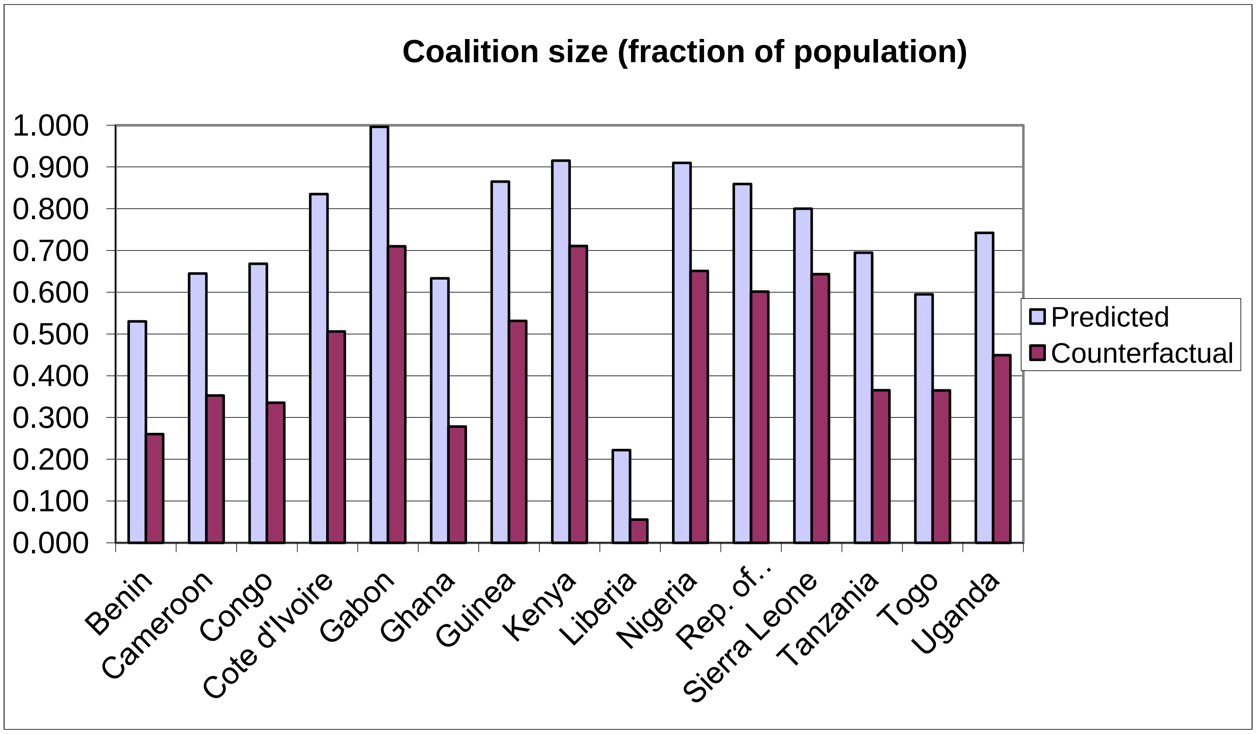

Figure 14: Counterfactual Shares to Leader's Group (1980-2004 predicted based on estimation of 1960-80 sample). Δ*r/r* = -.1

