Institutional Change as a Response to Unrealized Threats: An Empirical Analysis

Bruce Bueno de Mesquita*
Alastair Smith†

Abstract

Leaders shift political institutions to ameliorate threats to their tenure. The masses might rebel to replace the leader and change institutions. Disloyalty by political insiders might result in a coup. Leaders liberalize when the masses present a greater threat and 'autocratize' to dissipate threats from elites. A two-step procedure tests these arguments: 1) The risks of revolution and coup are estimated as a function of leader health, experience, economic conditions and extant institutions. 2) These risks are used to predict institutional change in a heteroskedastic regression model. The magnitude and direction of institutional change depends upon whether the masses or elites pose the greater threat. When both risks are high, leaders must gamble as to which risk they believe is greatest. In such circumstances, institutions are highly volatile even as the aggregate direction of change becomes unclear. Word Count: 10,833

*New York University. Email: bruce.buenodemesquita@nyu.edu.
†New York University. Email: alastair.smith@nyu.edu.

What leads governments to expand or contract their accountability, making them more democratic or more autocratic? We address this question by testing elements of the extended selectorate theory (Bueno de Mesquita and Smith, 2017). We focus on propositions about how government institutions change endogenously in response to leader beliefs about the risk of a mass uprising (revolt) or coup d'état and how those risks might be exacerbated if a leader's health is believed to be declining (Bueno de Mesquita and Smith, 2018). The theory indicates that when a leader believes that a revolutionary threat dominates, then the regime's winning coalition expands, resulting in democratization. When coups are anticipated as the dominant threat, however, then leaders are predicted to "autocratize," shrinking the size of their winning coalition. The magnitude of these expected responses is hypothesized to depend on whether other domestic groups – specifically, the winning coalition and the masses – believe that their leader suffers from a significant health issue that limit's the incumbent's reliability as a future source of benefits. When the leader is thought to be approaching death, coalition loyalty is undermined and in response the incumbent is hypothesized to expand the winning coalition of key supporters, thereby liberalizing the regime in an effort to garner more support with the costs of that liberalization shifted to the leader's successor.

The hypotheses being tested provide a novel explanation of institution change that complement some prior accounts and contradict others. Grounded in the selectorate framework, the hypotheses are based on anticipatory actions by leaders who are attempting to mitigate their risk of deposition. The evidence supports the hypotheses and shows that the *anticipation* of an elevated risk of a threat to a regime's stability more significantly affects its subsequent institutional configuration than does the actual realization of a revolt or coup. This result is established through a series of contingent, statistical assessments. First, some subset of the masses may be sufficiently dissatisfied with their well-being under the current regime that they begin to contemplate rising up to overthrow it. Second, in response to this danger, the incumbent's coalition of key

backers has three possible responses: (1) support the uprising in the hopes of preserving their privileges in a new regime; (2) launch a coup d'état, perhaps to pre-empt a mass movement by deposing the incumbent leadership; or (3) throw their weight behind the incumbent ruler in an effort to preserve her hold on power and, not insignificantly, their own stream of benefits that flow from the current leadership. Finally, in response to the threat from the masses and the path chosen by the essential backers of the incumbent, the leader evaluates what actions, including changing the size of the institutionalized winning coalition, will best thwart the threat or threats she believes she faces.

If the incumbent believes she has loyal backing from her coalition, then she can survive with politics as normal. However, if there are credible signs that her supporters are plotting a coup, then she may choose to purge the coalition to remove disloyal members. Alternatively, if she anticipates that the coalition might defect and support the revolutionary threat, then she might elect to liberalize by expanding the size of her winning coalition to become more accountable to the citizenry in an effort to regain their support and neutralize the threat of a mass uprising. Each of these responses is anticipatory and so many of the coups and revolts that could have credibly occurred are "selected out." Much – maybe most – of the time when a coup or a rebellion is contemplated, it does not happen, being pre-empted by the anticipatory response of the incumbent leader. The actual occurrence of such destabilizing events should be difficult to predict because visible, predictable signs of a coup or revolt should have stimulated counter-maneuvers by the regime leadership and, possibly, by the regime's winning coalition as well. While these counter-maneuvers cannot always succeed, they frequently can in equilibrium. Hence, perhaps counter-intuitively, an important implication of the theory is that estimates of the risks that leaders face are better predictors of institutional change than is knowledge of the actual occurrence of such destabilizing events as revolutions and coups. That is to say, those conditions that make one fear a revolution or coup are highly consequential for institutional change even if – perhaps especially if – the coup or mass uprising does not occur. The empirical results support

the theoretical argument that leaders act to ameliorate threats to their hold on power. Estimates of perceived threats are at least as good predictors of institutional change as the actual occurrences of such destabilizing events as revolutions and coups. Further, from a policy perspective, estimates of the risks leaders face provide an ex ante means to predict institutional change while the occurrence of destabilizing events can only be known ex post.

We begin with a review of the literature on political instability. Then we summarize the selectorate theory and its propositions regarding responses to real or anticipated threats to political stability. We list the core hypotheses to be tested following the summary of the theory. Then we introduce the data and test the arguments. We conclude with a discussion of implications for future research and for policy makers.

1 Literature

There is an extensive literature on revolutions, coups, and on how regimes adapt to the threat of these events. In reviewing this literature and its implications for this study, we draw attention both to what this study has in common with previous work and with important ways in which it diverges from previous investigations.

A common theme in the enormous literature on revolutions and mass protests against incumbent regimes draws attention to the incentives to rebel and mechanisms to negate those incentives. Gurr (1970), for instance, set out a theory of revolution grounded in the concept of relative deprivation. His research finds its extension and elaboration in more reccent studies into how unequal economic conditions may stimulate threats to regimes and induce institution change. Acemoglu and Robinson (2005), for instance, provide a seminal model of institutional change driven by inequality in economic conditions. They argue that institutional shifts between democracy and autocracy occur because of inequality between the rich and the poor. For instance, if the rich are in power, as is often true in an autocracy, and the poor have sufficient strength

to rebel, then the rich need to make concessions. If income inequality is high, then the rich cannot give the poor enough in the short term to buy them off, mitigating their relative deprivation, and can only credibly commit to compensate them in the long term through political concessions. Similar to the arguments we make, it is the threat of revolution, rather than the actual occurrence of revolution, in this literature that leads to democratization. However, in Acemoglu and Robinson's account opportunities to rebel or, alternatively, to organize a coup under democracy, occur exogenously. They, like Boix et al. (2003) and Svolik (2008), explain institutional change in terms of the allocation of economic resources but do not endogenize that distribution or changes in it other than through revolutionary threats.

Modernization theory provides an alternative economic perspective on institution change. It argues that economic growth leads to democratization (Jackman, 1973; Burkhart and Lewis-Beck, 1994; Treisman, 2015). Przeworski and Limongi (1997) shows that once nations are sufficiently wealthy then transitions to democracy become permanent; yet at lower income levels nations continue to transition between democracy and autocracy. The derived welfare function for coalition members in selectorate logic provides a micro-foundation for democratic permanency past a coalition-size cut-point.

Miller (2012) argues that economic conditions associated with modernization theory only promote democracy when there is a recent legacy of political violence. Geddes (1999) has provided a particularly thoughtful survey of the democratization literature. Consistent with much of the coup literature, Londregan and Poole (1990) identify economic conditions, and poverty in particular, as the principle driver of coups. In contrast, the theory tested here indicates that while negative economic shocks are likely to increase the risk of mass uprisings, they have only a modest impact on the risk of coups d'état. Other factors that have been shown in the literature to matter for coup risk include the organization of the military, cultural pluralism and competition between groups (Feaver, 2003; Jackman, 1978; Powell, 2012*a*).

Scholars also point to the ability of the people to organize and coordinate their

actions (Goldstone, 1994; Lohmann, 1993; Kuran, 1989) as central to the rise of mass movements that alter institutions. Much of this literature emphasizes the unpredictability of revolution as we do, although for quite different reasons. For scholars like Kuran or Lohmann, the unpredictability of revolution stems from the difficulty individual prospective revolutionaries have either in overcoming the collective action problem or in gathering enough information to be confident that others who share their discontent with government are prepared to act on that discontent. While acknowledging the importance of these concerns, the perspective here draws attention to the incentives leaders and their backers have to anticipate nascent revolutionary movements so that they can thwart any such threats before they occur (Bueno de Mesquita, 2010; Ginkel and Smith, 1999).

One reason that it may prove difficult for the masses or for insiders to organize a revolt or coup against the incumbent government resides in the regime's anticipation of such threats and its use of its security apparatus to thwart those threats. In that regard, our study shares much in common with Greitens' (2016) seminal empirical analysis of the state's security apparatus as designed to respond to anticipated threats either from among the masses (such as the threat of revolution) or from among the elite (such as the threat of coup d'état). Like her, we are primarily concerned with anticipated threats and like her we expect institutions to reflect concerns for leader survival. This study, while sharing important common concerns with Greitens', differs however in important respects. Our focus here is on such institutional changes as "democratization" or "autocratization" that are the endogenous, equilibrium responses to anticipated threats rather than specifically on the design and utilization of the state's security apparatus and we focus on these institutional changes in a large-N analysis.

Many explanations of governance transitions treat government institutions as either democratic or autocratic without consideration for variation within each category. However, there is a growing scholarly movement to examine differences within nondemocracies and to understand their power dynamics. Wintrobe (1998) was among

the first to classify autocracies according to the behavior and motivations of their leaders. Geddes et al. (2018) and Geddes, Wright and Frantz (2014) classify autocratic regimes along the dimensions of military rule, single-party systems and personalistic rule by a strongman. They examine how these characteristics affect how regimes end and the form of government likely to follow.

Autocrats face a dilemma. They need competent supporters to help them rule, but such supporters also create rivals for power (Egorov and Sonin, 2011). The lack of commitment to formal rules means constant power struggles between elites and leaders (Ezrow and Frantz, 2011; Myerson, 2008; Svolik, 2009, 2012). While Gandhi and Lust-Okar (2009) and Gandhi (2008) focus on the role of legislatures in moderating elite-leader power contests, others, as we have noted, focus on violent means of resolving power struggles. Coups and purges are violent manifestations of the power struggle between leaders and elites. Elites attempt to replace leaders via coups and, in response, leaders engage in coup proofing (Powell and Thyne, 2011; Powell, 2012*b*; Belkin and Schofer, 2003; Quinlivan, 1999; Sudduth, 2017*a*) with purges of the elite being an extreme measure. Sudduth (2017*b*) examines how expectations of coup risk affects the propensity of leaders to purge their military. Our analysis expands on this theme and shows that purges are the likely response by leaders who face a high risk of coup from within their coalition of supporters.

2 Selectorate Propositions Regarding Instability

The selectorate theory assumes that leaders seek to maximize their political survival and, conditional on achieving that goal, desire discretionary control over government revenue (Bueno de Mesquita et al., 2003). For their survival, leaders depend on the support of a winning coalition of size W that is drawn from a pool of potential members;

that is, those in the selectorate (S). The selectors, in turn, are the "enfranchised" subset of the total population, N, with N - S people being the disenfranchised masses. When the coalition is small, as in autocracies, juntas and monarchies, leaders emphasize the allocation of revenue toward private goods that benefit members of their coalition. As the coalition gets larger (that is, moves toward democracy) then leaders increasingly shift the mix of resource allocations away from private goods and toward public goods that benefit everyone. As the coalition expands, leaders also are compelled to spend a greater portion of their revenue to sustain coalition loyalty, thereby decreasing their discretionary pool of revenue.

The selectorate framework allows us to characterize the induced institutional preferences of different components of any society. Leaders, for example, prefer that they have a large selectorate and that they depend on a small coalition (so $\frac{W}{S}$ is small). Such an institutional structure yields the greatest returns for them and makes it easiest for them to retain power. Members of the selectorate and the disenfranchised prefer both that the winning coalition is large and that it is a large proportion of the selectorate. That way, even if they are excluded from future winning coalitions, being so excluded is not terribly consequential because as W increases relative to S the government spends more of its revenue and, the larger W is, the more those expenditures emphasize the provision of public goods. Such benefits, of course, go to everyone including all the masses in N - S.

Those in the winning coalition have the most complex institutional preferences. They value a high ratio of $\frac{W}{S}$ because that improves their prospects of being in any future winning coalition and compels the incumbent to spend more of her revenue on maintaining their loyalty. Members of the winning coalition like the idea of W being small and S being small because these conditions ensure that the members of the coalition receive lots of private goods. That is, all else being equal, coalition members particularly like the idea of juntas and monarchies. However, all is not always equal. They must also consider the risk of purges and other events that might turn them

out of the coalition and might alter the institutional structure they support. Hence, coalition members can also be supportive of large coalition, democratic institutions. Under such arrangements, leaders spend more to keep supporters loyal, albeit with a heavier emphasis on public goods. As the theoretically-derived asymmetric, non-monotonic shape of the welfare function for coalition members demonstrates, there is a feasible increase or decrease in coalition size from any initial size below a critical cut-point such that any individual who remains in the coalition can be equally well-off whether the coalition shrinks or expands.

Coalition members face a trade-off. When coalition size is small their rewards are concentrated on private goods; however, relatively little revenue is spent on them. As coalition size increases leaders spend more revenue on buying coalition loyalty, but there is a dilution of private goods. Intermediate sized coalitions provide the least welfare for coalition members. It is here in the mid-sized range that institutional structures are transient. Winning coalition members can be supportive of purges that contract the winning coalition (provided of course that they are not the ones being purged) or of liberalization that increases coalition size. Either institutional shift could improve their welfare.

Leaders, coalition members and would-be rebels within the mass population must calculate their expectations about the risks, costs and benefits of potential actions. Mass uprisings jeopardize the privileged access of coalition members to private goods. Leaders fear both the direct threat posed by the masses and the likely response by winning coalition members to such a threat. Which of the many choices is optimal for regime survival (or deposition) depends, ultimately, on the incumbent's expectations about the calculations of the coalition's members and the calculations of the disgruntled masses under alternative circumstances.

