

Political Succession: A Model of Coups, Revolution, Purges and Everyday Politics

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Abstract

In addition to everyday political threats, leaders risk removal from coups and mass movements such as rebellion. Further, all leaders face threats from shocks such as downturns in their health, their countrys economy, or their governments revenue. By integrating these risks into the selectorate model, we characterize the conditions under which each threat is pertinent and the counter-moves (purges, democratization, expansion of public goods, expansion of private benefits) that best enable the leader to survive in office. The model identifies new insights into the nature of assassins; the relative risk of different types of leader removal as a function of the extant institutions of government; and the endogenous factors driving better or worse public policy and decisions to democratize or become more autocratic. To our knowledge, no prior modeling has integrated all of these concerns to identify their interactive effects.

1 Introduction

Political succession, or rather its avoidance, is at the heart of the decisions leaders make. Except for the rare incumbent who voluntarily steps down, leaders overwhelmingly act as if they want to hold on to power as long as they possibly can. Unfortunately for them, they face numerous threats to their tenure. In addition to the normal give and take of everyday politics, leaders also risk deposition by coups d'état or mass uprisings such as revolutions and civil wars. Leaders are also mortal and face danger from sickness and assassination. They may also face threats to their power from foreign adversaries but we ignore those here and focus only on domestic considerations. We design a model that integrates each of the domestic threats to political power and the available counter-moves by incumbents, placing each threat within an equilibrium setting that while compatible with prior theorizing within the selectorate framework, expands on it and uncovers novel testable propositions.

Previous selectorate models (Bueno de Mesquita et al 2003; Smith 2008; Bueno de Mesquita and Smith 2009, 2010) have examined normal political transitions as well as revolutionary threats. Additionally, the selectorate framework has provided a basis for speculation about coups d'état and the risk of purges, a key counter-maneuver by leaders, but these conditions have not been carefully modeled. Nor have these factors been considered within a modeling framework in which leaders can lose office. Here we propose a model that examines

within a single theoretical framework the conditions conducive to coups, revolutions, purges, democratization and ordinary leader removal. And, unlike previous selectorate models, here we include possible exogenous shocks that can, and sometimes do result in the ouster of an incumbent leader. Furthermore we allow the size of the winning coalition and selectorate to change in response to outcomes across the range of possible sources of deposition and counter-moves to avoid deposition.

The rest of the paper proceeds as follows. In the next section we review the relevant literature on coups, purges, democratization, revolutions and normal leadership change. Typically, when modeled, these topics have been treated as distinct, unrelated events. We endeavor to provide micro-foundations that link these deposition mechanisms. The model's development proceeds by introducing key selectorate concepts. Then we modify the basic theory to include each of the potential means by which incumbents might be deposed. We explain the conditions an incumbent must satisfy to remain in office conditional on binding constraints from every-day political threats, coup threats and threats of mass uprising. We also expand on the counter-moves available to incumbents and the conditions under which their counter-moves cannot be sufficient to keep them in office.

2 Literature Review

Our approach is based on the selectorate model (Buono de Mesquita et al 2003). In that model the primary goal of leaders is to retain office and to do so they need to maintain the support of a coalition of supporters. The types of policies best suited to retaining power depend upon the number of supporters needed. In addition to deposition within the extant institutions, leaders risk being removed in coups or revolutions, or by the mundane, but unavoidable, risk of mortality. Although, as we review below, there are nuanced examinations of each of these risks, the value added of our approach is that it places these different forms of regime change within a common institutional framework and emphasizes how each deposition risk influences the others.

There is a strong tradition in examining how various forms of democracy differ (for instance, Persson and Tabellini 2003). There are parallels in the study autocracy. Wintrobe (1998) was among the first scholars to systematically differentiate between autocracies. He emphasized differences generated according to whether leaders focus on personal power or accumulating wealth. Geddes (2003) categories non-democratic regimes into personalist, one party, and military (and also hybrids of these groupings) according to the means through which leaders exercise power. Like others, she finds that parties and elections provide stability (Cheibub, Gandhi, Vreeland. 2010; Gandhi 2008; Gandhi and Lust-Okar 2009; Wright and Escriba-Folch 2012). Organizational features of autocracies affect policy performance (Besley and Kudamatsu 2007). However, despite the recognition that regimes differ, most studies of democratization (or its reverse) fail to incorporate variations within either democracies or non-democracies (Przeworski et al. 2000; Boix and Stokes 2003; see Geddes 1999 for a review of the democratization literature). Our focus is on selectorate theory which examines all governance in terms of the number of supporters a leader needs and the size of

the pool of potential supporters from which essential backers are drawn.

Our primary theoretical assumption is that leaders want to survive in office. Bueno de Mesquita and Siverson's (1995) analysis of the effects of war outcomes on leader survival provided the impetus for many subsequent leader based perspectives (Chiozza and Gommans 2011; McGillivray and Smith 2008, for instance). Leaders face numerous threats to their hold on power. All leaders, for instance, face the threats of infirmity and mortality. Although leader health is the topic of regular media speculation, to our knowledge there are no game theoretic models or large N statistical studies of the impact of leader health on political outcomes. McDermott (2007) and Post and Robins (1993) use a series of cases to explore how leaders handle declining health and how those around them cover up decrepitude. Jones and Olken use the natural experiments of sudden accidental leader death to measure the impact of individual leaders on growth (2005) and the impact of the success or failure of assassination attempts on the intensity of internal violence (2009). Our analysis examines how the prospect of a leader being removed because of ill health affects that leader's ability to manage political threats to tenure.

There is a vast literature on revolutions and mass protests against incumbent regimes. Much of this work focuses on the incentives to rebel, such as Gurr's (1970) relative deprivation argument. Scholars also point to the ability of the people to organize and coordinate their actions (Goldstone 1994; Kuran 1989; Lohmann 1993). Global games are a common means of modeling such coordination (Angeletos, Hellwig and Pavan 2007; Bueno de Mesquita, 2010; Morris and Shin 2003). Although coordinating resistance to the regime is important, all too often revolutions succeed because the backers of the regime fail to stop the masses (Bueno de Mesquita and Smith 2011; Myerson 2008; Tyson and Smith 2013). Post and Robins (1993), for instance, illustrate how ill health can often be the trigger for such desertion, while Casper and Tyson (2014a) simultaneously model coup risks and revolutions in a global game setting.

We treat coups as the seizure of power by a subset of the elites who before the coup supported the incumbent. Most analyses of coups focus on the involvement of the military in this process (Finer 1962; Feaver 2003). Coups occur when military elites receive relatively few rewards, which the literature conceptualizes in terms of low military spending, the absence of graft for the military or economic shocks (Besley and Robinson 2010; Collier and Hoeffler 2007; Gallego and Pitchik 2004; Londregan and Poole 1990; Leon 2011).

Acemoglu and Robinson (2001) provide an influential class-based model of sequential coups and revolutions in which income inequality drives institutional change. Based on the Meltzer and Richards (1981) model, in democracies the more numerous poor tax the rich. Should shocks provide the rich with an opportunity for a coup, they are most incentivized to do so when there is large income inequality. Similarly, inequality leads the poor to want to rebel against autocracy should they get the opportunity. Acemoglu and Robinson's model has some limitations in that it fails to differentiate between alternative forms of non-democratic institutions. Additionally, their model does not permit institutional transitions to alter the underlying ownership of wealth (although they affect the taxation of that wealth). That said, their work highlights an essential commitment problem that is also a theme of our model. Although the ruling class might be willing to compensate others to ameliorate

their demand for institutional change, leaders cannot provide enough additional rewards in a single period to compensate for giving up the opportunity for institutional change (see Powell 2004 for a general statement of the commitment problem). The only means by which leaders can commit to future rewards is through institutional reforms that ensure the delivery of rewards in the future. Our model examines expansions or contractions of the winning coalition, which can be thought of as democratization or purges. In contrast to the standard approach to democratization, in which nations pass some arbitrary threshold, our approach considers partial progress to more inclusive or less inclusive institutions.

Purges involve reducing the number of essential supporters, concentrating political power in the remaining (smaller) group of supporters. Purges often entail the execution, imprisonment or exile of those purged. While there are many studies of specific instances of purges, for example Conquest’s (1968) analysis of Stalin’s great purges, systematic studies, in terms of large N empirical or theoretical approaches are lacking. Perhaps most relevant here are studies by Egorov and Sonin (2011) and Svulik (2009). Both examine the choice of leaders with respect to their supporters in the face of other survival threats. Egorov and Sonin examine vulnerability created by the necessity of rewarding and promoting supporters for their assistance in suppressing rivals knowing that these same supporters can turn on the leader. In Svulik’s model, leaders want to cut down on the number of supporters they are beholden to, but supporters use the threat of a coup to deter purges. Also related, Casper and Tyson (2014b) model a leader’s ability to purge supporters in a global games context as a signal of regime strength that enables her to deter coups.

3 Basic Selectorate Competition

Since the selectorate model has been extensively developed elsewhere, here we describe its essential features, present a simple version of the base selectorate game with the addition of a health/mortality risk and derive the subgame perfect equilibrium of the game.

All political organizations can be thought of as made up of at least four nested groups: the population (N) of people subject to the government’s rule; the selectorate (S) consisting of the subset of N who have at least a nominal say in choosing leaders; the winning coalition ($W \subset S$, such that $W \leq S/2$) whose support is essential to keep an incumbent in power; and an incumbent leader (\mathcal{L}) and a domestic challenger (referred to as a foe, \mathcal{F}) who seeks to depose the incumbent. We designate everyone in $N - S$ as ”the masses.”¹

Leaders have R (where $R > W$) resources with which to provide public goods, g and private goods x . The price of public goods is q and, since coalition size determines the number of supporters receiving private goods, the implicit price of private goods is W . All members of the population benefit from public goods. For simplicity we assume a parametric utility function $u(g) = \ln(g)$. The value for coalition members of x private goods is x (linear utility function); those outside the winning coalition get no private goods. The basic game involves the incumbent and foe offering private and public goods provisions subject to a

¹Although an abuse of notation, we use N , W and S to represent both the sets of people and the size of sets.

budget constraint. The game is infinitely repeated with players having a common discount factor δ . In each period, selectors support the leader who provides them with the highest net present value of expected benefits. For each period they survive in office, leaders receive a payoff of Ψ plus a payoff equivalent to the difference between resources and their expenditure on private and public goods ($R - qg - Wx$). Leaders and foes receive nothing if they are out of office.

To survive in office the incumbent needs to retain the support of her W supporters. To depose the incumbent, a foe needs to entice at least one member of the existing winning coalition to support him. Hence, any foe to have a chance at coming to power must nominate a coalition of size W that includes at least one member of the incumbent's coalition. Although, both incumbent and foe need to attract W supporters, the incumbent has a significant advantage in that she can guarantee to reward her supporters in the future, at least for as long as she lives. A foe cannot make such a commitment.

Bueno de Mesquita et al (2002) extensively model coalitional choices. Here we utilize their results to provide a reduced form for coalition choice. The pertinent underlying assumption is that leaders have differing affinities for each selector; that is to say, all else equal, they would prefer to form a coalition from those they like and believe most likely to be loyal rather than from those they dislike or distrust. We assume that initially all affinity rankings are equally likely. Once a foe comes to power and becomes the new leader his affinity ordering is revealed. Ex ante uncertainty about a foe's affinity rankings forms the basis of the incumbency advantage.

In all future periods during which the foe (hereafter referred to as he) retains office his coalition is based on this affinity ordering. However, prior to the revelation of this ordering, that is when the new leader is still the foe, potential supporters know there is only a W/S chance that they will be in the top of his affinity ordering and rewarded in the long run. Hence, while a foe might offer more rewards than the incumbent offers today, he cannot commit to continue to reward indefinitely those who initially support him. In contrast, the incumbent, whose affinity ordering is already known, can commit to continue to reward her supporters. This creates an incumbency advantage that allows the incumbent to offer fewer rewards than the foe in the immediate period and still maintain the loyalty of her backers.

The size of the incumbency advantage depends upon the relative importance of private goods (x) compared to public goods (g) as a means of rewarding supporters, which, in turn, is determined by coalition size and the relative chance of inclusion (W/S) or exclusion ($1 - W/S$) from a foe's long run coalition. When the coalition is small, leaders can effectively reward their small number of supporters with private goods. Such systems also create a large risk of exclusion if supporters defect to the foe, especially when the selectorate is large, and so it is in these systems that the incumbency advantage is greatest.