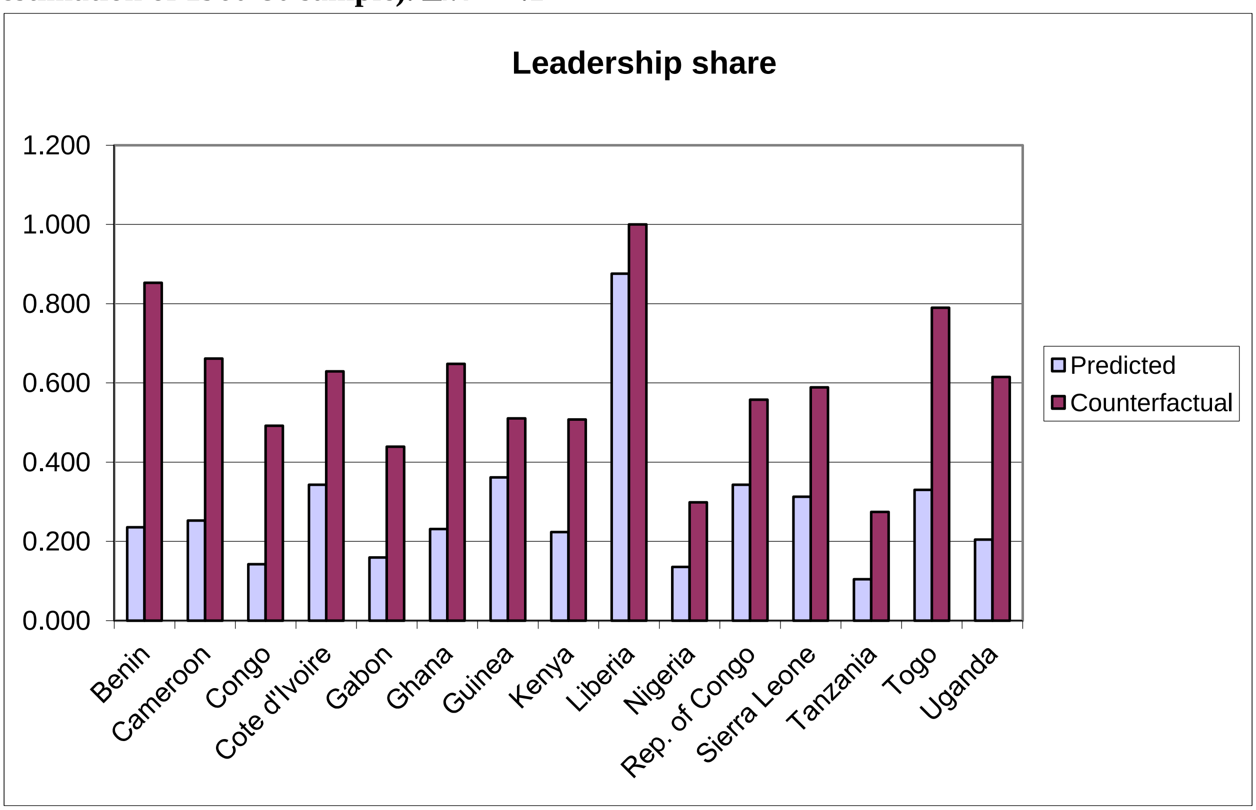

Figure 15: Counterfactual Shares to Largest Group (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta r/r = -.1$

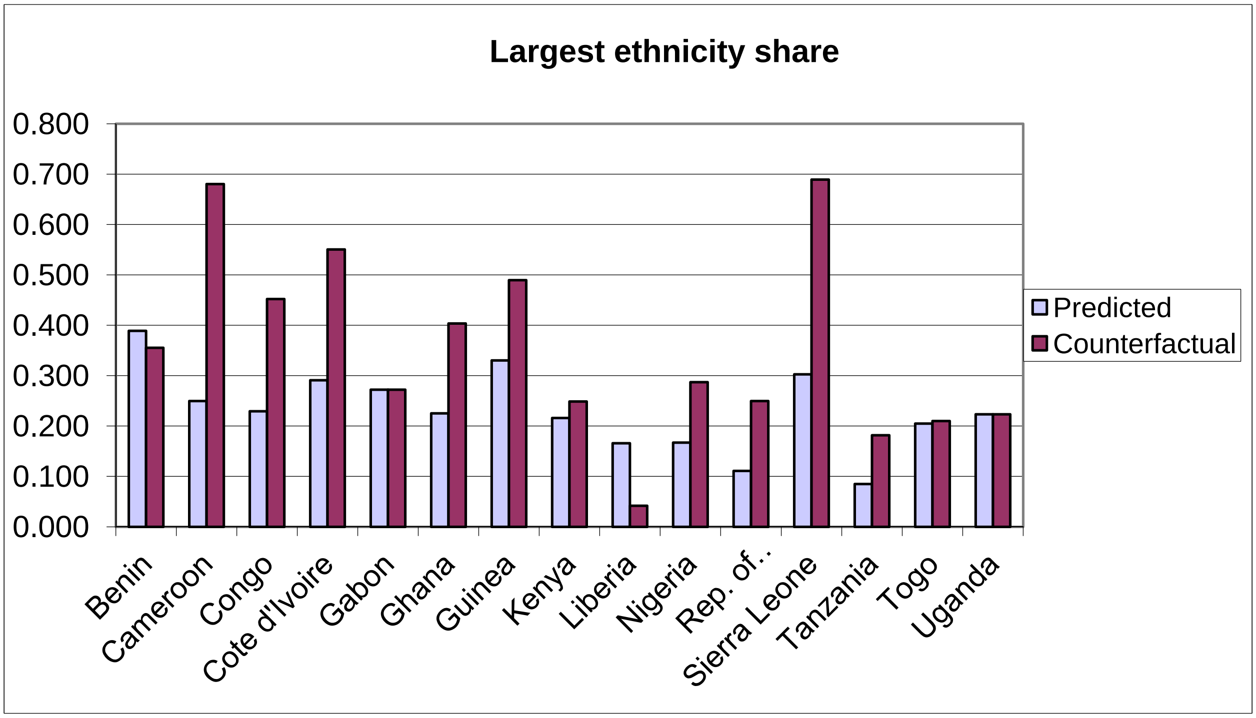

Figure 16: Counterfactual Coalition Size (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta\gamma/\gamma = -.25$