Uncontrollable external events, such as economic decline or the leader's development of a terminal illness, may further complicate the choice of countermoves. To see how this might be so, here we provide an informal assessment of the various threats leaders

face and the responses that different actors might take and why they might take them. A formal development of these ideas can be found in Bueno de Mesquita and Smith (2017) and, given space limitations and the empirical focus here, should be consulted for a more comprehensive exposition of the logic behind the argument.

2.1 Political Threats

The basic selectorate model characterizes the policies leaders adopt to survive normal everyday challenges by rivals. Political loyalty gives incumbents a political advantage, at least once they are established in power. Established incumbents have already reshuffled their supporters, replacing those they dislike or distrust with those supporters that they feel more secure about keeping in their inner circle (Francois, Rainer and Trebbi, 2014; Geddes et al., 2018). Once the transitional coalition has been shuffled, and a stable coalition established, the coalition's members can reasonably anticipate a continuous supply of private goods for as long as the ruler is in office. Political rivals cannot credibly offer such assurances. To come to power, a rival might promise great rewards, but once he is in power those who put him there face the risk of being replaced by those whom the leader likes or trusts more. The risk and costs of being displaced from the winning coalition generates political loyalty that, under normal circumstances, allows the incumbent to survive in office.

Political loyalty is derived from the expectation that the incumbent will remain in power to deliver a reliable supply of private goods. Once they doubt the ability of the incumbent to retain power, winning coalition members become reluctant to take costly action to sustain the incumbent in power. Instead, they start looking around to find their next source of political rewards, which in practice might mean switching to back a political rival, allowing the masses to overthrow the regime, or organizing a coup. The diminution of coalition loyalty enhances the likelihood of revolutionary success. Deposition threats from one source affect the risk of deposition by other means.

Although any leader might face the threat of replacement by foreign powers, here we focus on domestic threats. In particular, we examine the relationships between shocks to a leader's health, shocks to the economy, the prospects of revolutionary and coup threats and the actions leaders take to diminish such threats. Naturally, successful leaders do not remain idle as threats grow. Instead, they enact policy shifts and institutional reforms. When challenges come from within the masses or from within the winning coalition, especially when leaders are believed to face serious health problems or economic challenges, then the threat of revolution or of coup d'état is heightened, with economic challenges being more pertinent for revolutionary threats than coup threats. The leader's anticipation of a credible threat of a coup or a revolution may necessitate her recasting the institutions of governance (W and S) so as to stabilize the regime's future. In particular, if the incumbent faces a credible threat of mass uprising, then, according to the model's logic, she is expected to liberalize the regime, expanding its winning coalition and making it more democratic. Conversely, if the incumbent faces a credible threat of coup d'état, then purges are likely to follow that decrease the size of the winning coalition and render the regime more autocratic.

2.2 Health

Health concerns modify leader responses to threats and to normal resource allocations. Signs of a terminal illness create a serious political problem for leaders. The risk of a leader's death jeopardizes her supporters' steady flow of private goods. The next leader will reconfigure his coalition and those who were once valued supporters risk finding themselves on the outside. Sometimes, coalition members are lucky and have the same rapport with the successor that they had with the former incumbent. This argument forms the basis of support for dynastic rule although, as we know, even dynastic succession is often interrupted by competition from rival power-seekers (Sharma, 2015). Alternatively, supporters might try to make their own luck by influencing the

succession.

Serious illness can affect decision making and leader capacity (McDermott, 2007; Robins and Post, 1995). However, it is knowledge of the illness by supporters and the masses that creates the most serious political problem for sickly leaders. As the coalition learns that their leader will not be around to dispense largesse, coalition loyalty diminishes. If knowledge of the leader's illness becomes widespread, then potential revolutionaries anticipate a greater chance of success as the coalition is less likely to help suppress the masses and might even actively joint a revolution. Leaders want to exude vigor and hide any hint of serious illness. Yet, when illness strikes, leaders cannot always hide their condition. As knowledge of an incumbent's deteriorating health spreads, political risks grow. We treat the onset of a serious terminal illness as exogenous. While people can engage in unhealthy lifestyles and age increases the risk of disease onset, no one chooses to be ill. From a methodological perspective, we exploit this exogenous nature of disease onset in much the same way scholars have exploited the occurrence of natural disasters (Brancati, 2007).

2.3 Revolutions

Revolutions are defined as efforts by the masses (those individuals who are not in W) to depose the incumbent leader and alter the governance institutions so as to improve their welfare, meaning increasing W and increasing $\frac{W}{S}$. The probability that a rebellion succeeds is assumed to increase with the government's provision of such public goods as freedom of the press, freedom of speech and freedom of assembly because these goods facilitate coordination by potential rebels. Conversely, the utility from rebellion is assumed to decrease as these public goods are provided in greater abundance. When the coalition is sufficiently small there is little chance of a credible rebellion because the odds of success are too low for large numbers of people to take on the costs associated with revolution. When the polity's winning coalition is sufficiently large the masses

have little incentive to rebel because so many public goods are already being enjoyed. Between these extremes of coalition size, revolution is a possibility. Consistent with several extant studies that argue instability is most common in the middle of the institutional range (Jones and Lupu, 2018; Fearon and Laitin, 2003; Hegre, 2001), the theory predicts that regimes with intermediate sized winning coalition are more likely to experience revolution compared to either small or large winning coalition systems.

Perhaps the most important short-term criterion in the masses' decision to take to the streets is how they expect the coalition to respond. As Luttwak states "A ... mob-however large and determined-would be cut down by modern automatic weapons. ... Any attempt on the part of civilians to use direct violence with improvised means will always be neutralized by the efficiency of modern automatic weapons; a general strike, on the other hand, can temporarily swamp the system, but cannot permanently damage it, since in a modern economic setting, the civilians will run out of food and fuel well before the military (1963, p. 54 and p. vii)." Without at least coalition neutrality, revolutionaries have only a limited chance of success since the coalition commands the coercive power of the state. Anything that undermines coalition loyalty increases the possibility of revolutionary success and hence increases the incentive to rebel.

The possibility of revolution or some other form of mass uprising is heightened when the people believe that their leader is not expected to live long. A sickly leader cannot command the continued loyalty of the winning coalition and this increases the chances of revolutionary success. An economic downturn might also stimulate rebellion. Economic downtowns harm the welfare of the masses, giving them more gripes against the government, and at the same time deprive leaders of the resources to buy the people's acquiescence (Haggard and Kaufman, 1995). Economic decline is always visible to the masses and therefore increases the risk of revolution. In contrast, because leaders try to keep illness a secret, health concerns are not always detected by the masses, potentially ameliorating their impact on the risk of revolution.

2.3.1 Coups and defection

While the masses always want to liberalize political institutions through revolution, the incentives and possible actions of coalitions members are more numerous. As Kendall-Taylor and Frantz (2014), Geddes, Wright and Frantz (2014) and Svolik (2012) show, leaders are far more likely to be deposed by their coalition than by the masses. It is to the threat posed by the coalition that we now turn.

If a leader is healthy and the economy is doing well, then members of the winning coalition have every reason to remain loyal to the incumbent, meaning that they will work with the leader to suppress the urge that the masses feel to take to the streets.[1] But if there is a shock to the leader's health or a shock to the economy, then things unravel for the leader as coalition members rethink their loyalty to her. Chronic health concerns, in particular, undermine coalition loyalty. If the coalition's members detect signs that the leader's life is near its end, such as frequent visits to doctors (at home or abroad), advanced age, or extended periods out of the public eye, then they must think about securing their own future welfare by throwing their support elsewhere. They may decide to back or, at least, not oppose a nascent mass uprising in the hope that they will then be incorporated into the post-rebellion regime, as happened to significant leaders, like General El Sisi, in the Egyptian military immediately following the mass uprising that brought down Mubarak's government in 2011.[2] Alternatively, some or all of the coalition might decide that they can better secure access to private goods by deposing the leader themselves. The 2019 depositions of Algeria's Abdelaziz Bouteflika and Sudan's Omar al-Bashir both followed weeks of mass protests. By ousting these leaders, the coalition dissipated the revolutionary threat. Pushing the incumbent out

[1] Casper and Tyson (2014) use a global game to model the dynamics between rebellions and coalition loyalty.

[2] General Abdel Fattah el-Sisi became Mubarak's director of Egypt's military intelligence in 2010, a powerful position typically associated with coalition membership. Subsequently, he replaced General Tantawi, Mubarak's Defense Minister, becoming Morsi's Defense Minister, again a member typically of the winning coalition, before launching a subsequent coup that overthrew the Morsi regime.

of office can preserve the coalition's access to power and rewards.

In other instances, even without mass protests, coalition members, to secure or improve their position, may launch a coup to replace the leader. Gamal Abdel Nasser rose to power following a military coup in Egypt that deposed the monarchy in 1952. General Abdel Fatah el-Sisi did the same when he led a coup that overthrew President Morsi's Egyptian regime in 2014.

Coalition members are likely to be better informed about a leader's health than are the masses. While an economic downturn gives leaders fewer resources to reward their supporters, the savvy leader rewards supporters first and worries about the people later, if at all. Despite driving the Zimbabwean economy into the ground, for instance, Robert Mugabe maintained the loyalty of the army and elite to survive in office for 37 years (Meredith, 2009). It was his declining health and fears over his wife succeeding him, and not the collapsed economy, that led his previously loyalty coalition to turn on him (Cowell, 2019). Venezuela's Nicolás Maduro appears to be following the Mugabe's playbook, using whatever resources are available to pay army elites rather than to prop up the economy (New York Times, 2019). Especially when the coalition is small, the leader may find enough resources to buy loyalty. It is threats to the flow of private goods that leads to leader deposition.

2.4 Leader Reactions

Increases in the threat of rebellion and coup represent fundamental challenges to the leader's political survival and, perhaps too, her physical survival. Leaders are not passive when they face threats. Just as the prospective leaders of a coup have choices – launch the coup, support the mass uprising, or help the incumbent survive – so too does the incumbent. If the incumbent believes the threat of revolution or coup is sufficiently great to warrant a response, then she may try to coup-proof the country by reorganizing the military to include parallel security forces (Quinlivan, 1999; Greitens,

2016), expand the provision of private benefits to a select group of coalition members, possibly purging some to generate freed-up money to pay the cost, or expand the provision of public goods to dampen the incentive for an uprising among the masses. An expansion of the coalition is a leader's response to threats from the masses, while purges and contractions in coalition size are the preferred response to threats of coup and other forms of coalition disloyalty.

If the leader expands public goods to buy off the revolutionary threat, then to sustain the regime's equilibrium relationship between public goods spending, revenue and coalition size she may have to increase the size of the coalition, making the regime accountable to more people. Likewise if she provides more private goods to get coalition members to crush the threat of rebellion and the threat of a coup, then to maintain the equilibrium between coalition size, private goods allocations and revenue, she may have to shrink the coalition, purging some members and making the regime more autocratic and less accountable to the masses. In either case, the institutions of government are expected to change as part of the strategic response to the threat of a coup or mass uprising, whether it be demonstrations, revolution or civil war. If the leader gets it right, then the threats are dissipated and the events that could have deposed her never happen. Anticipation of threats creates the incentive to change governance structures. The occurrence of revolutions or coups reflects either a failure by the leader to anticipate the threat or a failure to successfully enact the required governance changes. Given the severe risk to leaders from coups and revolutions (at least successful ones), their occurrence should be much less frequent than governance change in anticipation of such events. It should be hard to accurately predict revolutions and coups precisely because when they are likely to occur, leaders act to prevent them.

The theory generates numerous predictions about how health, revolutions, coups, purges and institutional change are intimately related. Given the need for brevity, we focus on the central idea: Leaders face political threats, and they modify political institutions to ameliorate these threats. As the risks they face rise, leaders are more

likely to change institutions, which leads to elevated institutional volatility. Further, the nature of the threats they face, and in particular whether the more pertinent threats comes from the masses or elites, determines the likely direction of institutional change.

2.5 Hypotheses

Although selectorate theory makes numerous predictions about policy provision, tenure, instability and institutional change, we focus on the following predictions:

1. Polities with intermediate sized winning coalitions face higher risks of revolution and coup and are more likely to experience institutional change than either large or small winning coalition systems.
2. Economic shock and declining health increase the risks of revolution and coup.
3. The likelihood of leader deposition and occurrence of revolutions or coups is decreasing in leader tenure and increasing in concerns about the leader's health.
4. It should be hard to accurately predict revolutions and coups precisely because when they are likely to occur, leaders act to prevent them.
5. If a leader faces significant threats of deposition, revolution or coup, then she is likely to change institutional structures.
6. If a leader faces a high threat of revolution, then she is likely to expand winning coalition size.
7. If a leader face a high threat of coup, then she is likely to contract winning coalition size.

3 Data and Methods

The empirical approach is in two stages: first, we characterize the conditions that place leaders in jeopardy of losing power and identify whether this threat is most likely to

come from the masses or from elites. In the second stage, we investigate how leaders respond to such threats both in terms of their propensity to shift institutional arrangements (that is to say, variance in institutions) and the likely direction of institutional change (that is to say, does the leader autocratize or democratize).

Our goal is to examine how survival oriented leaders alter political institutions in response to their anticipation of political threats. The implementation of this goal requires making a number of trade-offs in terms of data and model specification. We take a broad, encompassing approach that allows the comparison of a large number of nations over a long time period rather than use better measured data or include additional variables that are only available for a smaller sample.

3.1 Data

The unit of observation for all of the analyses is the nation-year, where we use the subscripts i to denote nation and t to indicate year, although when there is no risk of ambiguity we suppress indices. Throughout we lag the independent variables, indicated by the notation X_{t-1}. The analyses require data on 1) political institutions, 2) political events, 3) leader characteristics and 4) economic conditions. Many of our data sources are standard. Here we focus our discussion on the less common sources.

3.1.1 Institutions

Given the theoretical focus on how many supporters a leader relies on to survive in power, our main institution measure is the selectorate theory's concept of winning coalition size, W. As a robustness check, the appendix contains analogous analyses using the Polity project's indicator of democracy minus autocracy score (Marshall, 2016) and finds similar results.