Under the normal circumstances of everyday politics, in every period of an infinite game where players have discount factor δ , selectorate competition proceeds as follows:

1) The leader, \mathcal{L} , and the leader's political foe, \mathcal{F} , offer to spend g public and x private goods subject to the budget constraint: $R \geq qg_L + Wx_L$ and $R \geq qg_F + Wx_F$, where the subscripts indicate which actor makes the offer.

As described above, \mathcal{L} forms a coalition of the W highest members of her affinity ordering and \mathcal{F} forms a coalition of size W that includes at least one member of \mathcal{L} 's coalition.

2) Selectors support either \mathcal{L} or \mathcal{F} . \mathcal{L} retains power if all of her coalition supports her. If any member of her coalition supports \mathcal{F} , then she is deposed. The chosen leader, \mathcal{L} or \mathcal{F} , implements their policies.

3) The chosen leader faces a mortality risk. With probability h she survives. With probability $(1-h)$ the leader dies. For convenience, we refer to h as health, but the mortality risk might equally well be an assassination risk or any other risk of removal that is exogenous to the modeled political competition. If the leader dies, then a new leader assumes office.²

4) The affinity ordering of the leader is revealed (be she the incumbent, challenger, or leader who inherits office).

We now characterize the stationary pure strategy symmetric subgame perfect equilibrium of the game in weakly undominated strategies.

Proposition 1 *Under long run selectorate competition, in every period the incumbent produces $g_L = g^* = \frac{W}{q}$ public goods and offers $x_L = x^* = \frac{(R-W)S(1-h\delta)}{W(S-h\delta W)}$ private goods to the W highest selectors in her affinity ordering. Foe \mathcal{F} offers $g_F = \frac{W}{q}$ public goods and offers $x_F = \frac{R}{W} - 1$ private goods to a coalition of size W that includes at least one member of the incumbent's coalition. Members of the incumbent's coalition support the incumbent if and only if*

$$u(g_L) + x_L + \delta(hV_w + (1-h)\frac{W}{S}V_w + (1-h)\frac{S-W}{W}V_s) \geq u(g_F) + x_F + \delta(\frac{W}{S}V_w + \frac{S-W}{S}V_s) \quad (1)$$

; otherwise they support the alternative leader, where

$$V_w = \frac{1}{W} \frac{S(R-W)}{S-h\delta W} + \frac{\delta}{1-\delta} \frac{R-W}{S-h\delta W} (1-h) + \frac{1}{(1-\delta)} \ln \frac{W}{q} \quad (2)$$

is the continuation value for members of the winning coalition and

$$V_s = \frac{\delta}{1-\delta} \frac{R-W}{S-h\delta W} (1-h) + \frac{1}{(1-\delta)} \ln \frac{W}{q} \quad (3)$$

is the continuation value for selectors outside of the winning coalition. The net present value of the private goods received by coalition members relative to selectors is $Z = V_w - V_s = \frac{1}{W} \frac{S(R-W)}{S-h\delta W}$. The incumbent's continuation value is

$$V_L = \left(\frac{\Psi + R - W}{1 - \delta h} - S \frac{R - W}{S - h\delta W} \right) \quad (4)$$

where Ψ denotes the value the incumbent attaches to remaining in office.

²We assume an infinite pool of potential replacement politicians.

Proof. Suppose there exists a subgame perfect equilibrium in which the incumbent plays g^* and x^* in every period and is reselected by her coalition.

Given these policies the continuation value for anyone who starts the game in the winning coalition is

$$V_w = u(g^*) + x^* + \delta(hV_w + (1-h)\frac{W}{S}V_w + (1-h)\frac{S-W}{W}V_s) \quad (5)$$

The rewards $u(g^*) + x^*$ correspond to the payoffs in the immediate period; the three components in $\delta(hV_w + (1-h)\frac{W}{S}V_w + (1-h)\frac{S-W}{W}V_s)$ correspond respectively to the situation in which (1) the leader survives (in which case the coalition member get V_w next period); (2) the leader dies but her replacement retains the previous leader's supporter; and (3) the leader dies and the new leader excludes the deceased leader's supporter (which has a continuation value of V_s).

Analogously, the continuation value for a selector outside of the coalition is

$$V_s = u(g^*) + \delta(hV_s + (1-h)\frac{W}{S}V_w + (1-h)\frac{S-W}{W}V_s) \quad (6)$$

The continuation value of incumbent, V_L , is the value of office holding Ψ plus revenues R less expenditures $qg^* + Wx^*$ plus the discount value of continuing into the next period (factoring in the health risk):

$$V_L = \Psi + R - qg^* - Wx^* + \delta hV_L \quad (7)$$

The best offer the challenger can make is to spend all possible resources: $\max u(g_F) + x_F$ subject to the budget constraint $qg_F + Wx_F \leq R$. This optimization can be rewritten as $\max u(g_F) + \frac{R-qq_F}{W}$ since the challenger can do no better than spend everything. Standard optimization implies FOC $u'(g) - \frac{q}{W} = 0$ and SOC $u''(g) < 0$. For $u() = \ln()$ this implies $g_F^* = \frac{W}{q}$ and $x_F^* = \frac{R-qq_F}{W} = \frac{R-W}{W}$.

Should the political foe come to power his affinity profile will be revealed and in the next period he will select the W highest affinity selectors. Hence, any selector in the current coalition who is offered private goods by the challenger has an expected value for backing \mathcal{F} that is equal to:

$$u(g_F^*) + x_F^* + \delta\left(\frac{W}{S}V_w + \frac{S-W}{S}V_s\right) \quad (8)$$

If in the immediate period the incumbent offers policies g_L and x_L , then the value to her coalition of retaining her is

$$u(g_L) + x_L + \delta\left(hV_w + (1-h)\frac{W}{S}V_w + (1-h)\frac{S-W}{W}V_s\right) \quad (9)$$

To survive the incumbent ensures that expression 9 is at least as large as expression 8, hence the incumbency constraint vis-a-vis \mathcal{F} 's challenge is:

$$u(g_L)+x_L \geq u(g_F^*)+x_F^*+\delta\left(\frac{W}{S}V_w+\frac{S-W}{S}V_s\right)-\delta\left(hV_w+(1-h)\frac{W}{S}V_w+(1-h)\frac{S-W}{W}V_s\right) \quad (10)$$

The FOC for minimizing expenditure implies that if L spends M resources then $g_L = \frac{W}{q}$ and $x_L = \frac{M}{W} - 1$. By the assumption $R > W$ there is spending on both private and public goods. By stationarity if $g_L = \frac{W}{q}$ and $x_L = \frac{M}{W} - 1$ are optimal policies in the current period given optimal policies g^* and x^* in future periods, then $g_L = g^* = \frac{W}{q}$ and $x_L = x^* = \frac{M}{W} - 1$. Hence solving equation 5, 6 and 10 yields that the incumbent spends $M = \frac{(1-h\delta)SR+h\delta W(S-W)}{S-h\delta W} < R$, offers policies and continuation values given in the proposition. ■

Since it is central to what follows, it is worthwhile to examine the institutional preferences of different groups.

3.1 Institutional Preferences

Coalition size shapes policy choices. In equilibrium, leaders spend more on public goods as the coalition size increases: $g^* = \frac{W}{q}$ and $x^* = \frac{(R-W)S(1-h\delta)}{W(S-h\delta W)}$. Further as the winning coalition increases in size, supporters of the incumbent face less risk of exclusion from future coalitions if they defect. Such decreased risk of exclusion coupled with more of the rewards being public goods reduces loyalty towards the incumbent, who in turn is induced to spend more of the available resources to buy support.

The masses, that is the $N - S$ people outside the selectorate who have no prospect of being part of the winning coalition, derive their welfare solely from public goods. As such, the masses want the coalition to be as large as possible.

The continuation value for selectors outside of the winning coalition is $V_s = V_s(W, S) = \frac{1}{(1-\delta)} \ln \frac{W}{q} + \frac{\delta}{1-\delta} \frac{R-W}{S-h\delta W} (1-h)$. We introduce the notation $V_s(W, S)$ to indicate the dependence on institutions. This expected value has two components, public goods, and the prospects of gaining private goods in a future coalition. Although the level of private goods declines as W increases, access to future private goods depends upon the ratio W/S and the risk of leader death $(1-h)$. Like the masses, selectors prefer large W and small S systems. Further they are unlikely to toast the King's health, as their welfare decreases in h . They prefer leaders at a high risk of dying; hence we anticipate assassins are generally drawn from this group.

The institutional preferences of the incumbent's supporters are $V_w = V_w(W, S) = \frac{1}{W} \frac{S(R-W)}{S-h\delta W} + \frac{\delta}{1-\delta} \frac{R-W}{S-h\delta W} (1-h) + \frac{1}{(1-\delta)} \ln \frac{W}{q}$. The winning coalition's welfare differs from that of selectors by $Z = Z(W, S) = V_w - V_s$, which is the net present value of immediate access to private goods. The value of these private goods increases as the coalition contracts, so coalition members value small coalition systems. As W expands these concentrated benefits are rapidly diluted as resources become shared by more people. However, as figure 1 shows, the coalition's payoff is non-monotonic in W . The sources of this non-monotonicity play a key role in institutional

change. In particular, two elements shape the welfare for members of W as the size of W increases.

When the coalition is small, private goods are divided among few people. Hence, private goods are highly concentrated and valuable. Although highly valuable, these private benefits are unlikely to continue to flow to the same people if the leader dies or is deposed. This loss is especially likely if W is small and S is large. As the size of the coalition increases private goods must be distributed to more people, diluting their value. However, as the coalition's size continues to increase the effects of dilution are gradually offset by the increased probability that a supporter will be included in future coalitions. This increase in the odds of inclusion forces the incumbent to spend a larger portion of revenue on keeping the coalition's loyalty. So, while the proportion of private rewards is falling (hence the preference of members of the coalition is to keep it as small as possible, provided, of course, that they remain in it), as W increases (holding S constant), the total spending on the coalition is rising, eventually rising enough to overtake the lost value of private gains. We also note that coalition payoffs are increasing in h . Assassination plots are unlikely to be hatched by coalition members.

Finally the incumbent's continuation payoffs are $V_L = V_L(W, S) = \left(\frac{R+\Psi-W}{1-\delta h} - S \frac{R-W}{S-h\delta W} \right)$. Leaders prefer small coalition, large selectorate systems. When the ratio W/S is small, the leader's incumbency constraint can be met at a lower cost relative to total revenue. Leaders prefer rigged, small W , large S systems in which competitors for power are strongly disadvantaged.

4 Political Threats

In addition to the selectorate threat just enumerated, leaders face threats from the masses who might rebel and from subsets of the winning coalition who might perpetrate a coup. We derive the nature of these threats, conditions under which they are most pertinent and what leaders can do about them. A leader's response comes in two form. First, she can shift policies to ameliorate the desire or ability of groups to remove her. Second, she can shift institutions, either contracting or expanding the coalition through purges and democratization respectively.

Our model shows that the possibility of deposition or institutional change by one group impacts the incentives of other groups. For instance, while coalition members might be happy with things the way they are under normal circumstances, if the masses threaten revolution, then elites might perpetrate a coup. To simultaneously model the competing risks and institutional changes in a tractable manner we consider deposition risks and shocks in the immediate period. After this initial period, political competition continues under the long run selectorate competition, as characterized in proposition 1.

We consider shocks at the beginning of the initial period that potentially intensify the political threats. In particular, we consider policy, budget and health shocks, $\Delta\varepsilon$, R_0 and h_0 . The policy shock $\Delta\varepsilon$ captures the idea that the incumbent's policy in a period differs substantially from normal and is added to the payoffs of the players in the initial period if the incumbent is retained. While such a policy shock could be related to any form of policy, one

simple interpretation of $\Delta\varepsilon$ is as an economic shock. If $\Delta\varepsilon < 0$, then the economy experiences a decline under the incumbent and all players suffer from the associated economic losses. A budget shock R_0 indicates change in an incumbent's access to resources in the initial period. A surplus or deficit of resources, for instance, could be due to an economic shock, sanctions or foreign aid.

Health shocks play an important role in precipitating political change. To model such effects, we denote the probability that the incumbent survives the mortality risk in the initial period as h_0 . Poor health, or a high risk of assassination, are reflected in a low value of h_0 .

Next we state a modified selectorate game that integrates shocks and choices over coups, revolutions, purges and democratization in the initial period. Detailed descriptions of these extra-normal risks follow. After the initial period there is long run selectorate competition under the institutional rules selected in the course of the initial period.