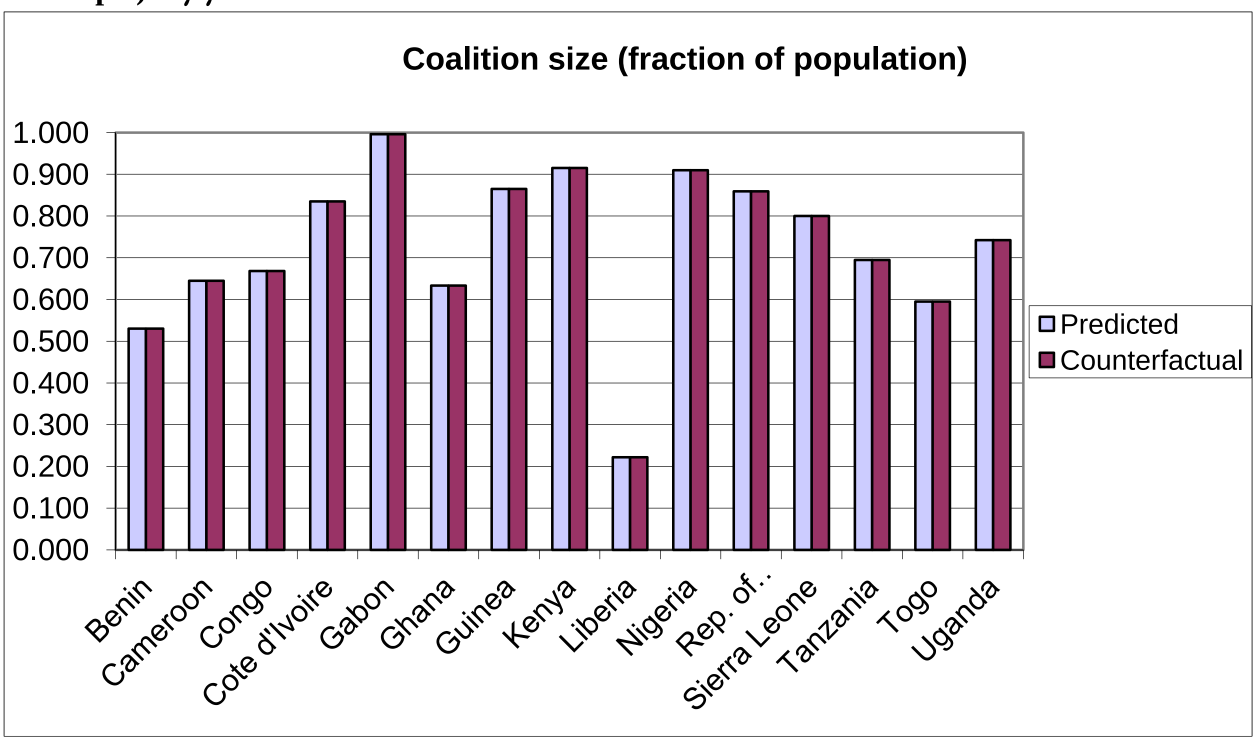

Figure 17: Counterfactual Shares to Leader's Group (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta\gamma/\gamma = -.25$