Bueno de Mesquita and Smith (2022) propose a new indicator of coalition size, W, that is continuous and is based on institutional variables in the V-Dem data set, ver-

sion 11 (2021). The V-Dem project is a broad and encompassing endeavor that codes virtually all nations since 1789 using item response theory (IRT) (Pemstein et al., 2020; Marquardt and Pemstein, 2018) based on surveys of country experts. Of V-Dem's vast array of issues, including political competition, policy outcomes and freedoms, the new indicator of W uses the following institutional dimensions: 1) Autonomy of election monitoring body (v2elembaut), 2) Opposition parties' autonomy (v2psoppaut), 3) Barriers to political party participation (v2psbars), and 4) Closed Succession: Indicators of succession by heredity or within a military or single party setting (constructed from $v2x_ex_hereditary$, $v2x_ex_military$, and $v2x_ex_party$).

These four primarily institutional dimensions measure whether coalition membership is broadly accessible or is exceedingly restrictive or anywhere in between. The selected institutional indicators facilitate the estimation of variation in the credible, institutionalized competition for coalition membership across polities and across time. The appendix provides justification and details of W's construction.The winning coalition size is constructed by summing the 4 standardized components and then dividing by 4 to take their average standardized score. Specifically, let j index the component, i index nation and t index year.

$$w_{i,t} = \frac{1}{4} \sum_{j=1}^{4} \frac{x_{j,i,t} - \bar{x_j}}{sd(x_j)}, \tag{1}$$

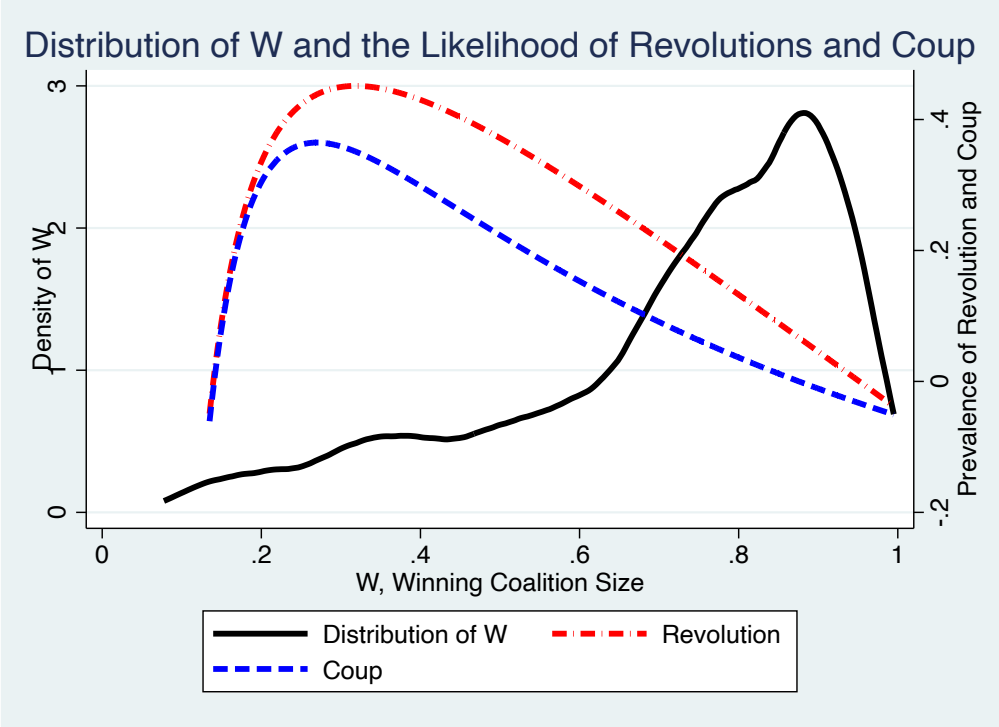
where $x_1 = v2elembaut$, $x_2 = v2psoppaut$, $x_3 = v2psbars$ and $x_4 = -max\{v2x_ex_hereditary$, v2x_ex_military, $v2x_ex_party\}$ and $\bar{x_j}$ and $sd(x_j)$ are the mean and standard deviation of x_j across all nation-year observations.

For ease of interpretation, we normalize the measure on coalition size, which takes on thousands of distinct values, to fall between 0 and 1:

$$W_{i,t} = \frac{w_{i,t} - min(w_{i,t})}{max(w_{i,t}) - min(w_{i,t})} \tag{2}$$

Many of the hypotheses predict a non-monotonic relationship between institutions and outcomes. To capture these non-monotonicities our models use quadratic specifications: W_{t-1} and W^2_{t-1} and the interactions between these institutional variables and other independent variables.

Figure 1: Distribution of Winning Coalition Size and the Prevalence of Revolutions and Coups



The solid line in figure 1 shows the distribution of W that is used in our analysis.[3] The dash-dot and dashed lines in figure 1 correspond to the prevalence of revolutions and coups at different institutional configurations.

3.1.2 Events Data

Mass events: Revolutions are attempts by the masses to overthrow the leader and reconfigure political institutions. We create a variable, Revolution, using Banks's Cross-

[3]In the appendix, Figure A1 shows the distribution of W for all possible nation years and Figure A2 shows the analogous graph using the Polity measure.

national time-series (2019) that identifies the occurrence of revolutions based on newspaper accounts. We also use the Banks data to create an index of mass protests based on the number of riots (r), strikes (s) and anti-government demonstrations (d) per nation-year. Let the function $std(x) = \frac{x-mean(x)}{std.dev(x)}$. Our measure of protest is

$$Protest = \frac{std(log(r+1)) + std(log(s+1)) + std(log(d+1))}{3} \tag{3}$$

Coalition events: Coalition members might remain loyal or abandon their leader. Our primary measure of elite abandonment is the occurrence of a coup. Using Powell and Thyne (2011) our coup measure indicates whether there was a successful or attempted coup in a nation-year.

3.1.3 Leader data:

We use Bueno de Mesquita and Smith (2018) data on the tenure and characteristics of leaders. These data update the Archigos data (Goemans, Gleditsch and Chiozza, 2009) and, in addition, code the cause of death for leaders who died within ten years of leaving office and the age of the leader relative to Swedish life expectancy (Relative Age). These data separate death into a variety of causes. The variable Sick indicates that a leader will die within five years from a chronic disease. Chronic illnesses are more likely to be detected than acute illnesses and so are more likely to prompt efforts to depose the incumbent and, therefore, are more likely as well to prompt anticipatory counter-measures by incumbents before threats to their political survival have emerged.

Our analyses include a measure of how long a leader has been in office (Log(tenure)). Political loyalty grows with tenure. In observations in which leader change occurs, the health and tenure measures refer to the incumbent on January 1st. The variable Leader Change (often abbreviated as LC) codes for any leader change within a nation year.

3.1.4 Economic Measures

The economic measures of per capita GDP, economic growth and population are taken from the World Bank's World Development Indicators. Throughout we include year controls in the forms of y, y^2 and y^3 to capture temporal trends.[4]

3.2 Methods

The data analysis proceeds in two stages. The initial stage estimates the likelihood of different political threats (Revolution, Coup and Leader Change) in nation i at time t as a function of a vector of covariates $X_{i,t}$. For instance,

$$Revolution_{i,t} = X_{i,t}\beta_{rev} + u_i + e_{i,t} \tag{4}$$

The u_i correspond to a fixed effect for nation i and $e_{i,t}$ is the error term. We have analogous equations predicting the occurrence of $\text{Coup}_{i,t}$ and $\text{Leader Change}_{i,t}$. These fixed effect regression estimates identify the conditions under which leaders face threats from the masses (revolution), from the coalition (coup), and the aggregate threat that results in leader change.

Based on these analyses, we estimate the likelihood of a revolution, $\widehat{Revolution}_{i,t} = X_{i,t}\beta_{rev} + u_i$. Likewise we estimate $\widehat{Coup}_{i,t}$ and $\widehat{LeaderChange}_{i,t}$. These estimates serve as indicators of a leader's belief or expectation that she will face a threat to her political survival and so serve as indicators of the need for anticipatory, institution-shifting, counter-measures.

The second stage analyzes how leaders respond to political threats by changing institutions. In particular, we define institutional change as the difference in coalition size between years $t+2$ and $t-1$; that is, before the anticipated threat to two years

[4]Specifically, $y = year - 2000$. The results are similar if year fixed effects are included instead.

after observing the perceived threat level:

$$\Delta W_{i,t} = W_{i,t+2} - W_{i,t-1} \tag{5}$$

The theory predicts that leaders do not stand idly by, allowing either the masses or the coalition to depose them. Instead, leaders ameliorate anticipated threats to their political survival by shifting political institutions. The second stage analyses have two components: volatility and direction.

The volatility component refers to the extent to which institutions change without regard to the direction of change. The theory predicts that as the risk of deposition grows, leaders become more likely to change institutions, and to change them by a greater amount. Leaders might respond to threats by liberalizing, that is increasing W. Alternatively, they might purge and contract the coalition. The essential prediction is that the greater the jeopardy a leader expects to face, the more volatile institutions are likely to be. As a result the variance in ΔW is associated with $\widehat{LeaderChange}_{i,t}$, the first stage prediction of deposition risk.

The direction of institutional change depends on which threat a leader perceives to be most salient. When the dominant threat is from the masses, the theory anticipates liberalization, that is to say an increase in W. In contrast, a leader's likely response to a large coup threat is to purge.

To simultaneously assess the volatility and directional predictions the analyses use a fixed effects regression model in which the variance of the error term is explicitly modeled as a function of the threats that a leader faces.

$$\Delta W_{i,t} = Z_{i,t}\beta_{\Delta} + v_i + \varepsilon_{i,t} \tag{6}$$

where $Z_{i,t}$ is a vector of covariates, v_i is a country fixed effect and $\varepsilon_{i,t}$ is the error term. We assume that this error term is normally distributed with mean 0 and variance σ^2.

To assess the volatility predictions, the variance, σ^2, is modeled as a function of a vector of covariates, $Q_{i,t}$. In particular,

$$Log(\sigma^2) = Q_{i,t}\gamma \tag{7}$$

Estimates of β_Δ assess how threats and conditions affect the direction of institutional change. Estimates of γ assess how threats and conditions affect institutional volatility. When, for instance, $\widehat{Revolution}_{i,t}$ dominates $\widehat{Coup}_{i,t}$ then we expect that $\Delta W_{i,t}$ increases and when $\widehat{Coup}_{i,t}$ is larger we expect that $\Delta W_{i,t}$ contracts. With respect to the second order statistic, all risks, and the threat of deposition in particular, increase institutional volatility.

4 Results

4.1 Estimating Threats

Table 1 shows fixed effects regression estimates examining the likelihood of Leader Change, Revolution and Coup.[5] Because leaders are expected to act in response to their anticipation of future danger, we do not expect that actual coups, revolutions or leader changes are well predicted. These outcomes should be successfully thwarted much of the time by counter-measures, putting such events "off the equilibrium path" whenever possible.

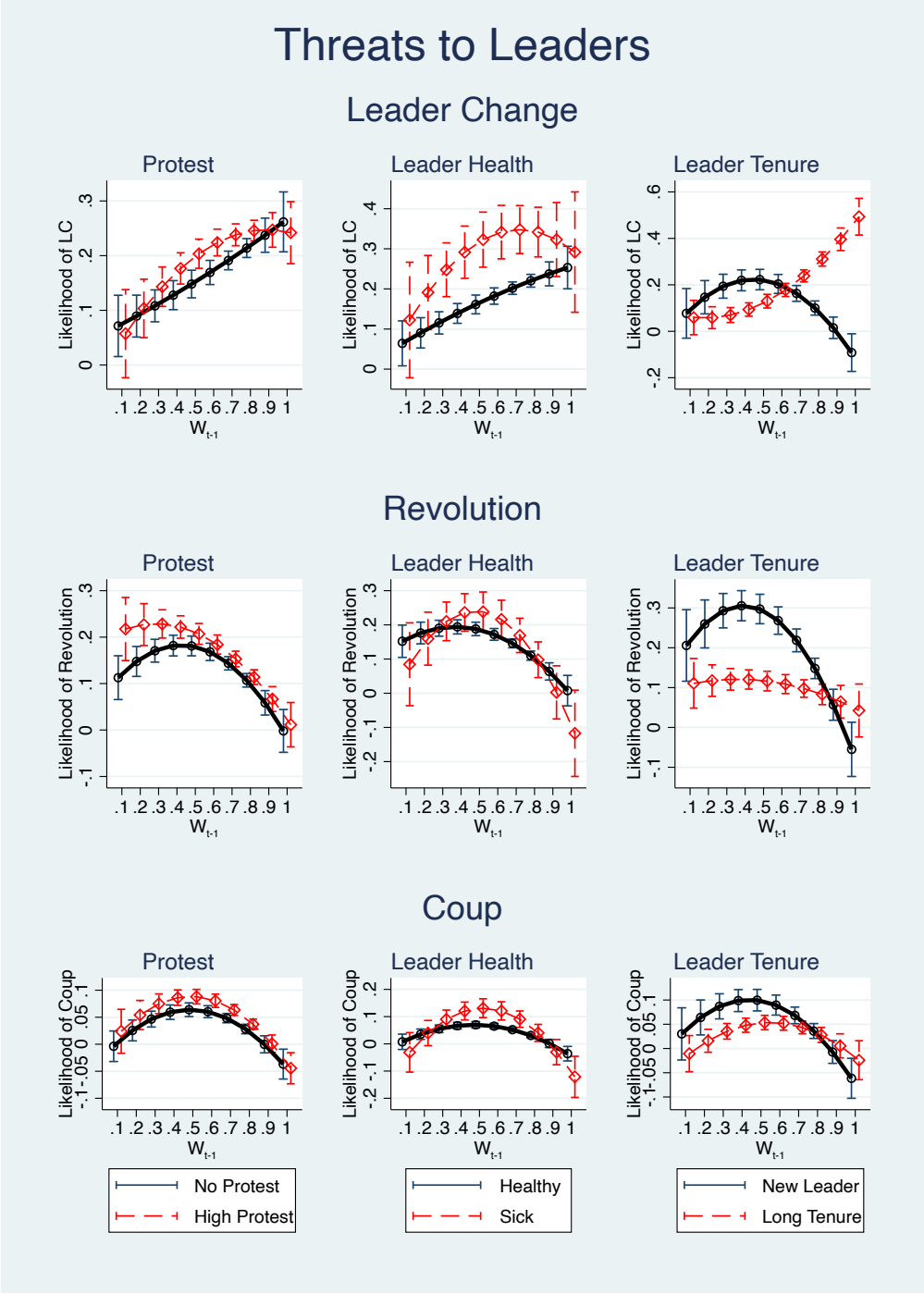
[5]Table A2, in the appendix, shows similar analyses using logit with fixed effects and table A3 shows analogous results with institutions measured using Polity.