The modified game in period $t = 0$ is:

a) Players learn the policy shock $\Delta\varepsilon$, budget shock R_0 and health shock h_0 .
b) Subject to the budget constraint, the incumbent, foe and coup plotters offer policies consisting of allocations of public and private goods. In particular, the incumbent leader, \mathcal{L} , offers public policy g_L and private goods x_L to a coalition of W selectors drawn from the highest affinity selectors. Foe, \mathcal{F} , offers public goods g_F and private goods x_F to a coalition of size W that includes at least one member of the incumbent's coalition. The coup plotter, \mathcal{C} , offers public goods g_c and private goods x_c to a subset of W_c members of the winning coalition.

c) Selectors decide whether to support the incumbent \mathcal{L} or foe \mathcal{F} . If all members of the incumbent's coalition support \mathcal{L} , then the incumbent survives; otherwise \mathcal{F} becomes the new leader and the period ends with the revelation of \mathcal{F} 's affinities (see step h).

d) If the incumbent survives the selectorate threat, then the members of W_c decide whether to initiate a coup. If all members of W_c support the coup, then the coup succeeds, members of W_c pay a cost c and \mathcal{C} becomes the new leader, institutions become W_c and S_c and the period ends with the revelation of \mathcal{C} 's affinities (see step h).

e) The masses ($N - S$) decide whether to rebel.

f) If the masses rebel, then members of the coalition decide whether to suppress the revolution at a cost of σ . If all coalition members suppress, then the masses pay the cost $2k$ and the revolution succeeds with probability ρ , which, as described more fully below, depends upon public goods. If the revolution is not suppressed, then the masses pay a lower cost of k and the revolution succeeds³. The payoff for a successful revolution is θ for all the people and the game ends.

g) If the incumbent leader is in power, then she dies with probability $(1 - h_0)$. If the leader dies then a replacement leader is picked.

h) The affinity ordering of the leader in power is revealed and long-run selectorate competition proceeds under the final institutions, as described by proposition 1.

The basic description of the modified game form does not yet specify all the details.

³The consequential assumption is that suppressed rebellion is costlier than unsuppressed rebellion. The factor 2 is readily generalized to any value greater than 1

Below we provide these details and derive the nature of different political depositions. Given the large number of moving parts, we place some restrictions on conditions and we present each form of deposition separately and derive constraints that shape behavior in the overall game. We start by considering selectorate competition.

4.1 Selectorate competition

Subject to ensuring her survival, the incumbent's objective is to maximize her budget surplus, which given policies g_L and x_L and coalition size W is

$$\Lambda(g_L, x_L, W) = R_0 - qg_L - Wx_L$$

Supposing for the moment that the incumbent does not attempt to alter coalition size and she is retained, then the payoff to her supporters is

$$u(g_L) + x_L + \Delta\varepsilon + \delta(V_s + (1 - (1 - h_0)\frac{S - W}{S})Z) \quad (11)$$

This corresponds to the immediate rewards of g_L and x_L and the economic shock $\Delta\varepsilon$. Further, if retained, then the leader survives the health risk with probability h_0 and supporters anticipate their net present value from access to private goods in this case. Supporters compare this level of rewards with what they anticipate receiving from an alternative leader.

Borrowing extensively on the technology developed in the infinitely repeated game, the greatest credible offer a foe \mathcal{F} can make is

$$F = u(g_F^*) + x_F^* + \delta(\frac{W}{S}V_w + \frac{S - W}{S}V_s) = u(\frac{W}{q}) + \frac{R - W}{W} + \delta(V_s + \frac{W}{S}Z) \quad (12)$$

where $g_F^* = \frac{W}{q}$ and $x_F^* = \frac{R - W}{W}$ maximize $u(g_F) + x_F$ subject to the budget constraint.

Comparing (11) with (12) provides a constraint on the incumbent. If she intends to survive selectorate competition, then

$$select(g_L, x_L, W) = u(g_L) + x_L + \Delta\varepsilon - u(\frac{W}{q}) - \frac{R - W}{W} + \delta h_0 \frac{S - W}{S}Z \geq 0 \quad (13)$$

4.2 Coup

Coup plotters also seek to come to power. They propose new leadership and a shift in institutions to a subset of the winning coalition. In particular they propose new coalition and selectorate sizes W_c and S_c . Given the budget constraint, the maximum rewards that plotters can offer in the immediate period is $u(\frac{W_c}{q}) + \frac{R - W_c}{W_c}$ and perpetrating a coup costs its supporters c . In the long run, following a coup, institutions shift and the coup plotter's affinities are revealed. Under the coup's proposed institutions, supporters of the initial coup have a W_c/S_c chance of being retained in the post-coup coalition, which has a net present value of $V_W(W_c, S_c)$. With probability $(1 - W_c/S_c)$ initial supporters are reshuffled out of

the long run post-coup coalition. Hence, the largest expected reward a plotter can offer a potential supporter is

$$C = u\left(\frac{W_c}{q}\right) + \frac{R - W_c}{W_c} - c + \delta\left(\frac{W_c}{S_c}V_w(W_c, S_c) + \frac{S_c - W_c}{S_c}V_s(W_c, S_c)\right) \quad (14)$$

In order to attract supporters, a coup leader needs to pick institutions to maximize the expected benefits given by expression 14. This expression is decreasing in S_c ; hence for any sized W_c , a coup leader should minimize S_c , which functionally means setting $S_c = 2W_c$. With $S_c = 2W_c$ the derivative of expression 14 with respect to W is $\frac{-(2-\delta-h\delta)R+W_c(2-h\delta)}{W_c^2(1-\delta)(2-h\delta)}$, so expression 14 has a non-monotonic shape reminiscent of the U-shaped curve for V_W seen in figure 1 with a minimum at $W_c = \frac{R(2-\delta-h\delta)}{2-h\delta}$. A coup plotter maximizes the attractiveness of a coup by minimizing the winning coalition size of the post-coup institutions and setting $S_c = 2W_c$. Obviously a coup cannot succeed unless the combined strength of its supporters is sufficient to overcome resistance by the rest of the regime. Lacking an organizational theory of precisely how many supporters are needed for a coup to succeed we assume there is a minimum size for W_c . For simplicity we assume that at this number of supporters, a coup succeeds if supported by all those in W_c . To minimize notation let $V_{w_c} = V_w(W_c, S_c)$ and $V_{s_c} = V_s(W_c, S_c)$.

To survive against the threat of coup, the incumbent must offer her supporters more than they anticipate under a coup. A comparison of (11) with (14) yields

$$\begin{aligned} coup(g_L, x_L, W) &= u(g_L) + x_L + \Delta\varepsilon + \delta V_s + \delta(1 - (1 - h_0)\frac{S - W}{S})Z_W \\ &\quad - u\left(\frac{W_c}{q}\right) - \frac{R - W_c}{W_c} + c - \delta\frac{W_c}{S_c}Z_c - \delta V_{s_c} \geq 0 \end{aligned} \quad (15)$$

A necessary condition for internal leader survival is that, under institutions W , the incumbent's offer (11) is at least as large as the challenger's (12) and the coup plotter (14) offers:

$$Internal(g_L, x_L, W) = u(g_L) + x_L + \Delta\varepsilon + \delta(V_s + (1 - (1 - h_0)\frac{S - W}{S})Z) - \max\{C, F\} \geq 0 \quad (16)$$

where $C = u\left(\frac{W_c}{q}\right) + \frac{R - W_c}{W_c} - c + \delta\left(\frac{W_c}{S_c}V_w(W_c, S_c) + \frac{S_c - W_c}{S_c}V_s(W_c, S_c)\right)$ and

$F = u\left(\frac{W}{q}\right) + \frac{R - W}{W} + \delta(V_s + \frac{W}{S}Z)$. However, satisfying the selectorate and coup constraints is only a necessary condition for avoiding political deposition. Other threats, such as rebellion, cause supporters to re-evaluate their support of \mathcal{L} .

4.3 Rebellion

Consistent with the institutional preferences characterized earlier, the stated goal of revolution is to create an inclusive political system- that is create a large W system- that provides the public goods oriented policies that benefit everyone. However, rebels also have a private

motivation. They want membership in the winning coalition. Some revolutions, such as the American Revolution, succeed in their stated goal of inclusiveness. Yet many others, such as the French and Russian Revolutions, result in changed, but still autocratic, institutions. Given the great social and economic upheavals associated with revolutions and their great variety of outcomes, we treat the value of a successful revolution as θ for all members of society, whether they were previously coalition members, selectors or disenfranchised.

While the romantic version of a revolution involves the people storming the barricades, in reality many revolutions succeed because elites (and military elites in particular) desert the regime (Myerson 2008). When the masses rebel, coalition members choose whether to suppress the rebellion or sit on their hands. If coalition members desert the regime, then the revolution succeeds and the masses, selectors and former coalition members all receive payoff θ . If coalition members suppress the revolution (at cost σ), then the probability that the revolution succeeds is reduced to $\rho(g_L)$. With probability $(1 - \rho(g_L))$, the regime survives and the coalition members receive payoffs associated with the incumbent less the cost of suppression, σ . Comparing this payoff with θ yields that coalition members suppress rebellion if and only if

$$\text{suppress}(g_L, x_L, W) = -\sigma + (1 - \rho)(-\theta + u(g_L) + x_L + \Delta\varepsilon + \delta(V_S + (1 - (1 - h_0)\frac{S - W}{S})Z)) \geq 0 \quad (17)$$

We assume the probability of revolutionary success, $\rho(g_L)$, depends upon the level of public goods. Many public goods facilitate communication and coordination between potential revolutionaries (Bueno de Mesquita and Downs 2006). In their absence it is hard for would-be rebels to coordinate their actions against the government. We assume ρ is a monotonic continuous, twice differentiable function of public goods.

The masses' decision to rebel depends upon the coalition's willingness to suppress. If $\text{suppress}(g_L, x_L, W) \geq 0$, such that the coalition will suppress the rebellion, then the rebels decision depends upon a comparison of the expected value of revolution $-2k + \rho(g_L)\theta + (1 - \rho(g_L))(u(g_L) + \Delta\varepsilon + \frac{\delta}{1-\delta}u(g^*))$ and the masses payoff under the incumbent's rule $u(g_L) + \Delta\varepsilon + \frac{\delta}{1-\delta}u(g^*)$. The masses rebel only if $\text{rebel}S(g_L, W) < 0$, where

$$\text{rebel}S(g_L, W) = 2k + \rho(g_L)(u(g_L) + \Delta\varepsilon + \frac{\delta}{1-\delta}u(g^*) - \theta) \quad (18)$$

The constraint $\text{rebel}S(g_L, W)$ depends upon institutions as these shape the rewards the masses can expect in the future (through $g^*(W) = W/q$), and the current level of public goods, g_L .

In circumstances where the coalition would not suppress the revolution, $\text{suppress}(g_L, x_L, W) < 0$, rebellion succeeds and gives the masses a payoff of $\theta - k$. Comparing this payoff with their rewards under the incumbent's rule implies that when $\text{suppress}(g_L, x_L, W) < 0$ the masses rebel when

$$\text{rebel}NS(g_L, W) = k + u(g_L) + \Delta\varepsilon + \frac{\delta}{1-\delta}u(g^*) - \theta < 0 \quad (19)$$

Again this constraint depends on the long-run policies under institution W and the current rewards, g_L .

5 Politics absent rebellion

Here we characterize politics when there is no threat of rebellion and when leaders do not attempt to change institutions. In particular we characterize the subgame perfect equilibrium in weakly undominated strategies given that play in subsequent periods is characterized by proposition 1. Our first result examines the politically optimal mix of public and private goods to satisfy internal coalition constraints.

Lemma 2 *The policies that maximize budget surplus and satisfy (16) are $g_0 = \frac{W}{q}$ and*

$$x_0 = -u\left(\frac{W}{q}\right) - \Delta\varepsilon - \delta(V_s + (1 - (1 - h_0)\frac{S - W}{S})Z) + \max\{C, F\} \quad (20)$$

Proof. The incumbent's program is $\min_{g,x} qg + Wx$ subject to $u(g) + x + Y = 0$, where $Y = \Delta\varepsilon + \delta(V_s + (1 - (1 - h_0)\frac{S - W}{S})Z) - \max\{C, F\}$. Using standard constrained maximization techniques, we form a Lagrangian and characterize First Order Conditions: $L = qg + Wx + \lambda(u(g) + x + Y)$. The FOCs are $L_g = q + \lambda u_g(g) = q + \frac{\lambda}{g} = 0$, $L_x = W + \lambda = 0$, and $L_\lambda = u(g) + x + Y = 0$. L_x implies $\lambda = -W$, so L_g implies $q = \frac{W}{g}$ so $g = W/q$. Finally, L_λ ensures $x = -Y - u(g)$. The SOC (not shown) ensure this minimizes expenditures. ■

The policies g_0 and x_0 are just enough to buy the support of coalition members against foes and coup plotters.