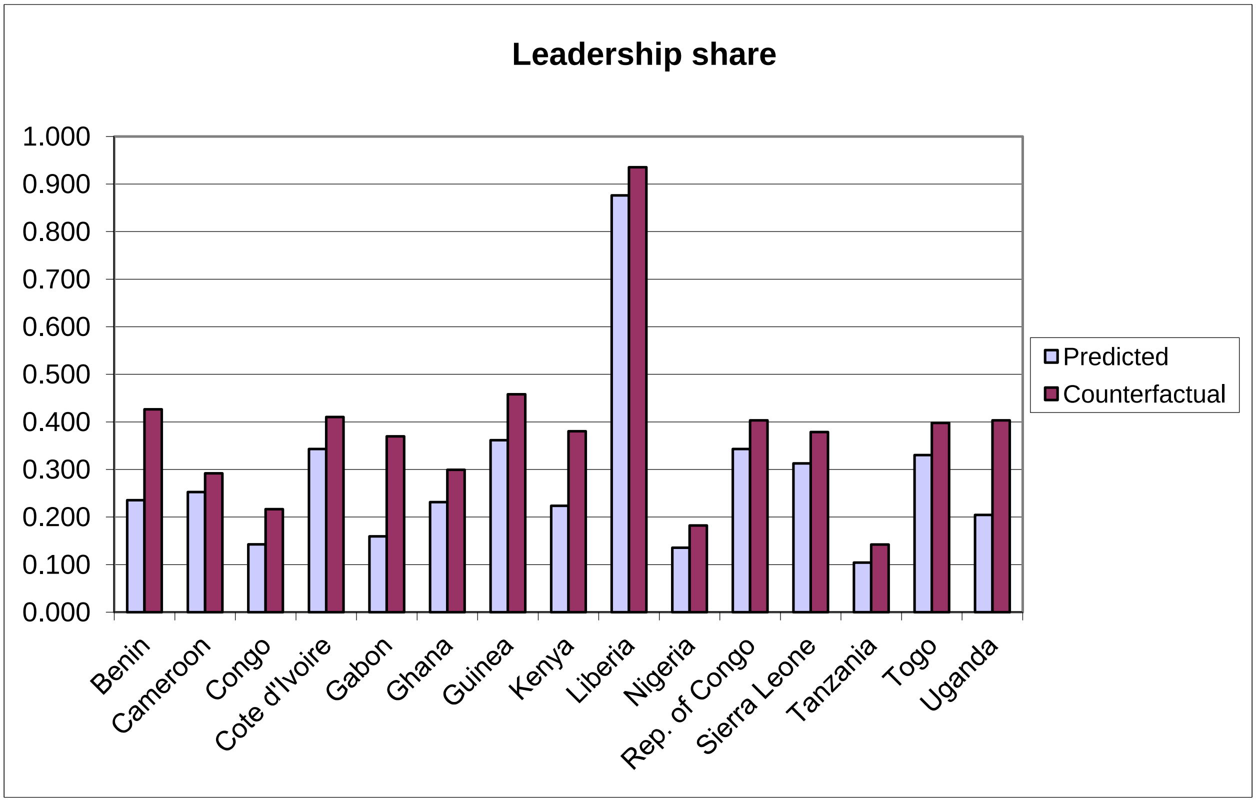

Figure 18: Counterfactual Shares to Largest Group (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta\gamma/\gamma = -.25$