Table 1: How Protest, Health and Tenure Affect the Risk of Leader Change, Revolution and Coup (Fixed effects regression analyses)

	(1) Leader Change	(2) Revolution	(3) Coup
W_{t-1}	0.872**	0.930***	0.472**
	(0.300)	(0.252)	(0.152)
W^2_{t-1}	-0.955***	-1.076***	-0.506***
	(0.262)	(0.220)	(0.133)
$Protest_{t-1}$	-0.0384	0.104**	0.0198
	(0.0404)	(0.0340)	(0.0204)
W_{t-1} *$Protest_{t-1}$	0.302*	-0.242*	0.0214
	(0.137)	(0.115)	(0.0699)
W^2_{t-1} *$Protest_{t-1}$	-0.279*	0.148	-0.0470
	(0.110)	(0.0925)	(0.0563)
Sick	0.00449	-0.133	-0.0939+
	(0.106)	(0.0894)	(0.0535)
W_{t-1} *Sick	0.594	0.723+	0.611**
	(0.441)	(0.371)	(0.222)
W^2_{t-1} *Sick	-0.560	-0.716*	-0.602**
	(0.401)	(0.337)	(0.202)
Log(Tenure)	0.0288	-0.0102	-0.00982
	(0.0353)	(0.0297)	(0.0179)
W_{t-1} *Log(tenure)	-0.406**	-0.243*	-0.0446
	(0.135)	(0.114)	(0.0688)
W^2_{t-1} *Log(tenure)	0.572***	0.286**	0.0668
	(0.118)	(0.0993)	(0.0601)
Age	0.00359***	-0.000201	0.000255
	(0.000526)	(0.000443)	(0.000265)
$Log(GPDpc_{t-1})$	0.0140	-0.0650***	-0.00468
	(0.0153)	(0.0129)	(0.00771)
$Log(Population_{t-1})$	-0.0252	-0.0530*	-0.0579***
	(0.0283)	(0.0238)	(0.0143)
Growth	-0.00289	-0.00534***	-0.00253**
	(0.00181)	(0.00152)	(0.000912)
W_{t-1} *Growth	-0.00343	0.000908	-0.000276
	(0.00313)	(0.00263)	(0.00158)
Observations	7486	7481	7432
Nations	164	164	162
R2	0.0443	0.0594	0.0344

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 2: How Protest, Health and Tenure Affect the Occurrence of Revolutions, Coup and Leader Turnover (Graphs based on the analyses in table 1)



Given the expectation that the impact of protest, health and tenure on survival will

be different as the institutional setting changes, each of these variables is interacted with both W_{t-1} and W_{t-1}^2. This quadratic specification makes a direct interpretation of regression estimates unwieldy and so we illustrate the effects graphically. Figure 2 illustrates how protest, health and tenure affect the likelihood of leader change (first row of graphs), the likelihood of revolution (second row of graphs) and likelihood of coup (final row of graphs). The first column of graphs contrasts the impact of a low level of protest (solid lines) with a high level of protest (dashed lines). The second column of graphs contrasts healthy and sickly leaders and the final column compares established, long-tenured leaders with new leaders.

The analyses in table 1 include population, wealth and growth. Economic growth reduces the risk of leader turnover in large coalition systems, but the analyses suggest growth has little impact on survival in small W systems. Economic growth reduces the risk of revolution and coup, but the magnitudes of these effects are small.

The statistical models predict when revolutions and coups are likely to occur. Yet these models do not allow us to perfectly discriminate between conditions when a revolution or coup will occur and conditions when they will not.[6] One approach to improving our ability to estimate coup and revolutions might be to include additional variables. For instance, Powell (2012*a*) details numerous factor that influence the occurrence and success of coups. Unfortunately, including such variables greatly reduces the range of countries and time for which we can estimate the prevalence of coups. As stated earlier, in terms of tradeoffs we explicitly chose a broad, encompassing approach. Yet, the theory predicts that even if such additional measures were broadly available, we would still under-estimate the risk that leaders face because leaders act to reduced elevated risks.

If we as analysts could identify when a leader is under threat, then we can be sure

[6]The R-squared statistic suggests that less than 10% of the variance is explained by the analysis, although this excludes the model fit accounted for by the fixed effects. Absent fixed effects, the regressors account for a much greater proportion of the variance and other approaches also suggest improved model fit statistics.

that leaders also recognize the risk. A savvy leader does not sit idly by while she is removed. When leaders are under threat they make efforts to ameliorate these threats by changing policies and institutions. Not all such efforts are successful. Some risks prove to be insurmountable. However, leaders are likely to perceive higher risks than we estimate and are often able to respond appropriately to dissipate such risks. We turn to an examination of these responses.

5 Leader Responses to Threats

The analyses of leader change, revolution and coup provide estimates of the risks that leaders face. When the risks are high we anticipate that leaders will be especially proactive in altering institutions. High risks generate institutional volatility and whether the greater threat comes from the masses or from the elites determines the direction in which leaders are most likely to modify institutions.

Table 2 shows fixed effect heteroskedastic regression models in which the dependent variable is change in institutions: $\Delta W_{i,t} = W_{i,t+2} - W_{i,t-1}$. The top portion of the table refers to standard regression estimates ($\hat{\beta}_{\Delta}$): the coefficient estimates indicate how each factor influences directional change in political institutions. The lower portion of the tables show how a vector of regressors affect the volatility of political institutions. Specifically, the variance in the error term: $ln(\sigma^2) = \gamma Q$. The estimates in the lower portion of the table correspond to $\hat{\gamma}$.

The first model, labeled Events, estimates how the actual occurrence of events affects institutional change. The second model, labeled Risks, assesses how the perceptions of risks (estimated above) affect how leaders alter institutions. The third model (Both) combines both actual events and risks. The fourth and fifth models replicate the assessments in model 3 (Both) but now separating the effects when the leader survived or was removed.

We start our discussion of the results by looking at the volatility component. The

results show two clear patterns. First, institutional change is greatest toward the middle of the range of W and smallest at large W. If $W_{t-1} = .4$ (and assuming no leader change or anticipation of leader change), then the estimated variance, σ^2, is about 0.01.[7] For a large coalition system, say $W_{t-1} = .8$, the variance in institutions is much lower, about 0.001.

Second, both leader change and the anticipation of leader change greatly increase the volatility of political institutions. As we see in Table 2, the coefficient for the estimated risk of leader change is about twice as large as the coefficient for the occurrence of actual leader change. It is perhaps not surprising that institutions are liable to change when leaders are replaced. However, the results here show that the anticipation that a leader faces a high risk of replacement also leads to substantial institutional change.

Columns 4 and 5 of table 2 examine cases where leader change does not occur and cases where leader change does actually occur (in year t or $t+1$). When leaders perceive a high deposition risk but manage to survive, the circumstance examined in model 4 (labeled No LC), institutions are extremely volatile. It would appear that leaders who anticipate a high risk of being deposed make substantial institutional changes to thwart that risk. Turning to the fifth column (labeled LC), we examine the set of events in which leaders are actually deposed (in either year t or $t+1$). In this model the risk of leader change appears to have little impact on the volatility of institutions. One interpretation of this finding is that a leader who ignores the high risk she faces and who fails to shake up institutions is a leader who ends up being deposed.[8] It would appear that leaders who successfully navigate a high deposition risk do so, at least in

[7] This estimate is $\hat{\sigma^2} = exp(-10.91W_{t-1}^2 + 7.416W_{t-1} - 6.079)$ where the -6.079 corresponds to the unreported constant.

[8] This interpretation is also supported by the exclusion of $\widehat{LeaderChange}$ or Leader Change from the σ equation. If $\widehat{LeaderChange}$ is excluded from the specification for σ, then the coefficient estimate for Leader Change is substantially smaller than those reported in model 3. In contrast, if Leader Change is excluded from the specification then the estimate for $\widehat{LeaderChange}$ is substantially increased.

part, via institutional change. We turn next to how the threat a leader faces affects whether such institutional change involves liberalization or purges.

The upper portion of table 2 shows the estimated direction and magnitude of institutional change: $\Delta W = W_{t+2} - W_{t-1}$. The estimates on W_{t-1} and W_{t-1}^2 highlight regression towards the mean: regimes at the boundaries of coalition size can only move towards the center. The first model (labeled Events) suggests that the occurrence of a coup leads to a contraction in coalition size of about 5% of the scale. In contrast, neither leader change nor revolution has an aggregate directional effect on winning coalition size. That is to say, on average, liberalizations are about as likely as institutional contractions when a leader is replaced or a revolution occurs.

The second model of table 2 examines the anticipated risk of events. Consistent with theoretical expectations, the significant positive coefficient estimate on $\widehat{Revolution}$ and the significant negative coefficient estimate on $\widehat{Coup}$ indicate that if the dominant risk is believed to come from the masses, then leaders are likely to liberalize and if the dominant threat is expected to come from the coalition, then purges are the likely response. It is worth noting that if the leader believes that she faces an approximately equal threat of coup and revolution, then neither threat dominates and the leader must gamble as to which institutional change is best. In this situation, threats result in high institutional volatility, but low predictability in terms of the direction of change. These risks, $\widehat{LC}$, $\widehat{Revolution}$ and $\widehat{Coup}$ are taken from the predicted values for the analyses in table 1. Based on the simulation approach suggested by King et al. (2001), in the appendix we show the robustness of the results by repeatedly drawing random samples from the estimated distribution for each risk. We then repeat the heteroskedastic regression from each of these samples and find similar effects in the aggregate sampling approach as we did using the predicted values.

The findings in the Events and Risks models hold in model 3 (labeled Both). Coup and the threat of coup lead to institutional contraction, while the risk (and to a lesser extent the actual occurrence) of revolution lead to institutional expansion.

Table 2: How Leader Change, Revolution, Coup and the Threat of these Events Affect Institutional Change and Institutional Volatility (Risks estimated from analyses in table 1)

	(1) Events	(2) Risk	(3) Both	(4) No LC	(5) LC
D2W					
W_{t-1}	-0.227***	-0.150***	-0.157***	-0.176***	-0.682***
	(0.0268)	(0.0295)	(0.0296)	(0.0300)	(0.0803)
W^2_{t-1}	0.0347	-0.0450$^+$	-0.0406	0.0228	0.208**
	(0.0225)	(0.0265)	(0.0265)	(0.0272)	(0.0639)
Leader Change	0.00214		0.00220		
	(0.00133)		(0.00135)		
Revolution	0.000218		-0.000633	0.00174	-0.00613
	(0.00214)		(0.00214)	(0.00241)	(0.00413)
Coup	-0.0564***		-0.0536***	-0.0348***	-0.0794***
	(0.00580)		(0.00578)	(0.00719)	(0.00920)
$\widehat{LeaderChange}$		0.0175**	0.0151**	0.0125$^+$	0.0148
		(0.00570)	(0.00570)	(0.00752)	(0.00955)
$\widehat{Revolution}$		0.139***	0.139***	0.130***	0.101*
		(0.0240)	(0.0239)	(0.0243)	(0.0507)
$\widehat{Coup}$		-0.392***	-0.368***	-0.265***	-0.322***
		(0.0499)	(0.0497)	(0.0536)	(0.0939)
lnsigma2					
$\widehat{LeaderChange}$	2.346***	2.497***	2.391***	2.847***	-0.608$^+$
	(0.171)	(0.171)	(0.171)	(0.218)	(0.326)
Leader Change	0.574***	0.606***	0.563***		
	(0.0473)	(0.0474)	(0.0474)		
W_{t-1}	7.533***	7.416***	7.354***	2.737***	15.32***
	(0.407)	(0.405)	(0.404)	(0.482)	(0.911)
W^2_{t-1}	-11.08***	-10.92***	-10.92***	-6.244***	-18.50***
	(0.354)	(0.353)	(0.352)	(0.425)	(0.754)
Observations	7269	7269	7269	5108	2161
Fixed Effects	162	162	162	161	158
R2	0.16	0.17	0.17	0.16	0.34
loglike.	11049.02	11030.83	11077.06	8535.42	3217.44
AIC	-21746.05	-21709.65	-21796.11	-16718.84	-6088.87

Standard errors in parentheses
$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The analyses in table 2 show clear patterns: 1) intermediate sized institutions are more volatile than the most democratic or most autocratic systems; 2) leader change and the risk of leader change increase institutional volatility; 3) when the dominant threat comes from the masses, leaders tend to liberalize; and, 4) if the coalition represents the dominant threat, then leaders tend to purge and contract winning coalition size.

The model specifications in table 2 provide a straightforward interpretation. However, those analyses have limitations. We anticipate that the impact of different threats on subsequent institutional change varies depending on current institutions. To assess the extent to which different forms of institutions respond differently to different threats, we interact the risk of events with a quadratic specification of political institutions in Table 3. For instance, we include $W_{t-1} * \widehat{LeaderChange}$ and $W_{t-1}^2 * \widehat{LeaderChange}$ as well as $\widehat{LeaderChange}$ (and equivalent interactions for the other risks and events).

A comparison of the Akaike Information Criteria (AIC) statistics from tables 2 and 3 suggest that the quadratic specification clearly dominates. Given the large number of interactions, the substantive impact of the risk and the occurrence of events is most easily seen graphically. Figures 3 and 4 are constructed from the third model specification that includes both events and risks.