Definition 3 *Given these policies, we define the institutions in which revolutionary threats exist as*

$$\mathcal{W}^{RT} = \{W : \text{either } (\text{suppress}(g_0, x_0, W) < 0 \text{ and } \text{rebelS}(g_0, W) < 0) \text{ or } \text{rebelNS}(g_0, W) < 0\} \quad (21)$$

Proposition 4 *If $W \notin \mathcal{W}^{RT}$ and $\Lambda(g_0, x_0, W) \geq 0$, then in the immediate period the incumbent \mathcal{L} proposes $g_L = g_0$, $x_L = x_0$, the incumbent survives political deposition (although they could die) and no revolution occurs.*

If $\Lambda(g_0, x_0, W) < 0$, then the incumbent cannot survive in office.

Proof. The leader's programming problem is $\max_{g_L, x_L} (R - qg_L - Wx_L)$ subject to $\text{select}(g_L, x_L) \geq 0$ and $\text{coup}(g_L, x_L) \geq 0$. From lemma 2, g_0 and x_0 solve this problem. Given that $W \notin \mathcal{W}^{RT}$, at these policies no revolution occurs. Provided these policies are feasible ($\Lambda(g_0, x_0, W) \geq 0$), the incumbent survives. If $\Lambda(g_0, x_0, W) < 0$, then the leader has insufficient resources to match the best possible offer of a coup plotter or foe and is deposed. ■

Next we examine how institutions shape a leader's ability to withstand shocks.

5.1 Political Impact of Shocks

Suppose there is no revolutionary threat and the selectorate constraint binds. The incumbent's budget surplus is $\Lambda(g_0, x_0, W) = R_0 - R + W\Delta\varepsilon + h_0\delta\frac{(R-W)(S-W)}{(S-h\delta W)}$. Standard calculus yields

Proposition 5 $\frac{d\Lambda(g_0, x_0, W)}{dW} = \Delta\varepsilon - h_0\delta\frac{RS(1-\delta h) + S(S-2W) + h\delta W^2}{(S-h\delta W)^2}$; $\frac{d\Lambda(g_0, x_0, W)}{d\Delta\varepsilon} = W$; $\frac{d\Lambda}{dR_0} = 1$;
 $\frac{d\Lambda(g_0, x_0, W)}{dh_0} = \delta\frac{(R-W)(S-W)}{(S-h\delta W)}$; $\frac{d^2\Lambda(g_0, x_0, W)}{dWh_0} = -\delta\frac{RS(1-\delta h) + S(S-2W) + h\delta W^2}{(S-h\delta W)^2} < 0$

When the coup constraint binds, the results are more complicated, but the intuitions are similar. The budget surplus is smaller in large coalition systems so leaders in such systems are more vulnerable to shocks. Although the impact of a budget shock ($R_0 < R$) is the same for all leaders, large coalition leader have less slack to compensate and so face a greater risk of being remove than their more autocratic counterparts. Policy shocks ($\Delta\varepsilon < 0$), such as economic loss due to a recession, is worse for large coalition leaders. Incumbents need to compensate each supporter for the policy loss. More supporters means more overall compensation. As the number of supporters rises the cost of this compensation can overwhelm an already tight budget for a large coalition leader. Only with respect to health shocks do large coalition leaders fare well compared to small coalition counterparts. As her health declines, the ability of an incumbent to promise future private goods diminishes. In large coalition systems private goods are relatively less important than in small coalition systems, so health scares diminish budget surpluses at a great rate in small than in large coalition systems.

Zimbabwe's Robert Mugabe exemplifies the relative resilience of small coalitions to shocks. Since becoming President in 1987 he has run the economy into the ground with seeming impunity. According to the World Bank's World Development Indicators between independence in 1980 and 2013 GDP has fallen from \$633 per head to \$430. He survives because he credibly delivers private goods to his supporters. However he is aging and his supporters must know he can't last forever. However currently he appears to defy his age. At his recent 90th birthday celebration, he appeared spritely and stated that "I feel as youthful and energetic as a boy of nine."⁴

Health concerns are also particularly important in triggering revolutionary threats in small coalition systems because they diminish the coalition's willingness to suppress rebellion. It is to the topic of rebellion that we now turn.

6 Politics in the Face of Rebellion

Rebellion requires both a desire for change from those outside the winning coalition and a means to implement such change. Shocks increase revolutionary pressures in several ways. Policy shocks reduce the masses' satisfaction with the regime, making revolutionary change relatively more attractive. Budget shocks harm a leader's ability to pay supporters to put

⁴<http://www.bbc.com/news/world-africa-26314918>

down rebellion. However, for small coalition leaders, health shocks are perhaps the greatest danger in terms of triggering rebellion. In 1979 the Shah of Iran fell because the military was no longer willing to suppress the masses. Similar fates befell Ferdinand Marcos in the Philippines in 1986 and Mobutu Sese Sese in Zaire 1997. Each had the same political problem; they were mortally ill and their supporters deserted them and refused to put down rebellion. Supporters are only prepared to suppress the masses when their interests are served by preserving the current regime. When the leader is sick, she can no longer promise access to future private goods⁵.

6.1 Revolutionary Threats and Coalition Concerns.

For pedagogical purposes, it is useful to examine the out of equilibrium policies g_0 and x_0 characterized in proposition 4. These policies are just sufficient to buy off selectorate and coup threats. Yet, when faced with a revolutionary threat, more rewards are required to retain support from coalition members; otherwise they depose the incumbent.

Lemma 6 *Suppose coalition members value extant institutions ($V_w > \theta$) and a revolutionary threat exists, $W \in \mathcal{W}^{RT}$; if the incumbent leader provides policies x_0 and g_0 , then either coalition members defect to \mathcal{F} or a coup occurs.*

Proof. If the incumbent sets $g_L = g_0$ and $x_L = x_0$ then $select(g_L, x_L, W) \geq 0$ and $coup(g_L, x_L, W) \geq 0$ and one of these constraints binds with equality. Suppose the former constraint binds, so $select(g_0, x_0, W) = 0$ implies that value of retaining \mathcal{L} is the same as the value of choosing \mathcal{F} , which is greater than θ : $u(g_0) + x_0 + \Delta\varepsilon + \delta(V_s + (1 - (1 - h_0)\frac{S-W}{S})Z) = u(\frac{W}{q}) + \frac{R-W}{W} + \delta(V_s + \frac{W}{S}Z) = V_w > \theta$, follows from equations (1) and (2). Supporters guarantee themselves at least V_w rewards (and more if the coup constraint binds) by deposing their leader. If they keep the leader, then given the revolutionary threat supporters' payoffs are either θ - if the revolution is not suppressed- or less than $V_w - \sigma$ (the latter payoff corresponds to the successful suppression of the revolt). Since revolution results in a lower payoff than deposition, the leader is deposed. ■

Absent a revolutionary threat, \mathcal{L} pays supporters just enough to prevent their defection to a coup plotter or foe. Such rewards are insufficient to keep them loyal when a rebellion arises because supporters will be required to suppress the masses to ensure the regime's survival. Unless \mathcal{L} pays the coalition more or removes the revolutionary threat, the incumbent's supporters are better off dumping her.

6.2 Policy Responses to Revolutionary threats.

Rebellion arise under two contingencies. First the masses rebel when they anticipate that coalition members won't stop them: $RebelNS(g_0, W) < 0$ and $suppress(g_0, x_0, W) < 0$.

$$\frac{5 \frac{d \text{suppress}(g_0, x_0, W)}{dh_0}}{dh_0} = (1 - \rho) \frac{\delta}{W} \frac{(S-W)(R-W)}{S-h\delta W} \text{ and}$$

$$\frac{d^2 \text{suppress}(g_0, x_0, W)}{dh_0 dW} = -(1 - \rho) \delta \frac{(S^2 - 2h\delta SW + h\delta W^2)R - SW^2(1-h\delta)}{W^2(S-h\delta W)^2}$$

Second, the can masses rebel even though they anticipate the coalition will suppress them: $rebelS(g_0, W) < 0$. Due to space considerations we focus here mainly on the former case and derive \mathcal{L} 's policy response. We outline the intuitions for the latter cases. These are similar to those developed in Bueno de Mesquita and Smith (2009, 2010) and Smith (2008), and so we consign the details of that analysis to the appendix.

6.2.1 Unsuppressed Revolutions

Figure 2 illustrates the onset of a revolution that is not suppressed. By unsuppressed, we mean that the revolutionary only occurs because the coalition is unwilling to suppress: $RebelNS(g_0, W) < 0 \leq rebelS(g_0, W)$ and $suppress(g_0, x_0, W) < 0$. The thick solid line plots $suppress(g_0, x_0, W)$ against coalition size. It is reminiscent of the U-shaped V_w curve seen in figure 1. This similarity is unsurprising since $suppress$ is effectively $V_w - \theta$ multiplied by $(1 - \rho)$ and minus σ . The $(1 - \rho)$ term flattens the right tail of $V_w - \theta$ because public goods increase as W increases. This reduces the chance that the regime survives the rebellion. Provided that $suppress$ is positive (and $rebelS(g_0, x_0, W) \geq 0$) the masses do not rebel as they anticipate suppression. In figure 2, when the coalition is smaller than \underline{W} , there is no revolutionary threat. In such small coalitions supporters strongly value the regimes continuance and, once suppressed, the rebellion is unlikely to succeed.

The thick dashed line plots the increasing curve $rebelNS(g_0, x_0, W)$, which is the value of rewards from the incumbent less the value of revolution (θ) and the cost of revolution (k). Leaders in large coalition systems generate lots of the public goods that the masses value: the people have no desire to rebel even if they are certain to succeed. In figure 2, once coalition size is above \bar{W} , there is no revolutionary threat as the masses do not want to rebel even though they would certainly succeed. At intermediate values of W between \underline{W} and \bar{W} , if the leader simply provided the policies that satisfy the internal coalitional constraints (g_0, x_0) , then the masses would rebel and so the coalition would preemptively depose her.

Revolutionary threats force leaders to either work harder to provide their supporters with additional rewards such that they value the continuance of the regime sufficiently that they are willing to suppress the revolution or to buy off the masses such that they no longer wish for revolutionary change. That is to say, to survive the incumbent needs to shift policy such that either $suppress(g_L, x_L, W) \geq 0$ or $rebelNS(g_0, W) \geq 0$.

Given $suppress(g_0, x_0, W) < 0$, $rebelNS(g_0, W) < 0$ and $rebelS(g_0, W) > 0$, let

$$g_1 = \frac{W}{q + \frac{\rho g(g_1)W\sigma}{(1-\rho(g_1))^2}} \text{ and } x_1 = \frac{\sigma}{1 - \rho(g_1)} + \theta - u(g_1) - \Delta\varepsilon - \delta V_S - \delta(1 - (1 - h_0)\frac{S - W}{S})Z$$

and $g_2 = e^{(\theta - k - \Delta\varepsilon - \frac{\delta}{1-\delta}u(g^*))} > g_0$ and $x_2 = -\theta + \frac{\delta}{1-\delta}u(g^*) + k - \delta(V_s + (1 - (1 - h_0)\frac{S - W}{S})Z) + \max\{C, F\}$

Proposition 7 *Consider the revolutionary threat where $suppress(g_0, x_0, W) < 0$, $rebelNS(g_0, W) < 0$ and $rebelS(g_0, W) > 0$ and $rebelS(g_1, W) \geq 0$. The incumbent leader sets policy to either (g_1, x_1) or (g_2, x_2) .*

Corollary 8 $g_1 < g_0$ and $x_1 > x_0$ and $g_2 > g_0$. If $\max\{\Lambda(g_1, x_1, W), \Lambda(g_2, x_2, W)\} < 0$, then there are no policies that enable leader survival at coalition size W . The policies (g_1, x_1) and (g_2, x_2) reduce the budget surplus relative to (g_0, x_0) : $\Lambda(g_0, x_0, W) > \Lambda(g_1, x_1, W), \Lambda(g_2, x_2, W)$.