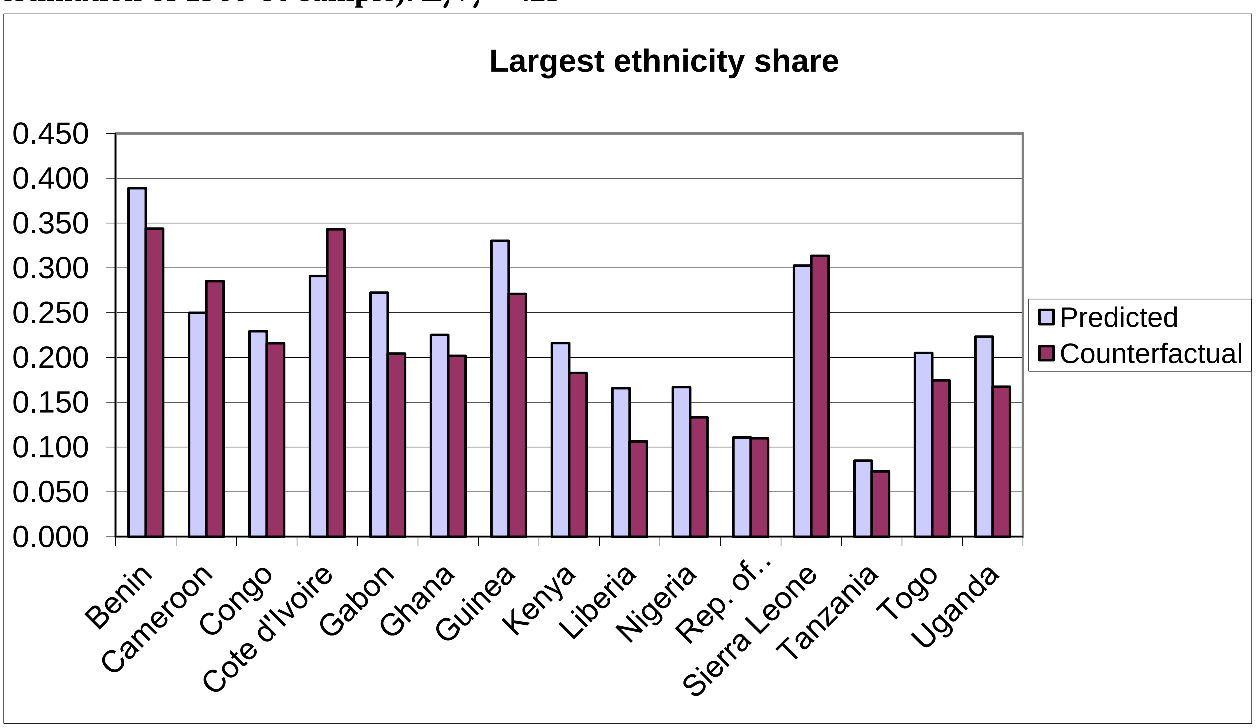

Figure 19: Counterfactual Coalition Size (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta F/F = -.25$

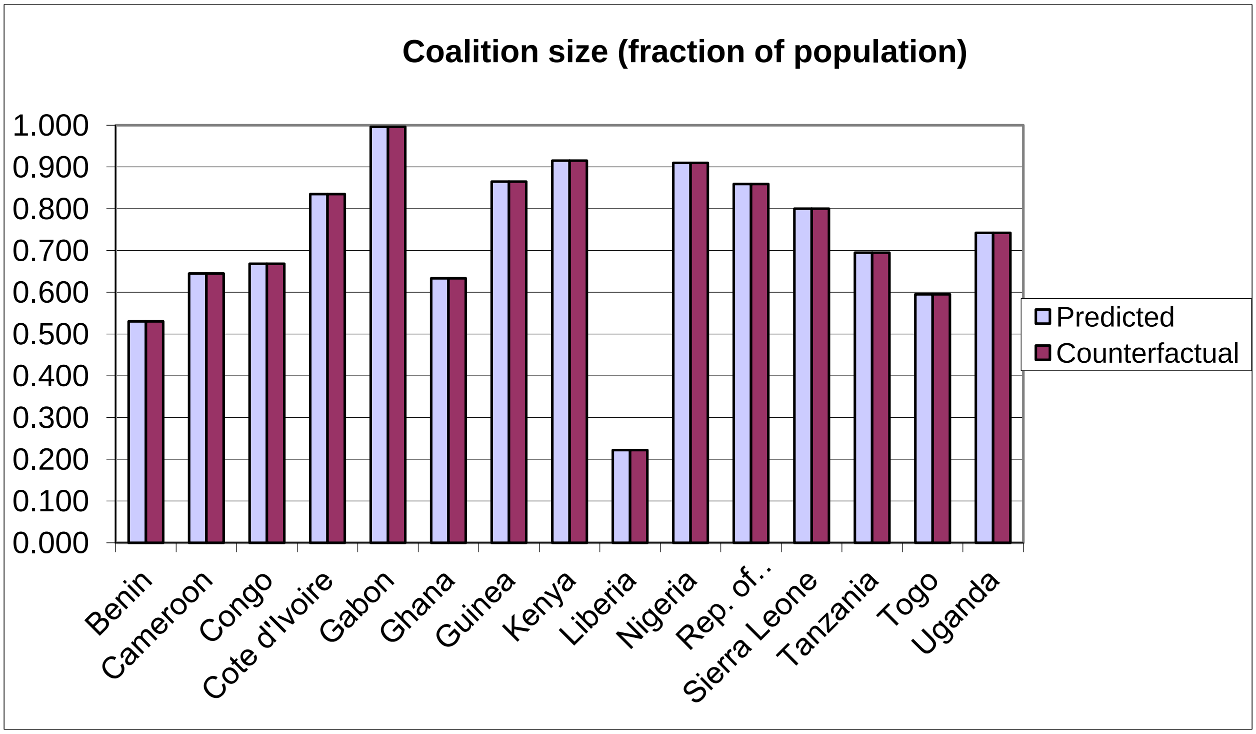

Figure 20: Counterfactual Shares to Leader's Group (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta F/F = -.25$