Figure 3 focuses on institutional volatility, the σ^2 variance component. The first panel shows how the occurrence of leader change increases institutional volatility in small coalition systems but has very little impact on institutional volatility in more inclusive political systems. The second panel examines the impact of the risk of leader change. The solid line shows that political institutions are relatively stable when the risk of leader change is low. However, as the deposition risk increases, institutional volatility in intermediate sized coalition systems increases substantially. In contrast, at the extremes of either very large or very small coalition systems, a high risk of leader change does little to increase institutional volatility. The figure shows clear

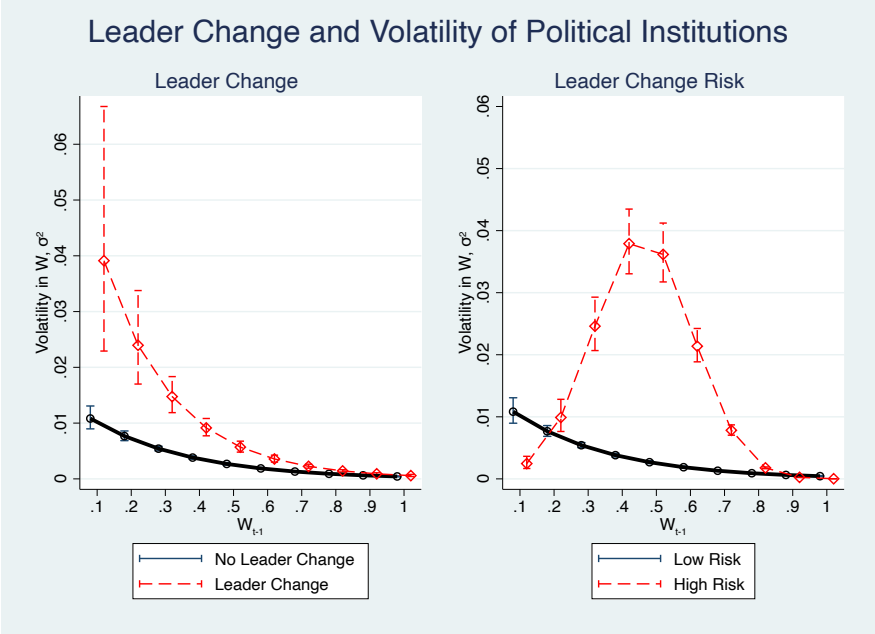
Table 3: How Leader Change, Revolution, Coup and the Threat of these Events Affect Institutional Change and Institutional Volatility (The risks are estimates from the fixed effects regression analyses show in table 1)

	(1) Events	(2) Risk	(3) Both
D2W			
W_{t-1}	-0.210***	-0.161***	-0.162***
	(0.0287)	(0.0483)	(0.0480)
W^2_{t-1}	0.0232	-0.0196	-0.0166
	(0.0233)	(0.0396)	(0.0393)
Leader Change	0.101***		0.121***
	(0.0273)		(0.0285)
W_{t-1} *Leader Change	-0.213**		-0.269***
	(0.0695)		(0.0725)
W^2_{t-1} *Leader Change	0.112*		0.149**
	(0.0447)		(0.0465)
Revolution	0.0410*		0.00431
	(0.0184)		(0.0205)
W_{t-1} *Revolution	-0.0684		0.0195
	(0.0604)		(0.0665)
W^2_{t-1} *Revolution	0.0215		-0.0295
	(0.0470)		(0.0511)
Coup	0.0619		0.0499
	(0.0435)		(0.0441)
W_{t-1} *Coup	-0.229		-0.116
	(0.163)		(0.165)
W^2_{t-1} *Coup	0.0531		-0.0666
	(0.142)		(0.143)
Growth	-0.000362+	-0.00193***	-0.00190***
	(0.000195)	(0.000314)	(0.000315)
W_{t-1} *Growth	0.000402	0.00210***	0.00206***
	(0.000307)	(0.000394)	(0.000394)
$\text{Log(GPDpc}_{t-1})$	-0.0103***	-0.0110***	-0.0108***
	(0.00204)	(0.00280)	(0.00279)
$\text{Log(Population}_{t-1})$	0.0226***	0.0137***	0.0144***
	(0.00306)	(0.00411)	(0.00408)
$\widehat{LeaderChange}$		-0.0377	-0.0702
		(0.0739)	(0.0749)
W^2_{t-1} *$\widehat{LeaderChange}$		0.0238	0.113
		(0.199)	(0.204)
W^2_{t-1} *$\widehat{LeaderChange}$		0.0143	-0.0442
		(0.139)	(0.143)
$\widehat{Revolution}$		0.0927+	0.0909
		(0.0557)	(0.0601)
W_{t-1} *$\widehat{Revolution}$		0.242	0.237
		(0.160)	(0.174)
W^2_{t-1} *$\widehat{Revolution}$		-0.520***	-0.512***
		(0.127)	(0.137)
$\widehat{Coup}$		0.332*	0.249
		(0.163)	(0.165)
W_{t-1} *$\widehat{Coup}$		-3.214***	-2.890***
		(0.477)	(0.486)
W^2_{t-1} *$\widehat{Coup}$		3.364***	3.119***
		(0.377)	(0.383)
lnsigma2			
Leader Change	1.217***	1.110**	1.439***
	(0.366)	(0.364)	(0.374)
W_{t-1} *Leader Change	-0.806	0.302	-1.588
	(1.298)	(1.299)	(1.332)
W^2_{t-1} *Leader Change	-0.200	-1.367	0.431
	(1.058)	(1.062)	(1.086)
$\widehat{LeaderChange}$	-10.58***	-11.76***	-11.42***
	(1.113)	(1.129)	(1.125)
W^2_{t-1} *$\widehat{LeaderChange}$	72.10***	76.97***	75.74***
	(4.108)	(4.157)	(4.133)
W^2_{t-1} *$\widehat{LeaderChange}$	-69.89***	-74.34***	-73.62***
	(3.396)	(3.439)	(3.417)
W_{t-1}	-3.994***	-4.599***	-4.426***
	(0.663)	(0.662)	(0.663)
W^2_{t-1}	0.322	0.988+	0.850
	(0.587)	(0.588)	(0.589)
Observations	7269	7269	7269
Fixed Effects	162	162	162
R2	0.20	0.20	0.23
loglike.	11537.92	11573.22	11647.34
AIC	-22695.83	-22766.44	-22896.68

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

patterns. It is in the smallest coalition systems that leader change results in the greatest institutional volatility and it is leaders in mid-size coalition systems that are most likely to alter institutional arrangements in response to political threats.

Figure 3: How Leader Change and Deposition Risk Affect the Volatility of Political Institutions (Graphs are based on the heteroskedastic fixed effects regression model estimates in table 3, which uses the risk estimates from the fixed effect regression analyses in table 1)

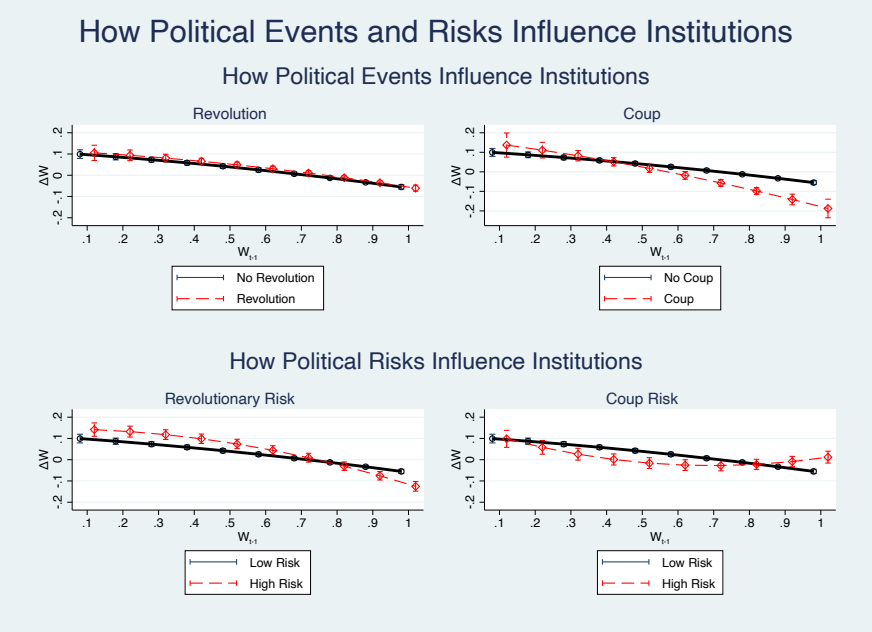


Turning to directional predictions, figure 4 shows how the occurrence and risks of revolution and coup lead to expansions or contractions in coalition size. The top row of graphs in the figure corresponds to the actual occurrence of revolution and coup. The figures clearly illustrate that on average the realization of these events does not meaningfully alter the average directional shift in institutions. Of course some revolutionary events will lead to liberalization but the graph suggests that such expansions are, on average, canceled out by revolutions that are followed by increased autocratization. The pattern is similar with respect to coups. Some coups are followed by coalition expansion while others lead to contraction. However, in the aggregate, the occurrence of a coup has no directional effect on the subsequent size of the winning

coalition.

The second row of graphs in figure 4 illustrates how a high risk of revolution or coup relate to directional shifts in institutions. The first of the lower graphs shows that in response to a high revolutionary threat, there is an aggregate expansion in coalition size in small and moderate size coalition systems. In the largest coalition systems, as anticipated, such revolutionary threats have little impact. The second lower graph examines the impact of a high coup threat. While the actual occurrence of a coup had little aggregate effect on institutions, the presence of a high coup threat induces leaders in intermediate sized coalitions to purge their supporters and contract the coalition.[9]

Figure 4: How Revolutions, Coup and the Risk of these Events Affect Political Institutions (Graphs are based on the heteroskedastic fixed effects regression model estimates in table 3, which uses the risk estimates from the fixed effect regression analyses in table 1)



The comparisons between the left and right sides of figures 3 and 4 provide a

[9]In the very largest W systems the graphs suggest that a high revolutionary threat leads to contraction and a high coup threat leads to expansion. We do not emphasize these effects since they rely on counterfactuals that are not present in the data. As illustrated in figure 1, revolutions and coups virtually never occur in the largest coalition systems.

stark visualization of the central arguments of this paper. Leaders anticipating threats to their tenure, whether from the masses or elites, alter institutions to ameliorate such threats. By and large, the pre-emptive responses to threats appear to have a larger impact than the actual occurrence of these events. In the most democratic systems, there is little institutional volatility. In intermediate sized coalition systems a heightened risk of deposition is associated with substantial institutional volatility. On average, leaders in such systems appear to respond to threats from the masses by liberalization and to purge their supporters when elites present the greater threat.

6 Conclusions

Driven by theoretical concerns, we examine mass political uprisings, coups and institutional changes holistically, rather than as separate phenomena. To come to power leaders make great sacrifices that, especially for non-democratic leaders, often place them in mortal jeopardy. It should come as little surprise that having attained office, they are reluctant to leave. The evidence suggests that leaders are responsive to threats and adjust political institutions to ameliorate risks. Leaders, particularly those who rule intermediate sized coalition systems, alter institutional arrangements in response to deposition risks. When the expected threat of revolution is high, leaders tend to liberalize. When elites present the greater danger, leaders typically purge. Although our analyses find that leader change has a large, and generally liberalizing, influence in very small coalition systems, by and large, outside of these very small systems the perceptions of risk have a larger influence on institutional change than does the actual realization of such threats. Leaders seem able to anticipate and to ameliorate the risks to their political survival.

We believe these results have important policy applications. If government can anticipate instability elsewhere, then it may be able to take action to alter the risk. We provide evidence that the selectorate theory can be used to anticipate regime changes

based on estimates of the risk rather than realization of such events as coups and revolutions.

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Institutional Change as a Response to Unrealized Threats: An Empirical Analysis: Appendix

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1 Measures of W and Events

The continuous measure of winning coalition size, W (Bueno de Mesquita and Smith, 2022), is based on institutional variables in the V-Dem data set, version 11 (2021). The V-Dem project is a broad and encompassing endeavor that codes virtually all nations since 1789 on a vast array of issues, including political competition, policy outcomes and freedoms. The W measures is composed of four institutional dimensions:

1. Autonomy of election monitoring body (v2elembaut)

2. Opposition parties' autonomy (v2psoppaut)

3. Barriers to political party participation (v2psbars)

4. Closed Succession: Indicators of succession by heredity or within a military or single party setting (constructed from $v2x_ex_hereditary$, $v2x_ex_military$, and $v2x_ex_party$)

The first element, autonomy of the election monitoring body, establishes the extent to which the administrative body responsible for monitoring elections is controlled by the government or other central authorities, like the military, or, instead, is independent and applies election laws impartially. This first component in our indicator of W assesses the extent to which there is an institutionalized mechanism that allows a large class of selectors – the electorate – a say in choosing the government or, instead, restricts that say to a smaller class of selectors, such as the incumbent regime or the military. Clearly, the size of the prospective winning coalition increases as the autonomy of such a board is institutionalized, assuring its independent operation.

An autonomous election monitoring board is an important element in assuring the opportunity for a large number of selectors to determine leadership succession but it is far from sufficient. After all, a one-party state, whether it has an autonomous election monitoring body or not, still restricts the set of people needed to form a winning coalition to those who endorse the one approved party. Hence, the second component of our indicator of W, opposition parties' autonomy, is V-Dem's measure of the degree to which political parties can operate independently of the incumbent regime. If a government has institutionalized a one-party state, such as Cuba has done, or if a government has institutionalized its authority to select parties (and their candidates) that are permitted to compete in elections, as Russia and Iran have done, then the government has restricted the size and composition of a winning coalition to members or supporters of authorized parties only, shrinking the subset of selectors (W) needed to sustain a leader in power. If, instead, there are many political parties competing for power, then more selectors will probably be attracted to participate in choosing a successor leadership and that means more support – a larger winning coalition – is likely to be needed to win and to sustain power. Democracy dies if there are not at least two political parties realistically competing for power.

The first two variables in the indicator for W insure preconditions that influence the size of a winning coalition. While the resolution of each may satisfy a necessary condition for a larger (or a smaller) winning coalition, they are not sufficient. Having autonomous, impartial mechanisms for enforcing election laws and independent opposition parties are important for accountable government but they fail to complete the requirements for such a government if selectors are encumbered in their *right and their opportunity* to form parties that can compete for control of the government. Hence, the third element in our indicator of

W evaluates the degree of encumbrance in participating in the government-selection process. There can be a large winning coalition only if the political structure has institutionalized an unencumbered right to form competitive parties; if the system has institutionalized the right to have multiple parties; and if the competition takes place over an expansive pool of people that allows for the prospect of a large winning coalition.