Proof. To guarantee survival in office, the incumbent needs to pick policies x_L, g_L such that, in addition to $select(g_L, x_L, W) \geq 0$ and $coup(x_L, g_L, W) \geq 0$, she must satisfy either ($suppress(g_L, x_L, W) \geq 0$ and $rebelS(g_L, W) \geq 0$) or $rebelNS(g_L, W) \geq 0$. There are two solutions to this problem. First, satisfy $suppress(g_L, x_L, W) \geq 0$ and, second, satisfy $rebelNS(g_L, W) \geq 0$. That is, raise costs and reduce public goods provision to hinder coordination among rebels or expand public goods to reduce the incentive among the masses to rebel. We consider each in turn:

Case 1: The incumbent's programming problem is $\max_{x_L, g_L} R_0 - qg_L - Wx_L$ subject to $Suppress(g_L, x_L, W) \geq 0$. Using standard constrained maximization techniques, we form a Lagrangian and find First Order Conditions (throughout we omit the SOC):

$L = R_0 - qg_L - Wx_L + \zeta_1(-\sigma + (1 - \rho(g_L))(-\theta + u(g_L) + x_L + \Delta\varepsilon + \delta V_S + \delta(1 - (1 - h_0)\frac{S-W}{S})Z))$
FOCs : $L_{\zeta_1} = 0$ implies $-\sigma + (1 - \rho(g_L))(-\theta + u(g_L) + x_L + \Delta\varepsilon + \delta V_S + \delta(1 - (1 - h_0)\frac{S-W}{S})Z) = 0$, $L_{g_L} = -q + \zeta_1((1 - \rho(g_L))u'(g_L) + -\zeta_1\rho_g(g_L)(-\theta + u(g_L) + x_L + \Delta\varepsilon + \delta V_S + \delta(1 - (1 - h_0)\frac{S-W}{S})Z)) + \zeta_2u'(g_L) = 0$ and $L_{x_L} = -W + \zeta_1((1 - \rho(g_L)) + \zeta_2) = 0$. From L_{x_L} , $\zeta_1 = \frac{W}{1 - \rho(g_L)}$ and from L_{ζ_1} , $(-\theta + u(g_L) + x_L + \Delta\varepsilon + \delta V_S + \delta(1 - (1 - h_0)\frac{S-W}{S})Z) = \frac{\sigma}{1 - \rho(g_L)}$. Therefore we write L_{g_L} as

$$L_{g_L} = -q + \frac{W}{g_L} - \frac{\rho_g(g_L)W\sigma}{(1 - \rho(g_L))^2} = 0$$

which implies $g_L = \frac{W}{q + \frac{\rho_g(g_L)W\sigma}{(1 - \rho(g_L))^2}}$ and $x_L = \frac{\sigma}{1 - \rho(g_L)} + \theta - u(g_L) - \Delta\varepsilon - \delta V_S - \delta(1 - (1 - h_0)\frac{S-W}{S})Z$.

These are the solutions labelled g_1, x_1 .

Case 2: Suppose instead the incumbent improves the masses' payoffs so they do not rebel ($rebelNS(g_L, W) \geq 0$) and pays the coalition enough to maintain its loyalty ($select(g_L, x_L, W) \geq 0$ and $coup(x_L, g_L, W) \geq 0$). Again we form a Lagrangian and show the FOC: $L = R_0 - qg_L - Wx_L + \zeta_2(k + u(g_L) + \Delta\varepsilon + \frac{\delta}{1 - \delta}u(g^*) - \theta) + \zeta_3(x_L + u(g_L) - X)$ with FOC $L_{\zeta_2} = (k + u(g_L) + \Delta\varepsilon + \frac{\delta}{1 - \delta}u(g^*) - \theta) = 0$, $L_{\zeta_3} = (x_L + u(g_L) - X) = 0$, $L_{g_L} = -q + \zeta_2(u'(g_L)) + \zeta_3(u'(g_L)) = -q + \frac{\zeta_2}{g_L} + \frac{\zeta_3}{g_L} = 0$ and $L_{x_L} = -W + \zeta_3 = 0$. From L_{x_L} , $\zeta_3 = W$ and from L_{ζ_2} , $g_L = e^{(\theta - k - \Delta\varepsilon - \frac{\delta}{1 - \delta}u(g^*))}$ and $x_L = X - u(g_L)$. We label these solutions g_2 and x_2 . ■

An incumbent has two approaches to ameliorating revolutionary threats. First she can incentivize supporters to suppress the revolution (so the masses do not want to rise in the first place) by increasing private rewards and contracting public goods. The logic for contracting public goods as part of this response is that it reduces the ability of the masses to coordinate and, since this enhances the coalition's chance of success, it incentivizes them to suppress rebellion. Second, the incumbent can expand public goods such that even though the masses could succeed their demands are satiated.

Figure 2 indicates the expenditures associated with each response to rebellion. The relatively flat dot-dashed line labeled $R_0 - qg_0 - Wx_0$ shows the incumbent's budget surplus absent a revolutionary threat. The decreasing dotted line labeled $R_0 - qg_1 - Wx_1$ plots the

budget surplus associated with enriching the coalition to incentivize them to suppress revolt. When $W < \underline{W}$ no revolutionary threat exists because the coalition puts down any rebellion. As coalition size increases above \underline{W} , the incumbent deters revolt by a contraction of public goods and an increase in private rewards such that coalition members suppress revolt. However, if W increases beyond \underline{W}' , $R_0 - qg_1 - Wx_1$ is negative, indicating that the incumbent needs to provide more goods than she can afford in order to sustain herself in office. At this point, deposition becomes unavoidable.

The second response to an unsuppressed revolutionary threat is to buy off the masses with additional public goods that reduces their desire for institutional change. On the right hand side of Figure 2 the increasing dotted line labeled $R_0 - qg_2 - Wx_2$ illustrates the budget surplus associated with this approach. When W is greater than \bar{W} , the incumbent's policies for paying off the coalition already provide enough public goods to buy off the citizens. However, as W shrinks below \bar{W} , the incumbent's needs to increase the public goods supply to reduce the masses' desire for revolutionary change. Unfortunately for her, once coalition size is below \bar{W}' , the incumbent needs to provide more public goods to buy off the revolutionary threat than she can afford and she cannot avoid deposition.

Thusfar we have considered revolutions that take place because the coalition is unwilling to suppress rebellion. However, revolutions can occur even if the coalition is willing to suppress rebels: $rebelS(g_0, W) < 0$ and $suppress(g_0, W) \geq 0$. As above, the incumbent has two basic strategies. First, she can contract the public goods supply. Such actions further intensify the masses' desire for change, but undermines their ability to enact change as the probability of revolutionary success is reduced by the contraction of g . Second, a leader can buy off the masses' demands by providing them with more public goods. We provide more detail in the appendix.

Policy responses to both forms of revolutionary threat face a credibility problem, similar to that identified by Acemoglu and Robinson's (2005) results. The incumbent might be willing to offer her supporters more to buy their support or improve public goods provision to satisfy the demands of the masses. However, the budget constraint means that she can only do so much in a single period, and often this is insufficient to avert revolt. Hence without an ability to commit to a long term shift in policy priorities, leaders may be unable to quash a large revolutionary threat. Institutional changes enable just such commitments to changes in long run policy and may provide leaders a way out of their predicament.

7 Counter-Maneuvers: Leader Initiated Institutional Change

Besides altering policy allocations to thwart threats, leaders can also initiate shifts in political institutions. Such shifts may induce new long term changes in allocations of public and private goods. Leader inspired institutional shifts are motivated by a desire to ameliorate political threats and enhance leader welfare. Any improvement in societal or coalition welfare is purely coincidental. In particular, in stage (b) of the immediate period, instead of simply

proposing public and private policies, the incumbent can also propose a purge to create a coalition of size W_p or an expansion of the coalition to size W_E . For brevity we assume the selectorate size remains fixed but note that given their druthers leaders want to increase S and that, by contracting S relative to W , leaders can commit to work harder for their supporters and deliver larger private goods in the future.

Whether \mathcal{L} 's proposed changes are adopted depends upon the choices of supporters, as we detail below. The new institutions are only adopted if the new coalition (with either fewer or more supporters) backs the incumbent rather than backing foe or coup plotter. In principle, a leader might propose any institutions. However, guided by what has proceeded we focus on simple changes to W .

1) Purge: \mathcal{L} proposes a purge, such that $W_p = jW$, where $j < 1$. If the purge takes place, then the incumbent pays an organizational cost o and the retained coalition members pay a cost v associated with the effort, and no doubt unpleasantness, of purging former colleagues and friends. We assume supporters of the purge are retained in the leader's post-purge long-term coalition with probability J .

2) Expansion: \mathcal{L} proposes a coalition increase: $W_E = \varphi W$ where $\varphi > 1$. In the extreme, expansions in coalition size result in democratization. Given the expansion of the coalition, we assume all supporters in the initial coalition expect to be retained in the larger coalition (in the terminology developed for purges, we might refer to this as $J = 1$). Again we assume the organizational cost of o for leaders.

In order to construct examples we use $j = .5$ and $\varphi = 2$; that is a halving or doubling of winning coalition size.

7.1 When leader led institutional changes are likely and feasible.

In addition to basic institutional preference considerations, a major factor in determining support for institutional change is the prospects of inclusion or exclusion in future coalitions, and on this dimension the leader is advantaged over challengers. Following selectorate de-position, selectors have a W/S chance of inclusion in the new leader's long term coalition. The comparable probability following a coup is $W_c/S_c = 1/2$. A purge involves a subset of the incumbent's highest affinity supporters. Therefore those supporters invited to join the purge have a high probability of being retained in the long run coalition, probability J in the model. Of course some subsequent reshuffles might occur. For instance, Nikolai Yezhov, the architect of Stalin's Great Purge, was eventually replaced. However, for Yezhov the prospects of being a core supporter under alternative leadership was probably extremely remote, so he could probably do no better than stick with Stalin. This is a key advantage the incumbent has over outside bids to contract the winning coalition such as arise with coups. Expansion of the coalition increase the number of supporters, making retention of initial coalition members highly likely.

First we examine purges and expansions in the absence of revolutionary threats before showing how the prospects of rebellion enhance a leader's desire for institutional change. As in the original model the maximum that a foe can offer is $F = u(\frac{W}{q}) + \frac{R-W}{W} + \delta(\frac{W}{S}Z + V_s)$

and the maximum a coup plotter can offer is $C = u(\frac{W_c}{q}) + \frac{R-W_c}{W_c} - c + \delta(\frac{W_c}{S}Z_c + V_{s_c})$.

If the incumbent proposes a purge and policies g_P and x_P , then her reduced coalition will only retain her if

$$u(g_P) + x_P - v + \Delta\varepsilon + \delta(h_0JZ_P + (1 - h_0)\frac{W_j}{S}Z_P + V_{s_P}) \geq \max\{F, C\} \quad (22)$$

where $V_{S_P} = V_s(W_j, S) = \frac{\delta}{1-\delta}\frac{R-W_j}{S-h\delta W_j}(1-h) + \frac{1}{(1-\delta)}\ln\frac{W_j}{q}$ and $Z_P = Z(W_j, S) = \frac{1}{W_j}\frac{S(R-W_j)}{S-h\delta W_j}$. If the incumbent proposes an expansion and policies g_E and x_E , then her coalition will only retain her if

$$u(g_E) + x_E + \Delta\varepsilon + \delta(h_0Z_E + (1 - h_0)\frac{W_\varphi}{S}Z_E + V_{s_E}) \geq \max\{F, C\} \quad (23)$$

where $V_{S_E} = V_S(W_\varphi, S) = \frac{\delta}{1-\delta}\frac{R-W_\varphi}{S-h\delta W_\varphi}(1-h) + \frac{1}{(1-\delta)}\ln\frac{W_\varphi}{q}$ and $Z_E = Z(W_\varphi, S) = \frac{1}{W_\varphi}\frac{S(R-W_\varphi)}{S-h\delta W_\varphi}$

In the absence of revolutionary threats the following policies accompany L 's institutional choice (the proof is analogous to that in proposition 4).

Proposition 9 *Suppose there are no revolutionary threats. If the incumbent retains the extant institutions, then she proposes $g_L = g_0$ and $x_L = x_0$. Provided that $qg_0 + Wx_0 \leq R_0$, she survives politically and her expected payoff is $\Psi + R_0 - qg_0 - Wx_0 + \delta h_0 V_L(W, S)$.*

If the incumbent proposes a purge, then she proposes $\hat{g}_P = \frac{W_P}{q}$ and \hat{x}_P is the lowest level of private goods that solves equation 22. Provided that $q\hat{g}_P + W_P\hat{x}_P \leq R_0$, she survives politically and her expected payoff is $\Psi + R_0 - q\hat{g}_P - W_P\hat{x}_P - o + \delta h_0 V_L(W_P, S_P)$.