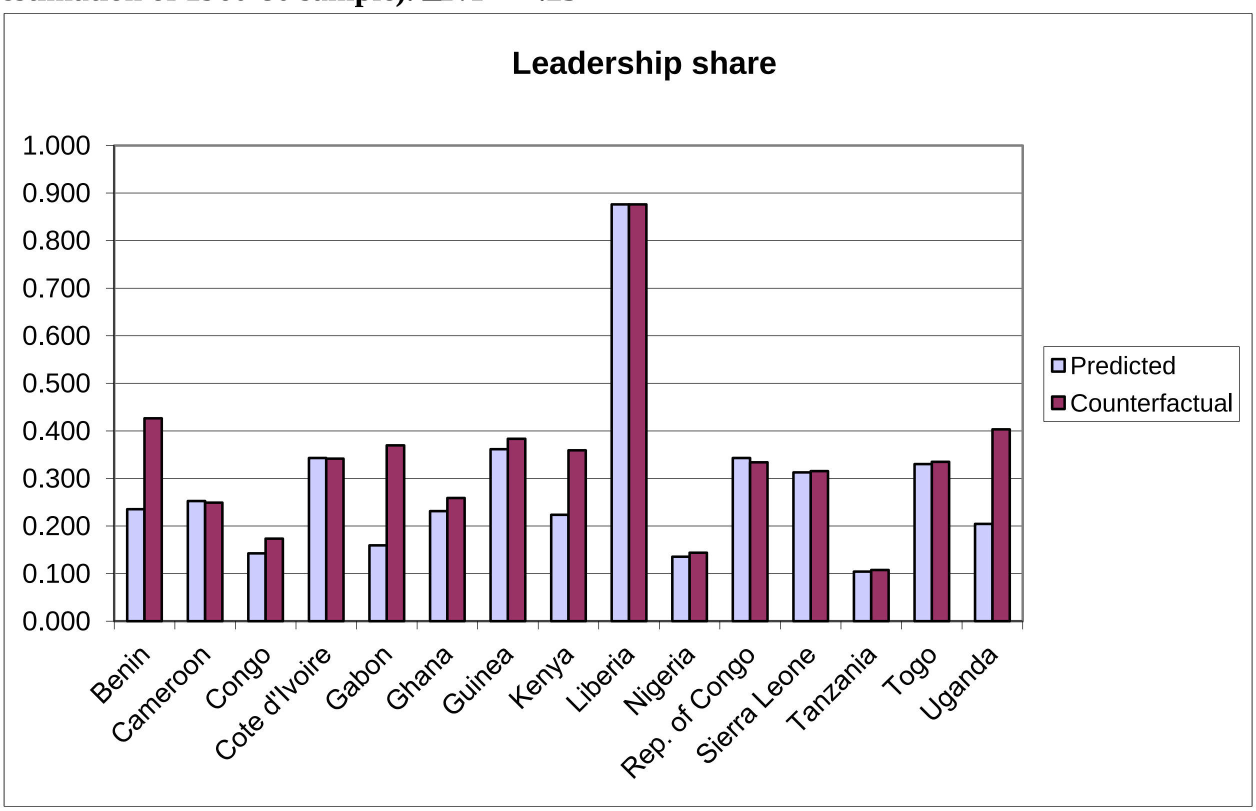

Figure 21: Counterfactual Shares to Largest Group (1980-2004 predicted based on estimation of 1960-80 sample). $\Delta F/F = -.25$