The extent of institutional fulfillment of the three variables – autonomous monitoring, autonomous opposition party participation and unencumbered rights to form parties – are collectively necessary and sufficient institutions to shape an electoral political system's winning coalition size. The more an electoral government falls down on one or more of these conditions, the smaller its coalition is likely to be. The more an electoral system has institutionalized the absence of encumbrances to party formation, the right to oppose the government and the right to have outcomes determined impartially and in light of the law, the larger the coalition is likely to be. But, not all political systems today, let alone over most of history, are electoral. Monarchies and military juntas, for instance, may not bother with even rigged elections. Thus, to cover all types of polity, we need to add a final set of conditions as part of our estimation of relative coalition size.

We construct a final component to W from V-Dem's variables $v2x_ex_hereditary$, $v2x_ex_military$, and $v2x_ex_party$. As their labels imply, these last three variables assess the extent to which a person's opportunity to lead a government is limited and depends on their hereditary status, their military position or is determined by a ruling party even if they have widespread support outside of these eligibility constraints. Institutionalized succession that is determined by any one of these three criteria assures that a government has a small winning coalition, consisting, for instance, of a royal family (as in Saudi Arabia) or a group of generals or other military leaders (as in today's Egypt), or a small cadre of party leaders (as in North Korea).[1] To the extent that these conditions are relaxed or absent it is likely that the size of the winning coalition grows.

We take the maximum value for each country-year from among hereditary, military and party and reverse its direction. That is, smaller values mean greater dependence on hereditary, military or party control and larger values indicate less reliance on such constraints on leadership selection.

Winning coalition size is constructed by summing the 4 standardized parts and then dividing by 4 to take their average standardized score. Specifically, let j index the component,

[1]Even these governments have held rigged elections although not for their national leader in the cases of Saudi Arabia and North Korea.

i index nation and t index year.

$$w_{i,t} = \frac{1}{4}\sum_{j=1}^{4}\frac{x_{j,i,t} - \bar{x_j}}{sd(x_j)}, \tag{1}$$

where $x_1 = v2elembaut$, $x_2 = v2psoppaut$, $x_3 = v2psbars$ and $x_4 = -max\{v2x_ex_hereditary$, v2x_ex_military, $v2x_ex_party\}$ and $\bar{x_j}$ and $sd(x_j)$ are the mean and standard deviation of x_j across all nation-year observations.

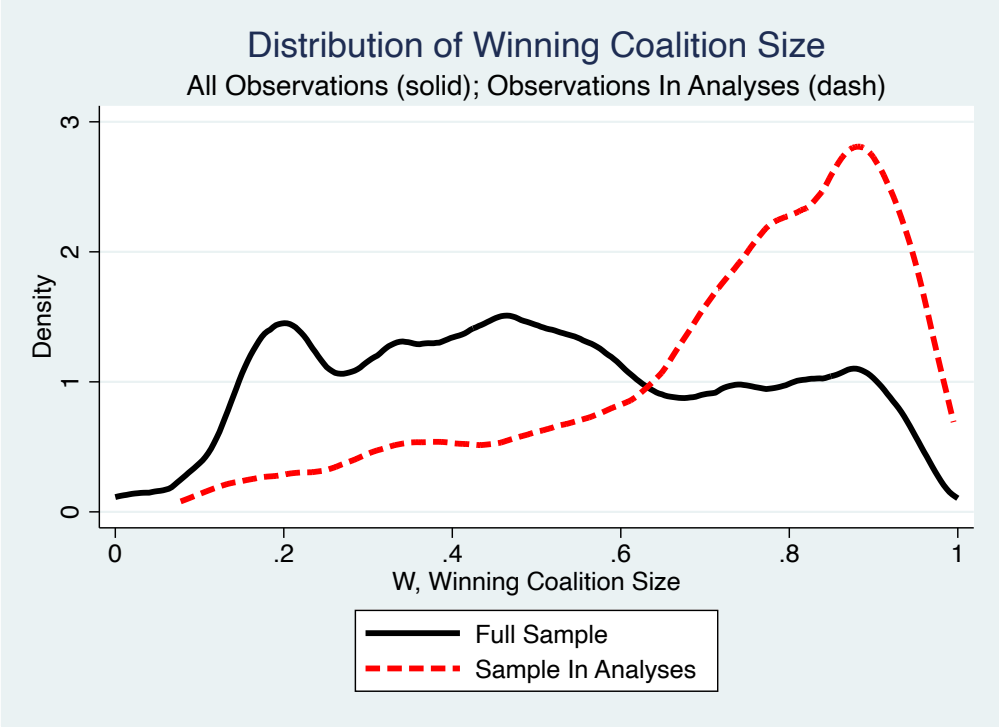
For ease of comparison to other measures of government type (which we normalize to fall between 0 and 1), we normalize our measure on coalition size:

$$W_{i,t} = \frac{w_{i,t} - min(w_{i,t})}{max(w_{i,t}) - min(w_{i,t})} \tag{2}$$

The normalization of $W_{i,t}$ (we suppress the indexing moving forward) insures that the coalition size indicator falls between 0 and 1.

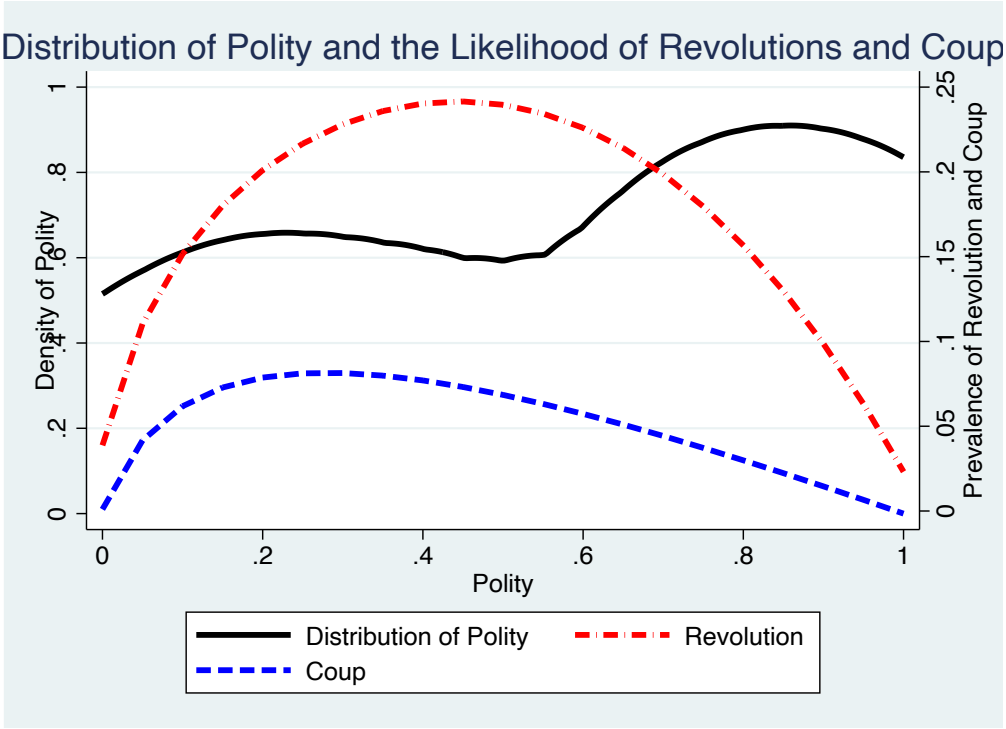
Figure 1 showed the distribution of W in the sample used in the analyses. The sample is composed of relatively recent events given the inclusion of economic variables. Figure A1 show the distribution of W for all available observation. The full sample contains many more examples of small coalition systems than is contained in the sample used in the main text. Of course, the main text's sample is restricted to more recent years because many independent variables – especially those associated with a nation's economy – are missing for earier periods.

Figure A1: Distribution of Winning Coalition Size (Solid line correspond to full sample of nations and the dashed line corresponds to the sample used in the analysis for which variables are available)



We replicate the analyses shown in the main text using the Polity score (democracy-autocracy, normalized to a 0 to 1 scale). Figure A2 shows the distribution of the polity score and the occurrence of coups and revolutions as a function of the polity score.

Figure A2: Distribution of Polity and the Prevalence of Revolutions and Coups



2 Occurrence of Revolution, Coup and Leader Change

As robustness checks, we replicate the fixed effects regression analyses shown in table 1 using logit analyses without fixed effects (table A1), fixed effect logit analyses (table A2) and using polity as the measure of political institutions (table A3). Figures A3, A4 and A5 graphically illustrate how protest, health and tenure influence the different risks that leaders face under each of these specifications

Table A1: How Protest, Health and Tenure Affect the Risk of Leader Change, Revolution and Coup (Logit analyses without fixed effects)

	(1) Leader Change	(2) Revolution	(3) Coup
main			
W_{t-1}	2.931	9.536***	17.33***
	(2.087)	(2.399)	(5.117)
W^2_{t-1}	-2.022	-10.66***	-19.52***
	(1.699)	(2.187)	(4.978)
$Protest_{t-1}$	-0.150	0.00639	0.0123
	(0.310)	(0.335)	(0.594)
W_{t-1} *$Protest_{t-1}$	1.902+	0.739	1.191
	(1.015)	(1.218)	(2.212)
W^2_{t-1} *$Protest_{t-1}$	-1.910*	-0.727	-1.013
	(0.790)	(1.038)	(1.966)
Sick	0.549	-9.394**	-7.795+
	(0.781)	(2.988)	(4.301)
W_{t-1} *Sick	2.893	40.76***	33.17*
	(3.043)	(11.91)	(16.32)
W^2_{t-1} *Sick	-3.462	-40.40***	-30.10*
	(2.663)	(11.57)	(15.09)
Log(Tenure)	-0.313	-0.0107	0.168
	(0.299)	(0.304)	(0.626)
W_{t-1} *Log(tenure)	-1.152	-2.229+	-3.795
	(1.046)	(1.212)	(2.618)
W^2_{t-1} *Log(tenure)	1.626+	2.623*	4.628+
	(0.857)	(1.131)	(2.592)
Age	0.0163***	-0.0131***	0.00148
	(0.00329)	(0.00383)	(0.00678)
$Log(GPDpc_{t-1})$	0.0283	-0.357***	-0.334***
	(0.0299)	(0.0364)	(0.0698)
$Log(Population_{t-1})$	-0.0152	0.230***	-0.0601
	(0.0216)	(0.0270)	(0.0489)
Growth	-0.0559***	-0.0640***	-0.0127
	(0.0162)	(0.0171)	(0.0269)
W_{t-1} *Growth	0.0295	0.0370	-0.119*
	(0.0259)	(0.0320)	(0.0520)
Observations	7486	7481	7432
Nations	164	164	162
ROC	0.6701	0.7930	0.8440

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A3: How Protest, Health and Tenure Affect the Occurrence of Revolutions, Coup and Leader Turnover (Logit without country fixed effects. Figures based on models in table A1)

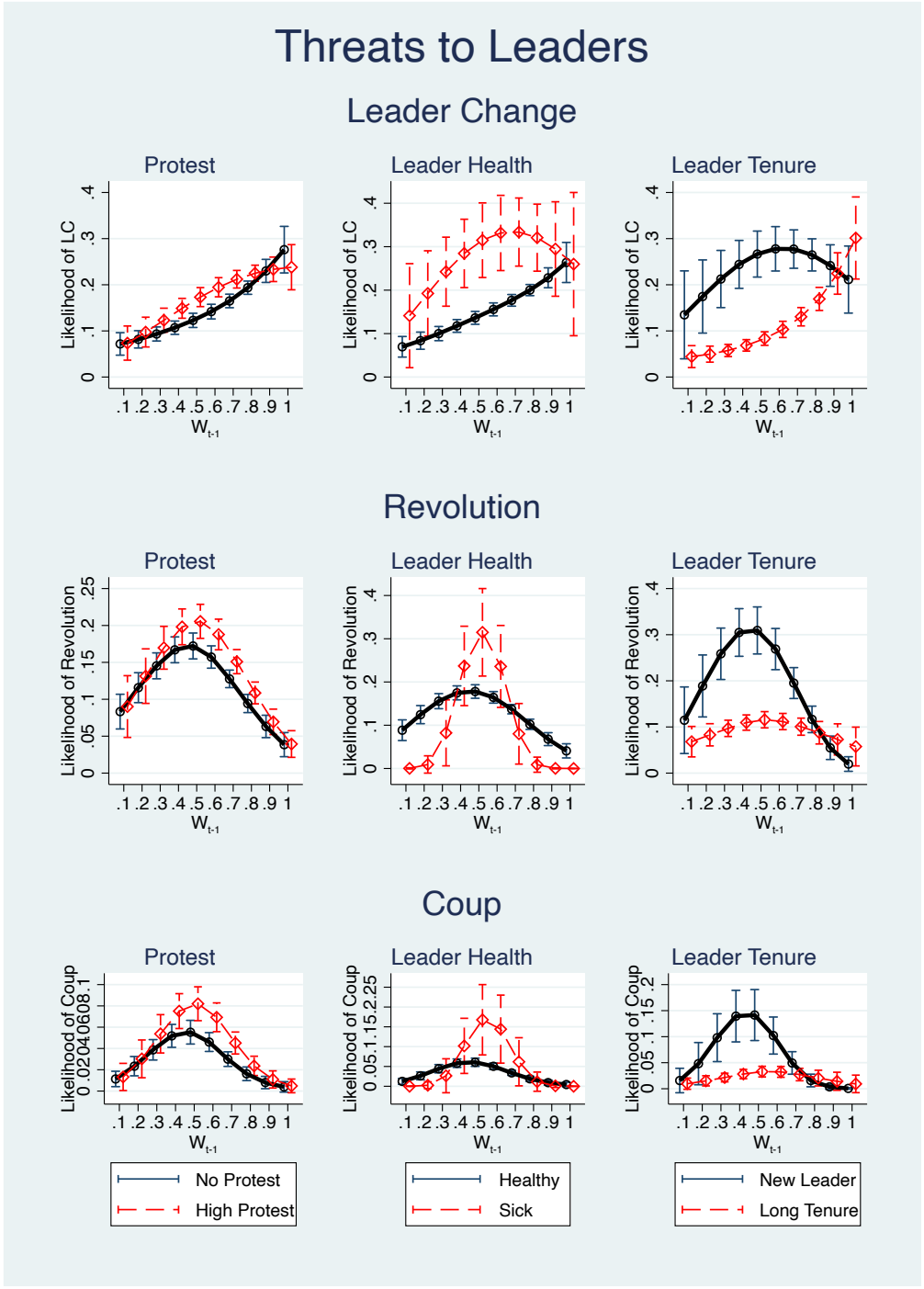


Table A2: How Protest, Health and Tenure Affect the Risk of Leader Change, Revolution and Coup (Logit analyses with country fixed effects)