If the incumbent proposes an expansion, then she proposes $\hat{g}_E = \frac{W_E}{q}$ and \hat{x}_E is the smallest value that solves equation 23. Provided that $q\hat{g}_E + W_E\hat{x}_E \leq R_0$, she survives politically and her expected payoff is $\Psi + R_0 - q\hat{g}_E - W_E\hat{x}_E - o + \delta h_0 V_L(W_E, S_E)$.

The incumbent proposes the institutions that maximize her expected payoff.

While proposition 9 characterizes policies and institutional choice, it provides little intuition as to leader and coalition incentives. As seen in figure 1, leaders prefer small coalition to large coalition systems. Figure 3 shows the long run rewards of purges and expansions relative to extant institutions for leaders and coalition members. The horizontal axis of the graph examines extant coalition size W and the vertical axis plots the long run rewards of a purge relative to extant institutions and an expansion relative to extant institutions. The purge considers a halving of current W and the expansion considered is a doubling of current W (assuming S remains fixed). Hence the solid line labeled L:Purge shows $V_L(W/2, S) - V_L(W, S)$ and the solid line labeled L:Expand shows $V_L(2W, S) - V_L(W, S)$. As the figure clearly shows, in the long run a purge improves the leader's welfare while an expansion in coalition size harms the leader's long term interests.

A leader can not just impose her desired institutions; she requires supporters to go along with them. If her supporters do not like her proposed institutional changes, then they can back an alternative and depose the leader. Whether supporters go along with the purge depends upon how much the leader pays them in the current period and the long run benefits of the leader-induced institutional change.

Figure 3 also shows the long run benefits of purge and expansion for supporters (although the scale is different to that for leaders). Consider a purge that retains jW of the original supporters and expels the other $(1 - j)W$ initial supporters. Obviously, coalition members expelled do not support such a purge. Whether those supporters who are retained continue to support the incumbent depends upon whether the rewards in the immediate period, $u(g_P) + x_P + \Delta\varepsilon - v$, and expected long run rewards, $\delta(h_0JZ_P + (1 - h_0)\frac{Wj}{S}Z_P + V_{s_P})$, are greater than they could expect from foe or coup plotter, $\max\{F, C\}$. The downward sloping lines labeled W:Purge in figure 3 show the differences in the expected long run rewards for a coalition member from supporting the purge ($j = 1/2$) versus supporting the incumbent under the extant institutions: $\delta(h_0JZ_P + (1 - h_0)\frac{Wj}{S}Z_P + V_{s_P}) - \delta(h_0Z + (1 - h_0)\frac{W}{S}Z + V_s)$. The dashed lines correspond to instances where the leader is healthy (high h_0), while the dotted lines indicate sick leaders (low h_0). The upward sloping dotted and dashed curves labeled W:Expand plot the corresponding comparisons for the relative long run value of coalition expansion ($\delta(h_0Z_E + (1 - h_0)\frac{W}{S}Z_E + V_{s_E}) - \delta(h_0Z + (1 - h_0)\frac{W}{S}Z + V_s)$).

If a purge occurs, then in future periods leaders focus on private goods. It is the prospect of these concentrated private benefits that make purges attractive to supporters, especially when W is already reasonably small. Yet, supporters fear reshuffles and leader death. After a purge there are few public benefits and supporters have a reduced chance of being included in future coalitions ($\frac{W_P}{S} < \frac{W}{S}$). If the leader is sickly (low h_0) or likely to reshuffle the coalition after the purge (low J), then supporters are likely to lose future access to private goods. Therefore, they oppose a purge. Figure 3 shows the impact of health. The dashed line, W: Purge, Healthy, shows that when coalition size is initially relatively small, a purge increases a supporter's long run benefits. However, if the leader is sickly or expected to reshuffle, then purges are less attractive, shown by the dotted line. It therefore follows that vibrant healthy leaders who are well established in office (i.e. affinity revealed and J close to 1) can most effectively purge. This was certainly the case in Uganda under Idi Amin, in Zimbabwe under Robert Mugabe, the Great Purges in Russia under Stalin and in China under Mao. In each case the leader waited several years before initiating the purge and all the purges petered out as the leaders aged.

When the initial coalition is large, purges are highly attractive to leaders as they make subsequent survival easier, but they are unattractive to supporters. The resulting institutions have not contracted W enough to generate concentrated private benefits and serve mainly to reduce the leader's future effort on behalf of the coalition while also reducing the prospects of public benefits in the future. To induce enough supporters in a large W system to go along with a purge requires the leader to greatly increase payoffs in the immediate period. Since there are many supporters who need additional immediate rewards it is unlikely that a leader has sufficient resources or incentive to do so.

Comparing equations 20 and 22, to gain support for a purge the incumbent must increase private spending on each of the Wj coalition members who have been retained by

$$x_P - x_0 \geq u\left(\frac{W}{q}\right) - u\left(\frac{Wj}{q}\right) + v - \delta(h_0JZ_P + (1 - h_0)\frac{Wj}{S}Z_P + V_{s_P}) + \delta(h_0Z + (1 - h_0)\frac{W}{S}Z + V_s)$$

The final two terms represent the difference in long run rewards, v reflects the unpleasantness of purging colleagues for which supporters require compensation and $u(\frac{W}{q}) - u(\frac{Wj}{q})$ is the level of extra private goods required to compensate for the decline in public goods. The incumbent can enact a purge only if $Wjx_p + Wj \leq R_0$ and she only wants to enact such a purge if $R_0 - Wjx_p - Wj - o + \delta h_0 V_L(Wj, S) \geq R_0 - Wx_L - W + \delta h_0 V_L(W, S)$. Healthy leaders can more readily elicit support for a purge than sickly leaders. They also have the greater interest in implementing a purge. For a sickly leader, expansions are more feasible and more desirable.

In the long run \mathcal{L} prefers small coalitions to large. However, for a sickly leader the future is relatively less important than the present and the leader might prefer to increase her budget surplus today even though tomorrow it makes survival harder. Further, when leaders are sickly, expansions become relatively more attractive for supporters than purges since an expansion reduces the risk and costs of being outside the coalition. By expanding the coalition \mathcal{L} commits herself and future leaders to increased public goods, something that is highly salient to coalition members when the leader is sick.

Leader health shapes the direction of leader-led institutional shifts. Healthy, vibrant leaders are likely to purge. In contrast, an elderly or sickly leader is likely to democratize. These differences are not driven by social consciousness or humanitarian goals. Instead they are the actions that enhance survival under different contingencies.

8 Leader Inspired Institutional Change Under Revolutionary Threats

Revolutionary threats reinforce the incentives for purge and expansion. We start by comparing the impact of purges and expansions with the policy shifts required to address revolutionary threats. As described in proposition 7, leaders have two response to revolutionary threats. Leaders can contract public goods, making revolution harder, and pay their supporters enough that they remain loyal and suppress any revolution or leaders can expand public goods to satiate the masses' desires. Unfortunately for leaders, taking these actions reduces their payoff in the immediate period and, because they can only shift so many rewards in a single period, they cannot always remove the revolutionary threat. Institutional change can help solve this commitment problem.

The logic of how revolutionaries can encourage leaders to implement institutional change is readily seen graphically by referring back to figure 2. Faced with the revolutionary threat characterized in figure 2, and absent institutional change, leaders of coalition systems between \underline{W}' and \overline{W}' cannot survive and are deposed. By contracting the coalition, \mathcal{L} commits to enrich her coalition in future periods. By expanding the coalition, \mathcal{L} commits greater public goods in the future. Such commitments to future policy allow her to either buy the support she needs from her coalition or to satiate the masses' desires. Although, absent a revolutionary threat, a purge or an expansion might be an inferior choice compared to extant institutions, if a revolutionary threat develops, then the leader will be removed if she does not change

institutions.

Suppose \hat{x}_p and \hat{x}_E are as defined in proposition 9 and let \hat{x}_p solve $suppress(\frac{W_p}{q}, \hat{x}_p, W_p) = 0$. We examine the case where $\underline{W}' < W < \overline{W}'$ (i.e. $suppress(g_L, x_L, W) < 0$, $rebelS(g_0, W) \geq 0 > rebelNS(g_0, W)$, $R_0 < qg_1 + Wx_1$ and $R_0 < qg_2 + Wx_2$, and so the leader is removed under the extant institutions). Consider a purge, $W_p \leq \underline{W}$ such that $rebelS(\frac{W_p}{q}, W_p) \geq 0$, and an expansion $W_E \geq \overline{W}$ such that $rebelNS(\frac{W_E}{q}, W_E) \geq 0$.

Proposition 10 *If $R_0 \geq W_p + W_p x_p^\dagger$, where $x_p^\dagger = \max\{\hat{x}_p, \hat{x}_P\}$, then having proposed a purge, the incumbent offers policy $g_p = W_p/q$ and x_p^\dagger and survives politically. If $R_0 \geq W_E + W_E \hat{x}_E$, then having proposed an expansion, the incumbent offers policy $g_E = W_E/q$ and \hat{x}_E and survives politically. If both policies permit political survival, then the leader proposes purge if $R_0 - W_p x_p - W_p - o + \delta h_0 V_L(W_p, S) > R_0 - W_E x_E - W_E - o + \delta h_0 V_L(W_E, S)$ and she proposes an expansion if the inequality is reversed.*

Proof. Consider the purge case. If a rebellion occurs, then the reduced coalition suppresses only if $suppress(g_p, x_p, W_p) \geq 0$. Given the coalition will suppress, the masses do not rebel by $rebelS(\frac{W_p}{q}, W_p) \geq 0$. If $suppress(g_p, x_p, W_p) < 0$ then the coalition will not suppress and the rebellion occurs and succeeds. Hence unless $suppress(g_p, x_p, W_p) \geq 0$ the leader is removed. A retained coalition member defects to an alternative leader or a coup plotter unless equation 22 holds. The incumbent's programming problem is $\max_{g_p, x_p} R_0 - qg_p - W_p x_p$ subject to $suppress(g_p, x_p, W_p) \geq 0$ and 22. Using the standard constrained maximization techniques used earlier, efficient spending ensures $g_p = \frac{W_p}{q}$, and the leader provides just enough private rewards to satisfy both constraints.

In the case of an expansion, satisfying equation 23 and minimizing expenditure implies $g_E = W_E/q$ and \hat{x}_E . These policies dissipates the revolutionary threat by $rebelNS(\frac{W_E}{q}, W_E) \geq 0$. ■

The logic behind proposition 10 is shown in figure 2. With respect to a purge consider a system with W such that $W_j < \underline{W} < \underline{W}' < W < \overline{W}'$. Absent institutional change the leader in such a system is removed. However, if the purge shifts coalition size sufficiently then the concentration of private benefits motivates the retained supporters to suppress any rebellion and therefore the rebellion is deterred. Absent a revolutionary threat, such a shift might well necessitate the leader to spend more in the immediate period, and hence not to be in the leader's interest. However once the threat arises the leader is sunk without institutional change. The logic is similar for expansions. If W is less than \overline{W}' (and $W > \underline{W}'$), then \mathcal{L} cannot provide enough public goods in the immediate period to buy off the masses. However, expanding the coalition commits her to future public goods provisions. If expansion pushes the coalition size beyond \overline{W} , then the revolutionary threat dissipates because the masses no longer want to rebel even though they would succeed if they did.⁶ The logic behind purges

⁶The proposition examines the case where institutional shifts fully remove the revolutionary threat. However, we might imagine cases where a purge to $W_p \in (\underline{W}, \underline{W}')$ combined with a distortion in policies, as per proposition 7, enables the leader to survive. Similar, if an expansion leaves W_E between \overline{W}' and \overline{W} , then the leader might be able to satiate the masses, partly by the commitment to long run increase

and expansions for leaders facing a suppressed revolutionary threat are similar and explored in the appendix.