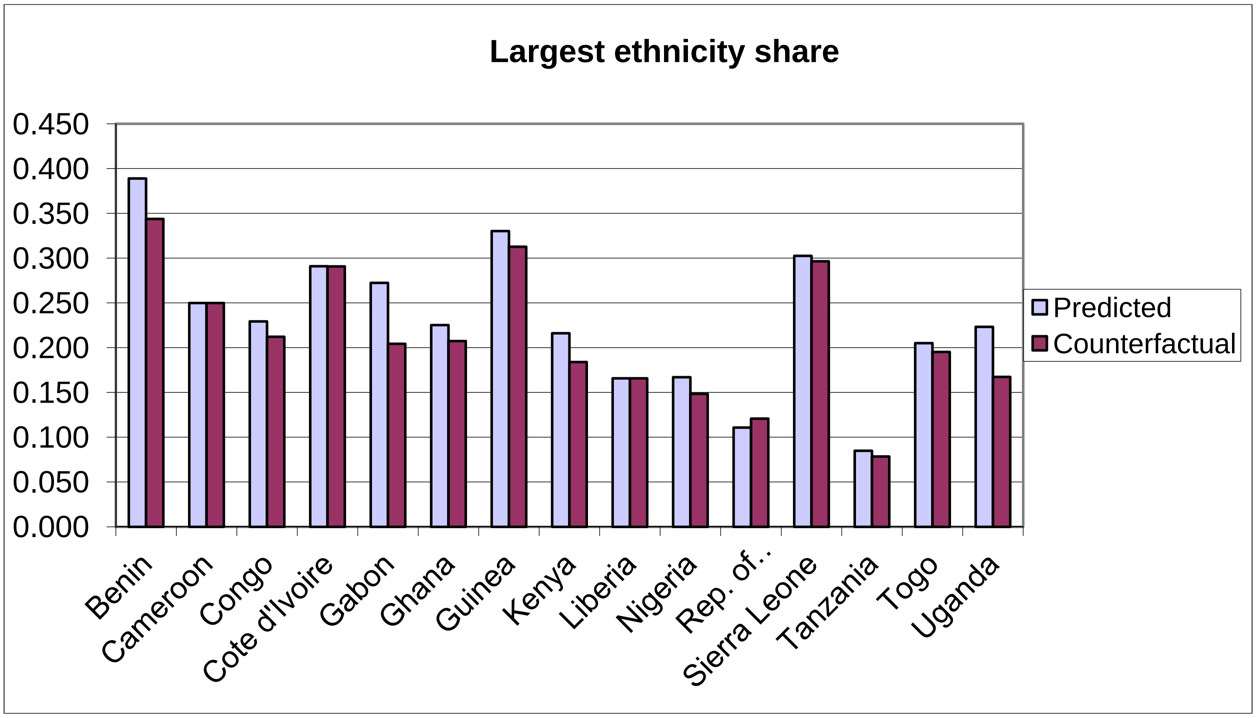

Figure 22: Counterfactual Coalition Size (1980-04 predicted based on estimation of 1960-80 sample). Counterfactual distribution $n_i = n_i - 1\%$ **for** $i=1,..,N/2-1$; $n_i = n_i + 1\%$ **for** $i=N/2+1,..,N$.