	(1) Leader Change	(2) Revolution	(3) Coup
main			
W_{t-1}	5.898*	7.000*	17.53**
	(2.792)	(3.179)	(6.281)
W^2_{t-1}	-6.614**	-8.947**	-18.45**
	(2.368)	(2.921)	(6.208)
$Protest_{t-1}$	-0.0477	0.0159	-0.477
	(0.351)	(0.424)	(0.768)
W_{t-1} *$Protest_{t-1}$	1.280	1.528	3.573
	(1.162)	(1.552)	(2.946)
W^2_{t-1} *$Protest_{t-1}$	-1.303	-1.965	-3.541
	(0.916)	(1.330)	(2.687)
Sick	0.954	-8.184**	-6.810
	(0.929)	(3.172)	(4.497)
W_{t-1} *Sick	2.576	36.30**	28.82+
	(3.625)	(12.66)	(17.47)
W^2_{t-1} *Sick	-3.598	-36.49**	-25.52
	(3.182)	(12.20)	(16.48)
Log(Tenure)	-0.181	-0.276	0.685
	(0.361)	(0.388)	(0.758)
W_{t-1} *Log(tenure)	-1.527	-1.532	-4.628
	(1.328)	(1.553)	(3.226)
W^2_{t-1} *Log(tenure)	3.051**	2.215	5.440+
	(1.119)	(1.455)	(3.232)
Age	0.0284***	0.000234	0.00123
	(0.00428)	(0.00537)	(0.00905)
$Log(GPDpc_{t-1})$	0.0935	-0.519**	-0.963**
	(0.149)	(0.169)	(0.327)
$Log(Population_{t-1})$	-0.139	0.0444	-0.388
	(0.261)	(0.439)	(0.797)
Growth	-0.0662***	-0.0452*	-0.0117
	(0.0186)	(0.0190)	(0.0296)
W_{t-1} *Growth	0.0265	-0.00175	-0.141*
	(0.0289)	(0.0358)	(0.0590)
Observations	7393	5569	3752
Nations	160	118	71
ROC	0.7680	0.8266	0.8122

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A4: How Protest, Health and Tenure Affect the Occurrence of Revolutions, Coup and Leader Turnover (Logit with country fixed effects. Figures based on models in table A2)

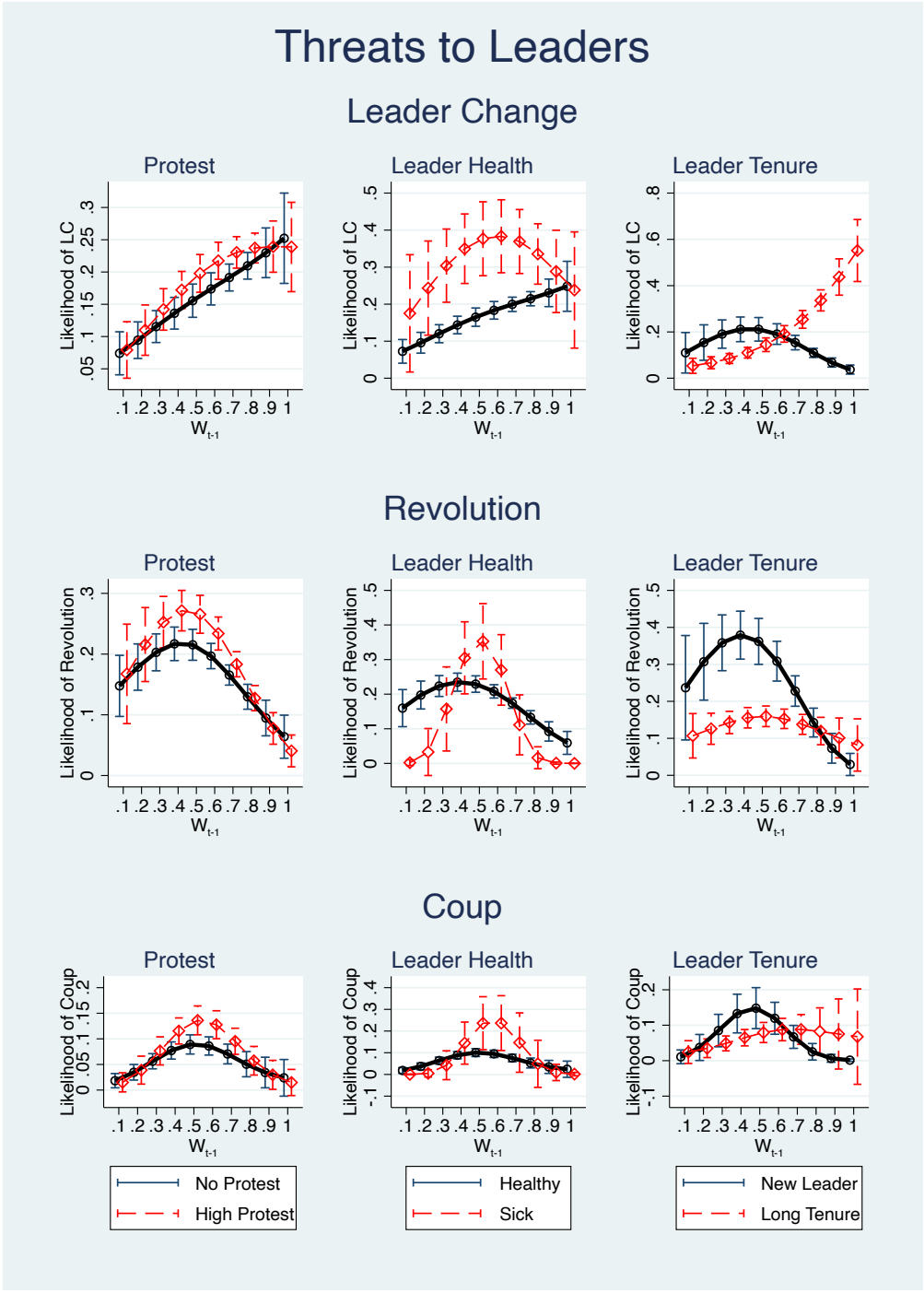
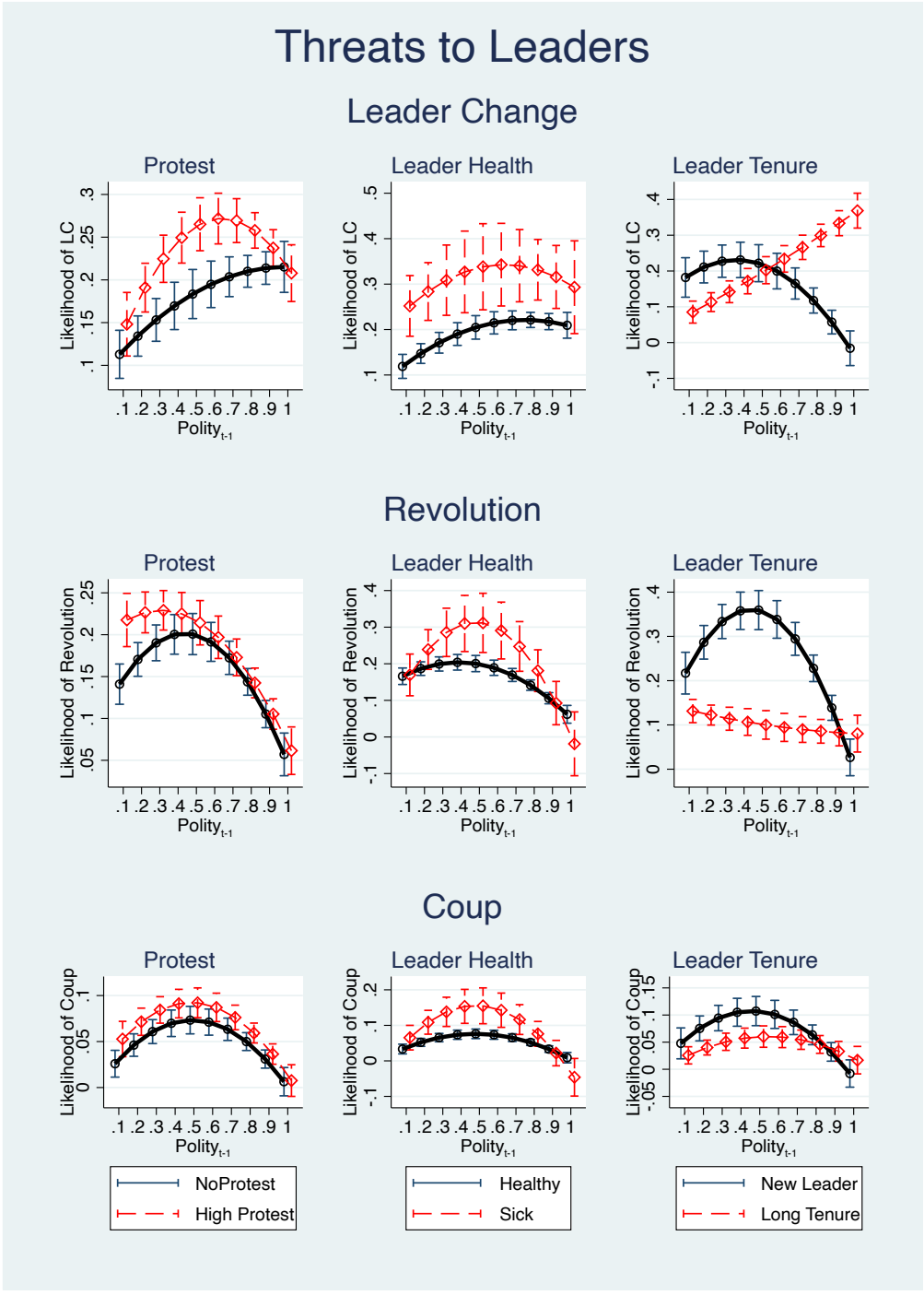


Table A3: How Protest, Health and Tenure Affect the Risk of Leader Change, Revolution and Coup (Fixed effect regression analyses with Polity as the institutional measure)

	(1) Leader Change	(2) Revolution	(3) Coup
Polity_{t-1}	0.391*	1.093***	0.394***
	(0.196)	(0.167)	(0.102)
Polity^2_{t-1}	-0.527**	-1.156***	-0.398***
	(0.178)	(0.152)	(0.0928)
Protest_{t-1}	0.00565	0.0775***	0.0217*
	(0.0208)	(0.0178)	(0.0108)
Polity_{t-1} *Protest_{t-1}	0.242**	-0.194*	-0.00753
	(0.0919)	(0.0785)	(0.0480)
Polity^2_{t-1} *Protest_{t-1}	-0.253**	0.120+	-0.0132
	(0.0810)	(0.0692)	(0.0426)
Sick	0.127*	-0.0594	-0.00108
	(0.0497)	(0.0424)	(0.0257)
Polity_{t-1} *Sick	0.0681	0.703**	0.374*
	(0.309)	(0.264)	(0.163)
Polity^2_{t-1} *Sick	-0.112	-0.725**	-0.428**
	(0.302)	(0.258)	(0.160)
Log(Tenure)	-0.0273	0.00557	-0.00149
	(0.0170)	(0.0145)	(0.00878)
Polity_{t-1} *Log(Tenure)	-0.0721	-0.380***	-0.0665
	(0.0855)	(0.0730)	(0.0445)
Polity^2_{t-1} *Log(Tenure)	0.228**	0.393***	0.0762+
	(0.0789)	(0.0674)	(0.0411)
Age	0.00347***	-0.000301	0.000164
	(0.000538)	(0.000460)	(0.000278)
$\text{Log(GPDpc}_{t-1}\text{)}$	0.0128	-0.0550***	-0.00392
	(0.0157)	(0.0134)	(0.00811)
$\text{Log(Population}_{t-1}\text{)}$	-0.0266	-0.0436+	-0.0607***
	(0.0292)	(0.0249)	(0.0151)
Growth	-0.00257*	-0.00492***	-0.00206***
	(0.00115)	(0.000979)	(0.000592)
Polity_{t-1} *Growth	-0.00615**	-0.00127	-0.00230+
	(0.00237)	(0.00203)	(0.00123)
Observations	7085	7082	7005
Nations	159	159	156
r2	0.0480	0.0639	0.0348

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A5: How Protest, Health and Tenure Affect the Occurrence of Revolutions, Coup and Leader Turnover (Regression analyses with country fixed effects. Institutions are measured using Polity. Figures based on models in table A3)



3 Impact of Threats and Events on Political Institutions

To assess the robustness of the findings reported in the main text as to how the occurrence and risk of events affects political institutions, we replicate our analyses using Polity as the measure of political institutions and using the logit predictions of risk. We also conduct simulations toi test for robustness.

3.1 Simulation based estimates

The estimates on institutional change in tables 2 and 3 are based on the regression analyses of the risks leader face reported in table 1. The analyses in the main tables simply use the predicted risk. However, it is reasonable to ask whether the findings based on this single assessment of risk are robust. In particular, rather than rely on a single prediction of risk based on $X\hat{\beta}$, we repeatedly draw random samples from the estimated distribution of the β parameter and then repeat the heteroskedastic regression analysis for each of these samples. The bottom line is that our results are robust given a simulation approach, as we show for model 3 of table 2, and so for brevity we do not report this approach in the main text.