9 Conclusions

We have proposed a selectorate model that demonstrates how each domestic threat to leadership survival interacts to prompt choices over government policies; that is, provision of public and private goods, and also choices over governance institutions; that is, whether to democratize or become more autocratic through purges. Additionally we have identified theoretically how these choices are shaped by shocks to a leader's health, economic performance, and available budget. The model captures many intuitive results but also identifies a large number of previously unidentified hypotheses. For instance, the model indicates that healthy leaders who face a credible revolutionary threat are particularly likely to purge members of their winning coalition, shrink public goods provision and increase dependence on private goods expenditures while sickly or elderly (age being a terminal illness) leaders facing the same threat of rebellion are expected to democratize by expanding their winning coalition and improve public goods provision. Similarly, the model indicates that assassins are expected to be disproportionately drawn from the selectorate rather than from the disenfranchised or from members of the winning coalition. This turns out to mean that the risk of assassination efforts is greater in small selectorate systems, such as military dictatorships and monarchies, than in democracies or rigged-election autocracies such as exist in China or North Korea. Indeed, there is also a significant risk, within the modeling logic, that observers such as journalists, may mis-identify assassinations as coups d'etat.

The model identifies the conditions that are expected to lead to coups, to mass rebellion and to the suppression of such rebellions. It also highlights the circumstances under which incumbent leaders can thwart these threats and when they cannot. The model instructs us, unsurprisingly, that all leaders are harmed by declines in their health, by economic downturns, and by unexpectedly limited revenue streams. Less obviously, the model also demonstrates that economic shocks are much more dangerous for democratic leaders than for autocratic incumbents while health shocks disproportionately increase the risk of coups and rebellions for autocrats compared to democrats. Indeed, the model indicates that democracies are, as others have observed empirically, almost immune to threats of revolution and coup. This finding poses a challenge to Marxist theory in which market-economies (which are often found in large coalition, democratic environments) are expected inevitably to face a revolution.

Much remains to be done in devising careful empirical tests of the model's implications. That will be the work to which we, and we hope others, will now turn.

in public goods through coalition expansion and partly by the offer of more immediate public goods. Such institutional shift might not have been in the leader's interests without a revolutionary threat, but in the presence of rising mass discontent it becomes essential to survival.

10 Figures

Figure 1: Preferences Over Institutions: Continuation Values and W

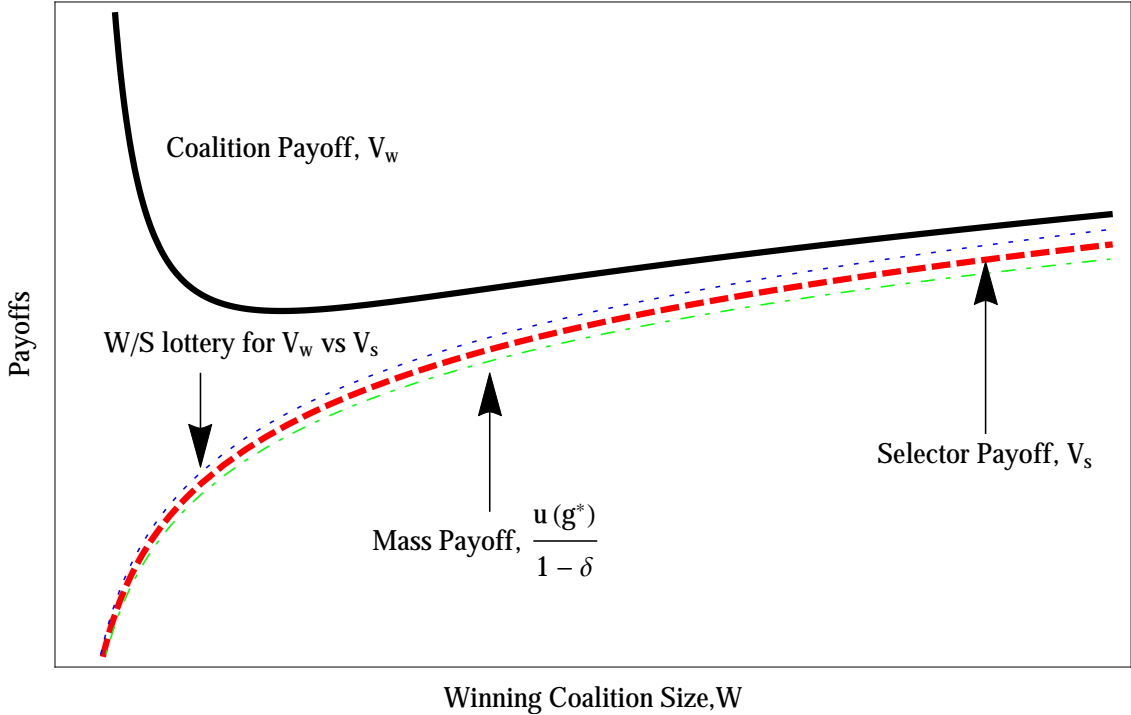


Figure 2: Unsuppressed Revolutionary Threats

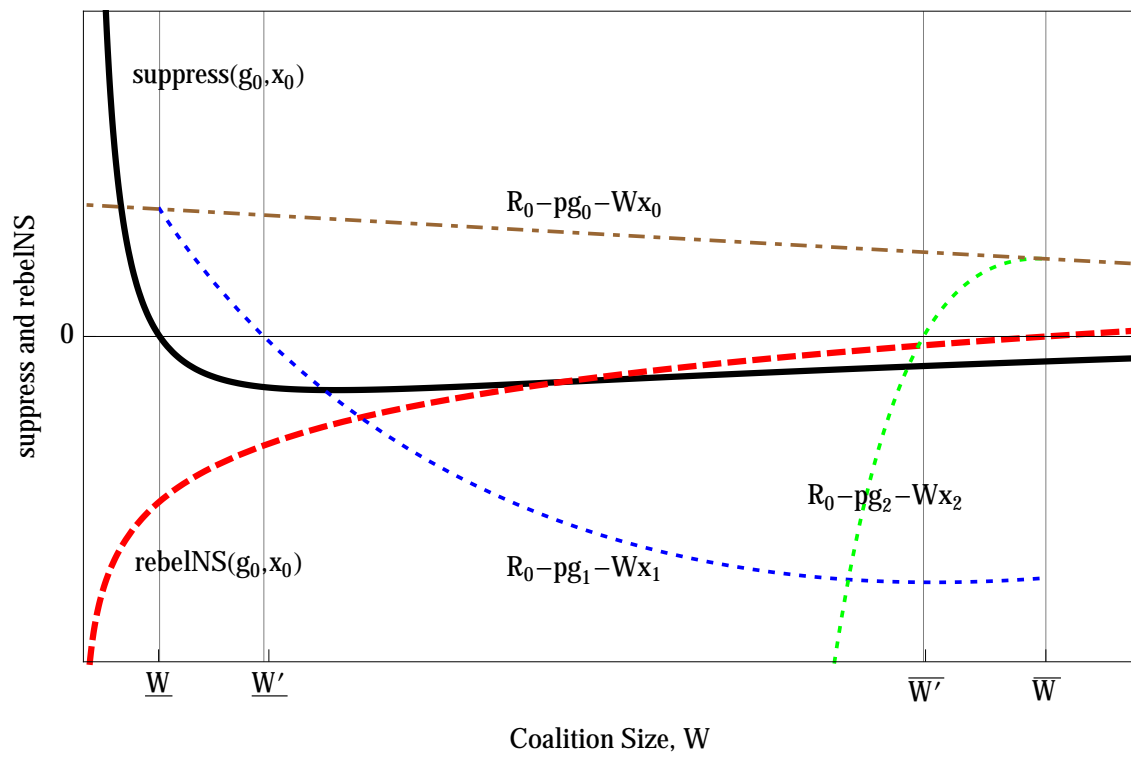
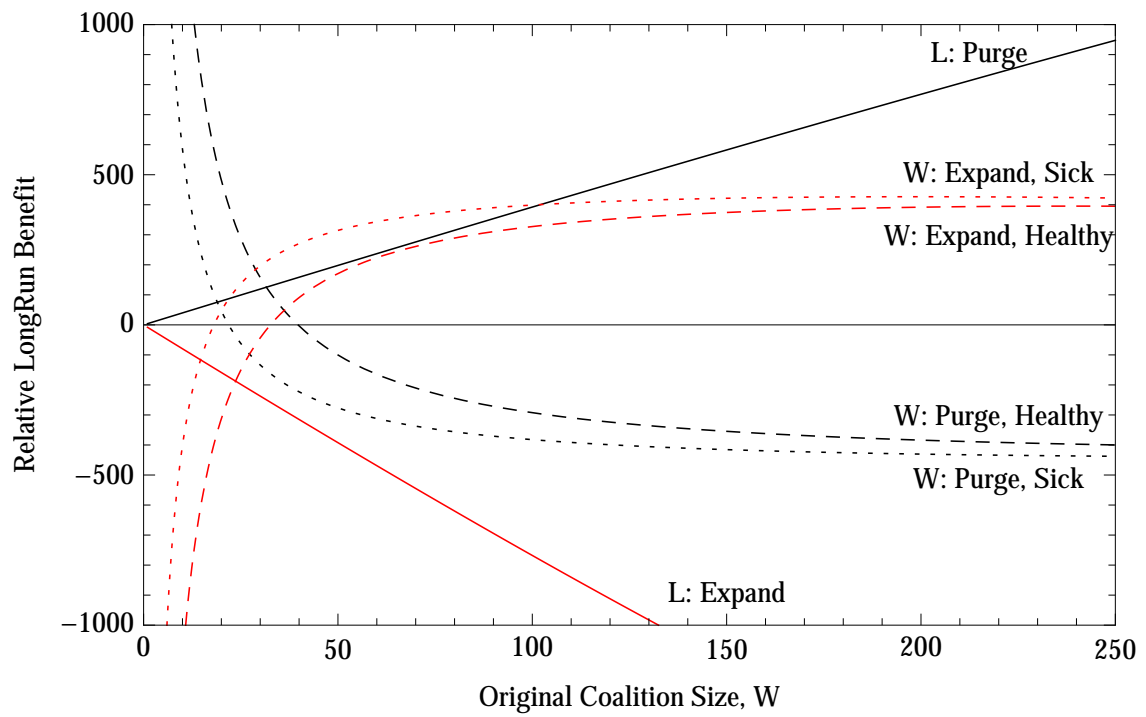


Figure 3: Long-run Incentives for Purges and Expansion



11 References

Acemoglu, Daron and James Robinson (2001), "A Theory of Political Transitions," *The American Economic Review* 91, 938-963.

Angeletos, George-Marios, Christian Hellwig and Alessandro Pavan. 2007. *Dynamic Global Games of Regime Change: Learning, Multiplicity, and the Timing of Attacks*. *Econometrica* 75(3):711-756.

Besley, Timothy and Kudamatsu, Masayuki (2007) *Making autocracy work*. DEDPS 48. Suntory and Toyota International Centres for Economics and Related Disciplines, London School of Economics and Political Science, London, UK.

Besley, Timothy and James Robinson. 2010. *Quis Custodiet Ipsos Custodes? Civilian Control Over the Military*. *Journal of the European Economic Association* 8(2-3):655-663.

Boix, Carles, and Susan C. Stokes. 2003. *Endogenous Democratization*. *World Politics* 55(4): 517-49.

Bueno de Mesquita, Bruce, and George W. Downs. 2006, "Intervention and democracy." *International Organization* 60(3): 627-649.

Bueno de Mesquita, Bruce, and Randolph M. Siverson. "War and the survival of political leaders: A comparative study of regime types and political accountability." *American Political Science Review* 89.04 (1995): 841-855.

Bueno de Mesquita, Bruce, James D. Morrow, Randolph M. Siverson, and Alastair Smith. 2002. "Political institutions, policy choice and the survival of leaders." *British Journal of Political Science* 32(4): 559-590.

Bueno de Mesquita, Bruce, Alastair Smith, Randolph Siverson and James Morrow. 2003. *The Logic of Political Survival*. Cambridge, MA: MIT University Press.

Bueno de Mesquita, Bruce, and Alastair Smith. "Political survival and endogenous institutional change." *Comparative Political Studies* 42.2 (2009): 167-197.

Bueno de Mesquita, Bruce, and Alastair Smith. "Leader survival, revolutions, and the nature of government finance." *American Journal of Political Science* 54.4 (2010): 936-950.

Bueno de Mesquita, Bruce, and Alastair Smith. 2011. *The Dictator's Handbook: Why Bad Behavior is Almost Always Good Politics*. Public Affairs Press.

Bueno de Mesquita, Ethan. 2010. *Regime Change and Revolutionary Entrepreneurs*. *American Political Science Review* 104(3):446-466.

Casper, Brett A. and Scott A. Tyson. 2014a. "Popular Protest and Elite Coordination in a Coup d'etat." forthcoming (2014) *Journal of Politics*

Casper, Brett A. and Scott A. Tyson. 2014b. "The politics of government purges." Working Paper, Dept of Politics, New York University.