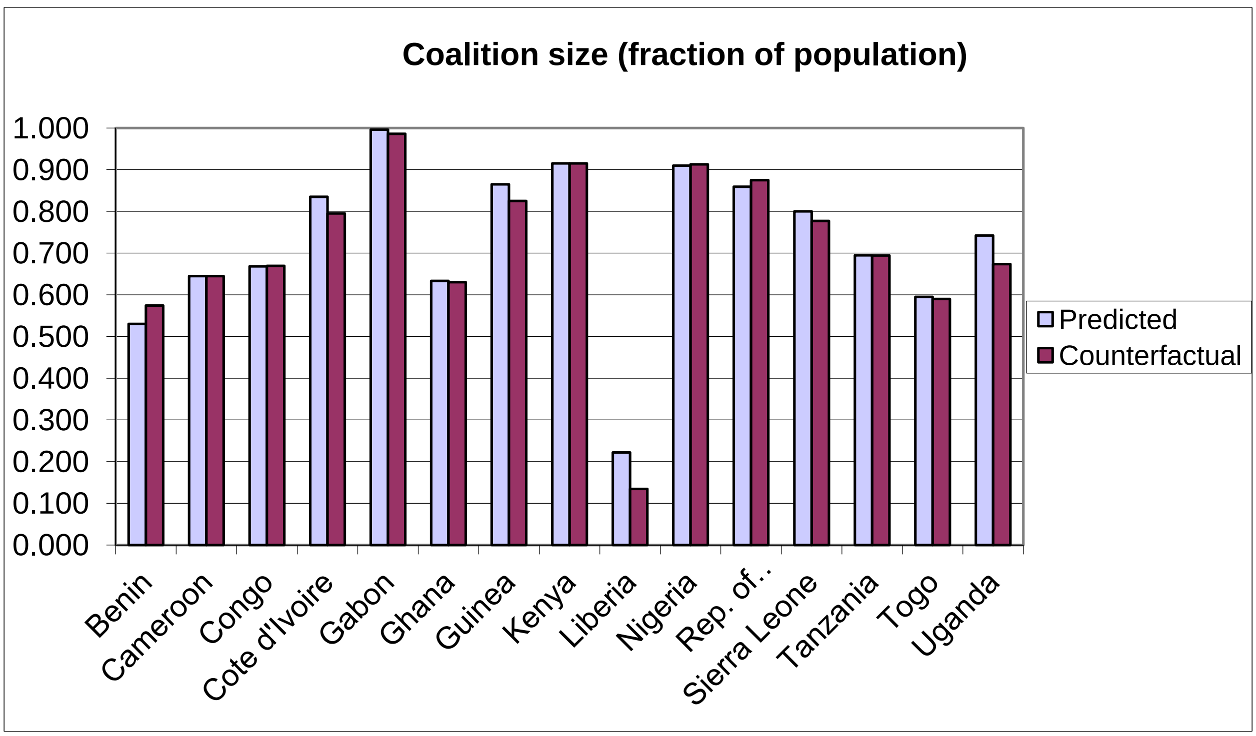

Figure 23: Counterfactual Shares to Leader's Group (1980-04 predict. based on estimation of 1960-80 sample). Counterfactual $n_i = n_i - 1\%$ for $i=1,..,N/2-1$; $n_i = n_i + 1\%$ for $i=N/2+1,..,N$.

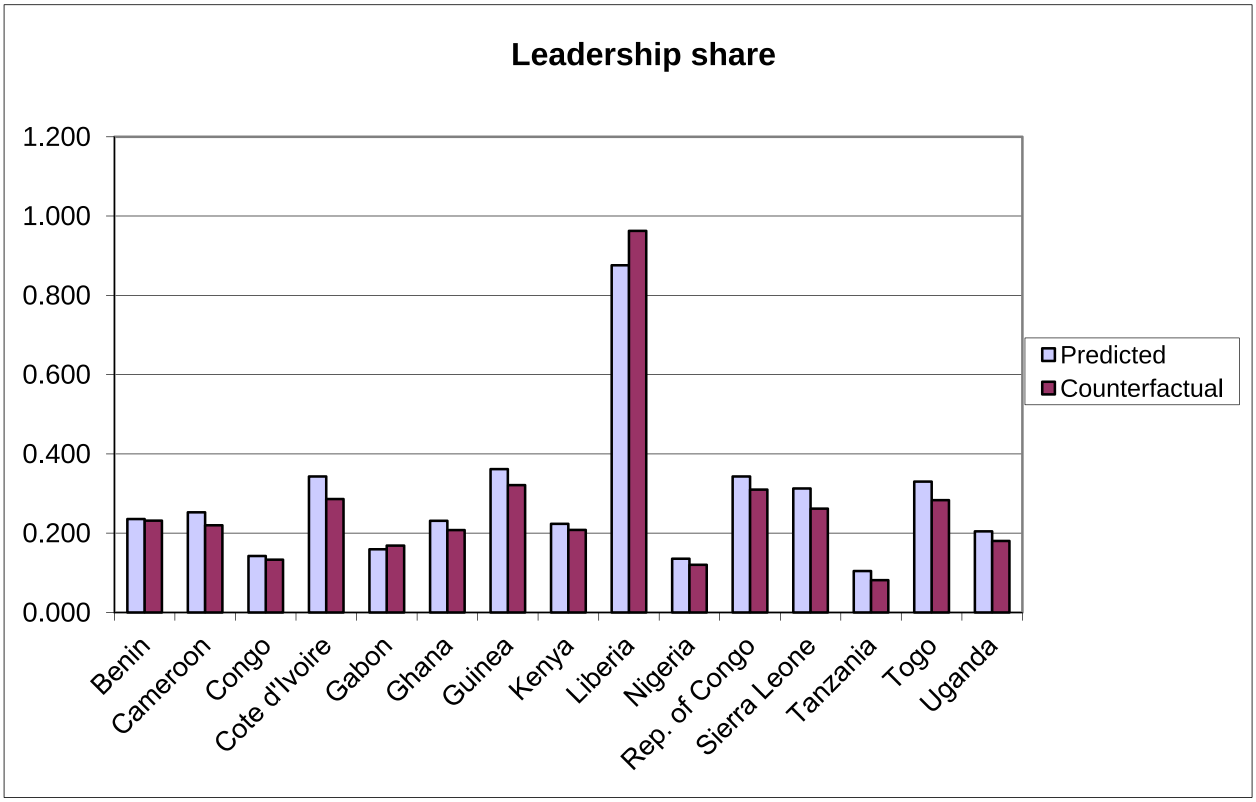

Figure 24: Counterfactual Shares to Largest Group (1980-04 predict. based on estimation of 1960-80 sample). Counterfactual $n_i = n_i - 1\%$ for $i=1,..,N/2-1$; $n_i = n_i + 1\%$ for $i=N/2+1,..,N$.