Cheibub, Jose Antonio, Jennifer Gandhi, and James Raymond Vreeland. 2010. *Democracy and Dictatorship Revisited*. *Public Choice* 143 (1-2):67-101.

Chiozza, Giacomo and Hein. E. Goemans. 2011. *Leaders and International Conflict*. Cambridge University Press

Collier, Paul and Anke Hoeffler. 2007. *Military Spending and the Risks of Coup Detat*. Mimeo - Oxford University pp. 132.

- Conquest, Robert. 1968. *The great terror: Stalin's purge of the thirties*. New York: Macmillan
- Egorov, Georgy, and Konstantin Sonin. 2011. "Dictators And Their Viziers: Endogenizing The LoyaltyCompetence Trade?Off." *Journal of the European Economic Association* 9(5): 903-930.
- Feaver, Peter (2003), *Armed Servants*, Harvard University Press.
- Finer, Samuel E. (1962), *The Man on Horseback*, Pall Mall Press
- Gallego, Maria and C. Pitchik. 2004. An economic theory of leadership turnover. *Journal of Public Economics* 88: 23612382
- Gandhi, Jennifer. *Political institutions under dictatorship*. Cambridge: Cambridge University Press, 2008.
- Gandhi, Jennifer and Ellen Lust-Okar. 2009. Elections Under Authoritarianism. *Annual Review of Political Science* 12: 403-422
- Geddes, Barbara. 1999. What Do We Know About Democratization After Twenty Years? *Annual Review of Political Science* 2:115144.
- Geddes, Barbara. 2003. *Paradigms and Sand Castles* (Ann Arbor: University of Michigan Press).
- Goldstone, Jack. 1994. Is Revolution Individually Rational? *Groups and Individuals in Revolutionary Collective Action. Rationality and Society* 6(1):139166.
- Gurr, Ted (1970), *Why Men Rebel*, Princeton: Princeton University Press.
- Jones, Benjamin F. and Benjamin A. Olken. 2005. Do leaders matter? National leadership and growth since world war II. *The Quarterly Journal of Economics*, 120(3):835864, 2005.
- Jones, Benjamin F. and Benjamin A. Olken, 2009. "Hit or Miss? The Effect of Assassinations on Institutions and War," *American Economic Journal: Macroeconomics*, American Economic Association, vol. 1(2), pages 55-87, July.
- Kuran, Timur. 1989. Sparks and Prairie Fires: A Theory of Unanticipated Political Revolution. *Public Choice* 61(1): 4174.
- Leon, Gabriel. 2011. *The Economic Causes of Coups*. Mimeo: University of Cambridge pp. 133.
- Lohmann, Susanne. 1993. A Signaling Model of Information and Manipulative Political Action. *American Political Science Review* 87(2):319333.
- Londregan, John and Keith Poole (1990), "Poverty, The Coup Trap, and the Seizure of Executive Power," *World Politics* 42, 151-183.
- McDermott, Rose. 2007. *Presidential Leadership, Illness and Decision Making*. New York: Cambridge University Press.
- McGillivray, Fiona, and Alastair Smith. 2008. *Punishing the Prince*. Princeton, NJ: Princeton University Press.
- Meltzer, Allan. and Scott Richard, *A Rational Theory of the Size of Government?*, *Journal of Political Economy* 89 (1981), 91427.
- Morris, Stephen and Hyun Song Shin. 2003. *Global Games-Theory and Applications*. In *Advances in Economics and Econometrics*, 8th World Congress of the Econometric Society,

- ed. M. Dewatripont, L. Hansen and S. Turnovsky. Cambridge University Press pp. 56-114.
- Myerson, Roger B. 2008. The Autocrat's Credibility Problem and Foundations of the Constitutional State. *American Political Science Review* 102(1): 125-139.
- Persson, Torsten and Guido Tabellini (2003), *The Economic Effects of Constitutions*, Cambridge, MA: MIT Press.
- Post, Robert S. and Jerrold Post. 1993. *When Illness Strikes the Leader: The Dilemma of the Captive King* Yale University Press.
- Powell, Robert. 2004. The Inefficient Use of Power: Costly Conflict with Complete Information. *American Political Science Review* 98(2): 231-241.
- Przeworski, Adam, Michael E. Alvarez, Jose Antonio Cheibub and Fernando Limongi. 2000. *Democracy and Development: Political Institutions and Well-Being in the World, 1950-1990*. Cambridge, UK: Cambridge University Press.
- Smith, Alastair. 2008. "The perils of unearned income." *The Journal of Politics* 70(3): 780-793.
- Svolik, Milan. 2009. Power Sharing and Leadership Dynamics in Authoritarian Regimes. *American Journal of Political Science* 53(2):477-494.
- Tyson, Scott, and Alastair Smith. 2013. "Regime Insiders and Revolutions." Midwest Political Science Association Annual Meeting Paper.
- Wintrobe, Ronald. *The political economy of dictatorship*. Vol. 6. Cambridge: Cambridge University Press, 1998.
- Wright, Joseph, and Abel Escriba-Folch. 2012. "Authoritarian institutions and regime survival: Transitions to democracy and subsequent autocracies." *British Journal of Political Science* 42.2 (2012): 283-309.

12 Appendix

In the main text we analyzed the case where revolutions arise because the coalition is not prepared to suppress rebellion. Here we examine the case where the masses rebel even though they anticipate suppression: $rebelS(g_0, W) < 0$ and $suppress(g_0, W) \geq 0$. We now focus the occurrence of such threats and how incumbents deal with them. Figure 4 shows a pair of graphs showing conditions under which citizens rebel given that the coalition are willing to suppress. The top panel plots $rebelS(g_0, W) = 2k + \rho(g_0)(u(g_0) + \Delta\varepsilon + \frac{\delta}{1-\delta}u(g^*) - \theta)$ against winning coalition size. The U-shaped constraint $rebelS(g_0, W)$ is composed of the relative value of the rewards for the masses under the incumbent minus the value of a revolution multiplied by the probability of revolutionary success and the cost of rebelling ($2k$). The probability of revolutionary success depends in part on the level of public goods. As seen on the left hand side of the upper panel, when coalition size is small ($W \leq \underline{W}$ in figure 4), the incumbent provides few public goods and such a low supply of public goods makes it unlikely that a revolution will succeed. Masses' inability to enact change insulates very small coalition systems from rebellion. Large coalition systems are also relatively immune to revolution. In large coalition systems the value of public goods is high so that even when the masses could almost certainly succeed, they have little desire to do so ($W \geq \overline{W}$ in figure

4). However, at coalitions sizes, such as W^\ddagger , $W^{\ddagger\ddagger}$ and $W^{\ddagger\ddagger\ddagger}$, that fall between these extremes the masses are sufficiently discontent and sufficiently likely to succeed that they rebel even though coalition members will suppress them.

We focus on the case where survival in office is a leader's primary objective ($\Psi \rightarrow \infty$).

Proposition 11 *Suppose $rebelS(g_0, W) < 0$, and where they exist, define $g_3 = \max g < g_0$ such that $rebelS(g, W) = 0$ and $g_4 = \min g > g_0$ such that $rebelS(g, W) = 0$ and $x_3 = X - u(g_3)$ and $x_4 = X - u(g_4)$. If $Suppress(g_3, x_3, W) \geq 0$ and $Suppress(g_4, x_4, W) \geq 0$, then, if $\Lambda(g_3, g_3, W) \geq 0$ and $\Lambda(g_3, g_3, W) \geq \Lambda(g_4, g_4, W)$, then incumbents policies are (g_3, x_3) and if $\Lambda(g_4, g_4, W) \geq 0$ and $\Lambda(g_4, g_4, W) > \Lambda(g_3, g_3, W)$, then the incumbents policies are (g_4, x_4) .*

Proof. Again the proof follows by standard constrained optimization. The leader's problem is

$$\max_{g_L, x_L} R_0 - qg_L - Wx_L \text{ subject to } u(g_L) + x_L - X \geq 0 \text{ and } rebelS(g_L, W) = 2k + \rho(g_L)(u(g_L) + \Delta\varepsilon + \frac{\delta}{1-\delta}u(g^*) - \theta) \geq 0$$

To survive deposition from the coalition the incumbent must satisfy the constraint that $x + u(g) - X \geq 0$. From proposition 4, g_0 and x_0 minimize the expenditure required to maintain coalition loyalty and the expenditure $qg + Wx$ that satisfies $x + u(g) - X \geq 0$ are increasing in g for $g > g_0$ and decreasing in g for $g < g_0$. To avoid revolution the incumbent needs to pick g such that $rebelS(g, W) \geq 0$. The expenditure minimizing solutions are those public goods closest to g_0 . Alternatively, the incumbent could risk deposition by revolution and pay the coalition enough to avoid deposition from the coalition. However, such a solution has some net risk of removal and so as $\Psi \rightarrow \infty$ such a solution is dominated by completely removing the revolutionary threat. ■

The lower panel of figure 4 illustrates a means to dissipate revolutionary threats. The lower panel plots $rebelS(g, W)$ against g for three coalitions sizes, W^\ddagger , $W^{\ddagger\ddagger}$ and $W^{\ddagger\ddagger\ddagger}$. Absent a revolutionary threat, a leader produces W/q public goods. However such a level of public goods induces revolution. The incumbent has two responses: either contract or expand public goods.

By contracting the supply of public goods, the incumbent ameliorates the revolutionary threat by reducing the likelihood that the masses succeed. As g declines then so does $\rho(g)$ and, therefore, the masses expected value from rebelling. Smaller coalition systems need to contract public goods to a lower level than larger coalition systems to suppress the revolutionary threat. As the figure illustrates the dashed line associated with W^\ddagger is below the solid line associated with $W^{\ddagger\ddagger}$, which is in turn below the dotted line associated with $W^{\ddagger\ddagger\ddagger}$. Smaller coalition systems generate few public goods in the long run so revolutionaries are more motivated to overturn such systems.

An alternative means to dissipate a revolutionary threat is by increasing public goods to buy off the revolutionaries desire to rebel. However, in the examples shown the leader does not have sufficient resources. One problem leaders face with buying off the masses is that increasing g simultaneously strengthens the revolutionaries ability to rebel. In the example illustrated in figure 4 the rebels are empowered to challenge the regime at a faster rate than

they are bought off. The citizens can be bought off but it often required a large increase in public goods. The incumbent faces the major limitation that she cannot commit to expand public goods in future periods.

12.1 Leader Initiated Institutional Change with a Suppressed Revolutionary Threat

The intuition as to why purges or expansions enable a leader to survive can be seen in figure 4. Let $\mathcal{W}^{SRT} = \{W : rebelS(g_0, W) < 0 \text{ and } suppress(g_0, x_0, W) \geq 0\}$ be the set of institutions in which \mathcal{L} faces a suppressed revolutionary threat. In figure 4 this is the set of coalitions between \underline{W} and \overline{W} . If a purge contracts coalition size below \underline{W} then the leader avoids the revolution by providing the level of public goods associated with that coalition. Provided that incumbent has sufficient resources to also provide the private goods required to maintain internal coalition loyalty, a purge removes the revolutionary threat. The intuition for expansion is similar. If expansion pushes W_E above \overline{W} , then the leader commits to increased public goods in future period and this satisfies the masses desire for revolutionary change.

Proposition 12 *If $W \in \mathcal{W}^{SRT}$, $W_p \notin \mathcal{W}^{SRT}$ and the incumbent proposes a purge, then she proposes $\hat{g}_p = \frac{W_p}{q}$ and \hat{x}_p is the lowest level of private goods that solves equation 22. Such a purge is feasible and allows the incumbent to survive politically with expected payoff $\Psi + R_0 - q\hat{g}_p - W_p\hat{x}_p - o + \delta h_0 V_L(W_p, S_p)$ if $q\hat{g}_p + W_p\hat{x}_p + o \leq R_0$.*

Proposition 13 *If $W \in \mathcal{W}^{SRT}$, $W_E \notin \mathcal{W}^{SRT}$ and the incumbent proposes a purge, then she proposes $\hat{g}_E = \frac{W_E}{q}$ and \hat{x}_E is the lowest level of private goods that solves equation 23. Such an expansion is feasible and allows the incumbent to survive politically with expected payoff $\Psi + R_0 - q\hat{g}_E - W_E\hat{x}_E - o + \delta h_0 V_L(W_E, S_E)$ if $q\hat{g}_E + W_E\hat{x}_E + o \leq R_0$.*

Figure 4: Suppressed Revolutionary Threats