We describe the simulation approach based on the repeated sampling techniques in King et al. (2001). In particular, first we estimate the risk of revolution via equation 4. Second, based on the estimates of $\hat{\beta}_{rev}$ we draw a random sample for $\beta_{rev,j}$ for $j = 1, ..., m$. Third, for each $\beta_{rev,j}$, we generate a predicted risk of revolution, $\widehat{Revolution}$. Likewise we draw analogous samples for the leader change and coup analyses. Fourth, for each j of the m samples, we repeat the heteroskedastic analysis described in equation 6 to generate estimates $\hat{\beta}_{\Delta,j}$. Based on these m analyses, we report statistics as to the impact of risk on institutional change.

Table A4 reports the $m = 100$ simulation results for model 3 of table 2 for each of the threats leaders face. The first three rows correspond to the estimates of the standard linear model, while the last row reports estimates of the volatility components. The first column, labelled $\overline{\beta}_{\Delta}$, reports the average coefficient estimate, $\overline{\beta}_{\Delta} = \frac{1}{m}\sum_{j=1}^{m}\hat{\beta}_{\Delta,j}$. The variance within the estimates is $S[\hat{\beta}_{\Delta,j}]^2 = \sum_{j=1}^{m}\frac{(\hat{\beta}_{\Delta,j}-\overline{\beta}_{\Delta})^2}{m-1}$. Let $SE[\hat{\beta}_{\Delta,j}]$ be the standard error for the estimate of $\hat{\beta}_{\Delta,j}$. From Rubin (1987), the variance for the simulation estimate is

$$SE(\hat{\beta}_{\Delta})^2 = \frac{1}{m}\sum_{j=1}^{m} SE[\hat{\beta}_{\Delta,j}]^2 + S[\hat{\beta}_{\Delta,j}]^2\frac{m+1}{m}$$

the square root of which we report in column 2 as $SE(\hat{\beta}_{\Delta})$. While the impact of $\widehat{LC}$ on directional change of W is marginally significant, the other variables appear highly significant, consistent with the estimates reported in the main text.

Table A4: Estimates of the Impact of Threats on Institutional Change via Simulation Methods

Estimate	$\overline{\beta}_{\Delta}$	$SE(\hat{\beta}_{\Delta})$
	$X\beta$	
$\widehat{LC}$	-.0024	.0011
$\widehat{Revolution}$	.0109	.0009
$\widehat{Coup}$	-.02446	.00167
	$log(\sigma^2)$	
$\widehat{LC}$	.4085	.0062

3.2 Replication using estimated threats based on logit analyses

Table A5 is based on the basic logit risk estimates in table A1. For consistent comparison with other results, the risks are parameterized as $log\left(\frac{\hat{p}}{1-\hat{p}}\right)$)

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Table A5: How the Occurrence of Leader Change, Revolution and Coup and the Risk of these Events Affects the Direction and Volatility of Institutional Change (Risks estimated from logit specification in table A1)

	(1) Events	(2) Risk	(3) Both
D2W			
W_{t-1}	-0.191***	-0.448***	-0.338***
	(0.0297)	(0.101)	(0.102)
W^2_{t-1}	0.00476	0.254***	0.178*
	(0.0240)	(0.0727)	(0.0735)
Leader Change	0.111***		0.115***
	(0.0281)		(0.0298)
W_{t-1} *Leader Change	-0.230**		-0.245**
	(0.0714)		(0.0753)
W^2_{t-1} *Leader Change	0.119**		0.131**
	(0.0458)		(0.0479)
Revolution	0.0379*		0.0152
	(0.0192)		(0.0195)
W_{t-1} *Revolution	-0.0688		-0.0110
	(0.0621)		(0.0629)
W^2_{t-1} *Revolution	0.0246		-0.0116
	(0.0475)		(0.0481)
Coup	0.104*		0.104*
	(0.0451)		(0.0450)
W_{t-1} *Coup	-0.425*		-0.372*
	(0.166)		(0.166)
W^2_{t-1} *Coup	0.246+		0.180
	(0.142)		(0.141)
Growth	-0.000528**	-0.00161***	-0.00162***
	(0.000186)	(0.000363)	(0.000366)
W_{t-1} *Growth	0.000754*	0.00147**	0.00145**
	(0.000307)	(0.000504)	(0.000509)
Log(GPDpc$_{t-1}$)	-0.0121***	-0.0130***	-0.0127***
	(0.00223)	(0.00225)	(0.00225)
Log(Population$_{t-1}$)	0.0288***	0.0167***	0.0171***
	(0.00336)	(0.00350)	(0.00349)
$\widehat{LeaderChange}$		0.0197+	0.0121
		(0.0107)	(0.0109)
W^2_{t-1} *$\widehat{LeaderChange}$		-0.0348	-0.0138
		(0.0314)	(0.0318)
W^2_{t-1} *$\widehat{LeaderChange}$		0.0188	0.00485
		(0.0235)	(0.0238)
$\widehat{Revolution}$		0.0486***	0.0501***
		(0.00739)	(0.00749)
W_{t-1} *$\widehat{Revolution}$		-0.0682**	-0.0728***
		(0.0211)	(0.0214)
W^2_{t-1} *$\widehat{Revolution}$		0.0169	0.0204
		(0.0150)	(0.0152)
$\widehat{Coup}$		-0.0544***	-0.0567***
		(0.00881)	(0.00890)
W_{t-1} *$\widehat{Coup}$		0.0445+	0.0531*
		(0.0237)	(0.0239)
W^2_{t-1} *$\widehat{Coup}$		0.0133	0.00662
		(0.0161)	(0.0162)
lnsigma2			
Leader Change	1.103**	0.867*	1.298***
	(0.374)	(0.368)	(0.380)
W_{t-1} *Leader Change	0.990	2.668*	0.354
	(1.327)	(1.307)	(1.352)
W^2_{t-1} *Leader Change	-2.236*	-3.900***	-1.754
	(1.078)	(1.063)	(1.100)
$\widehat{LeaderChange}$	-1.801***	-2.009***	-1.913***
	(0.176)	(0.175)	(0.169)
W^2_{t-1} *$\widehat{LeaderChange}$	10.41***	11.39***	11.21***
	(0.689)	(0.691)	(0.671)
W^2_{t-1} *$\widehat{LeaderChange}$	-9.340***	-10.26***	-10.34***
	(0.631)	(0.637)	(0.623)
W_{t-1}	26.46***	28.13***	27.48***
	(1.456)	(1.455)	(1.408)
W^2_{t-1}	-27.90***	-29.36***	-29.21***
	(1.212)	(1.221)	(1.185)
Observations	7269	7269	7269
Fixed Effects	162	162	162
R2	0.2048	0.2018	0.2315
loglike.	11394.7514	11437.2513	11504.0643
AIC	-22409.5028	-22494.5026	-22610.1285

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A6: How Deposition Risk and Leader Change Affect the Volatility of Political Institutions (Graphs based on model 3 in table A5 in which the risk measures are predicted from basic logit analyses without country fixed effects in table A1).

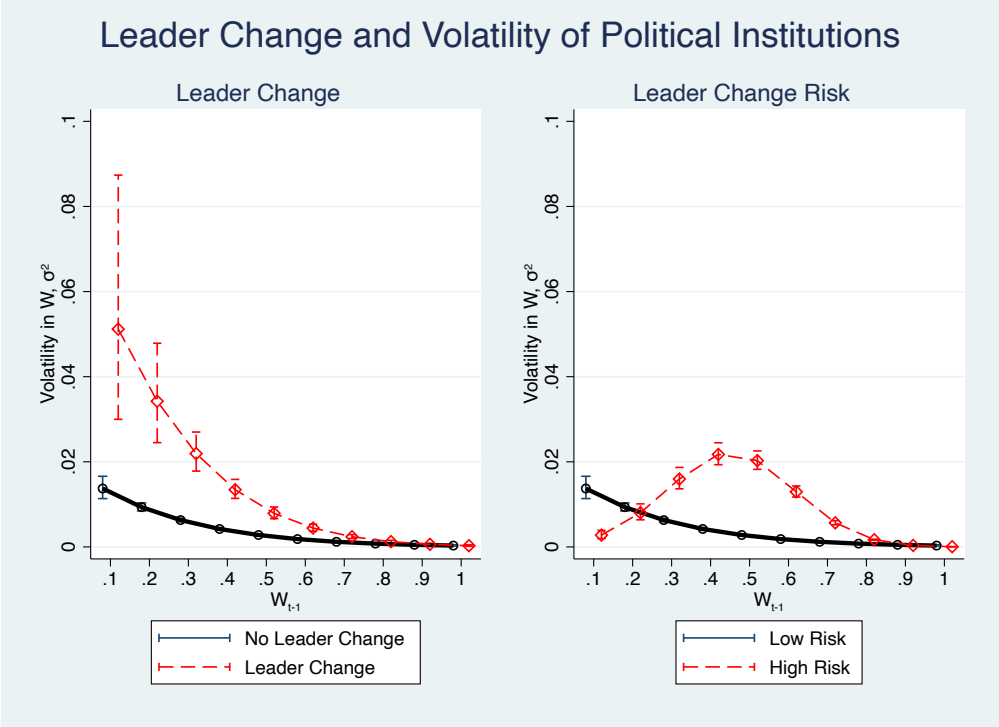

Figure A7: How Revolutions, Coup and the Risk of these Events Affect Political Institutions (Model 3 in table A5 in which the risk measures are predicted from basic logit analyses without country fixed effects in table A1)

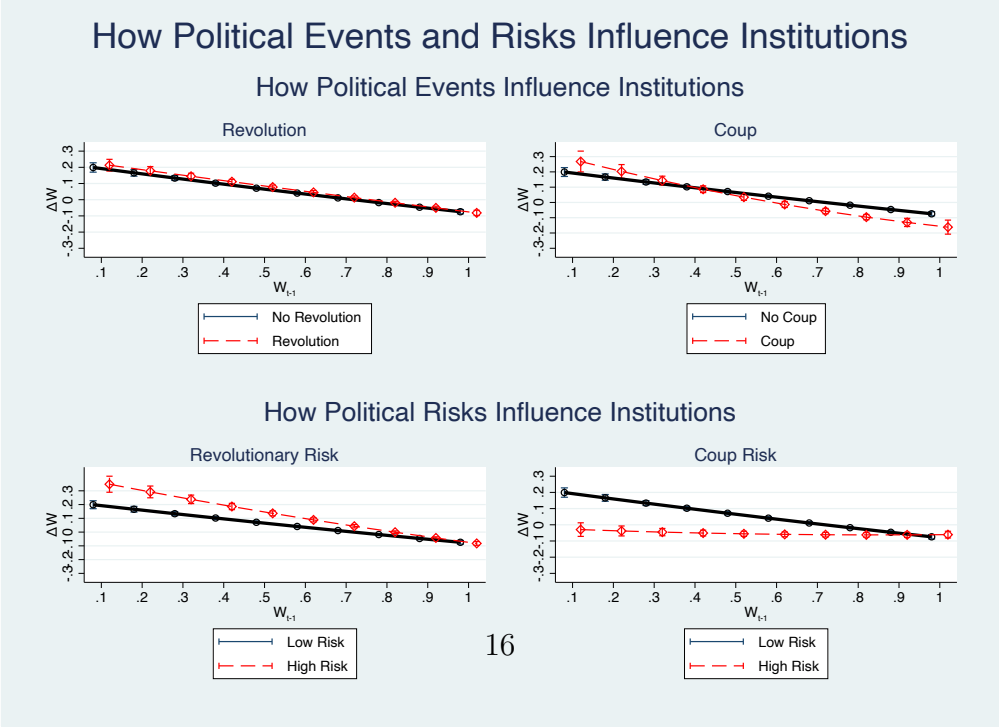

Table A6 show analyses of institutional change using a fixed effect heteroskedastic regression model. The risk scores are obtained from the country fixed effect logit analyses reported in table A2 (and, for consistency with other results, these risks are parameterized as $log\left(\frac{\hat{p}}{1-\hat{p}}\right)$).

Figure A8: How Deposition Risk and Leader Change Affect the Volatility of Political Institutions (Graphs based on model 3 in table A6 in which the risk measures are predicted from basic logit analyses without country fixed effects in table A2)

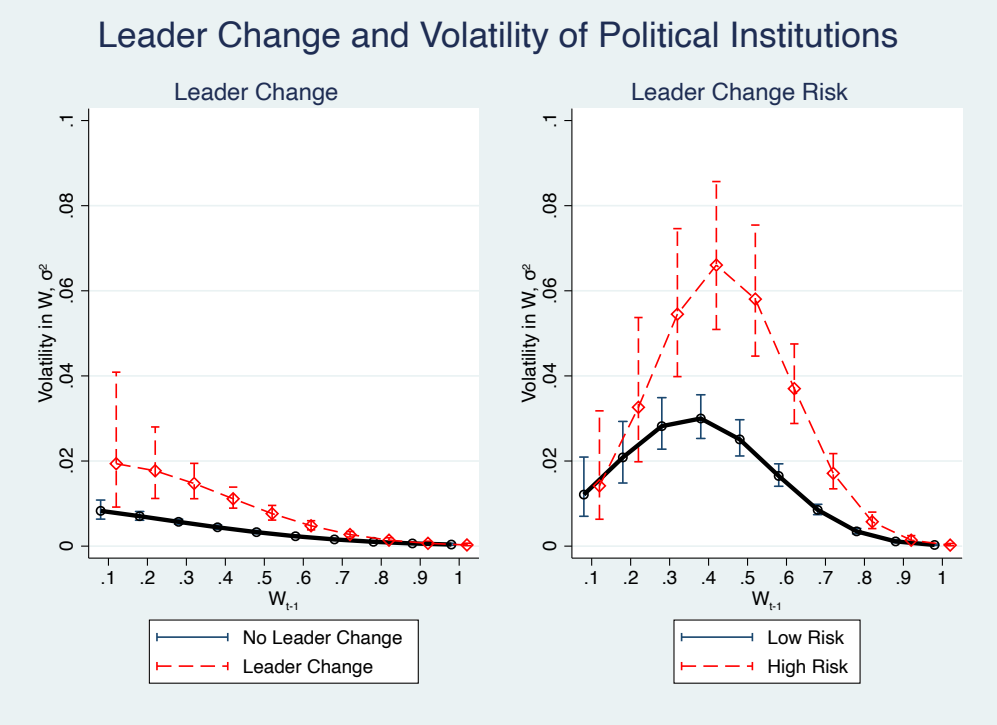

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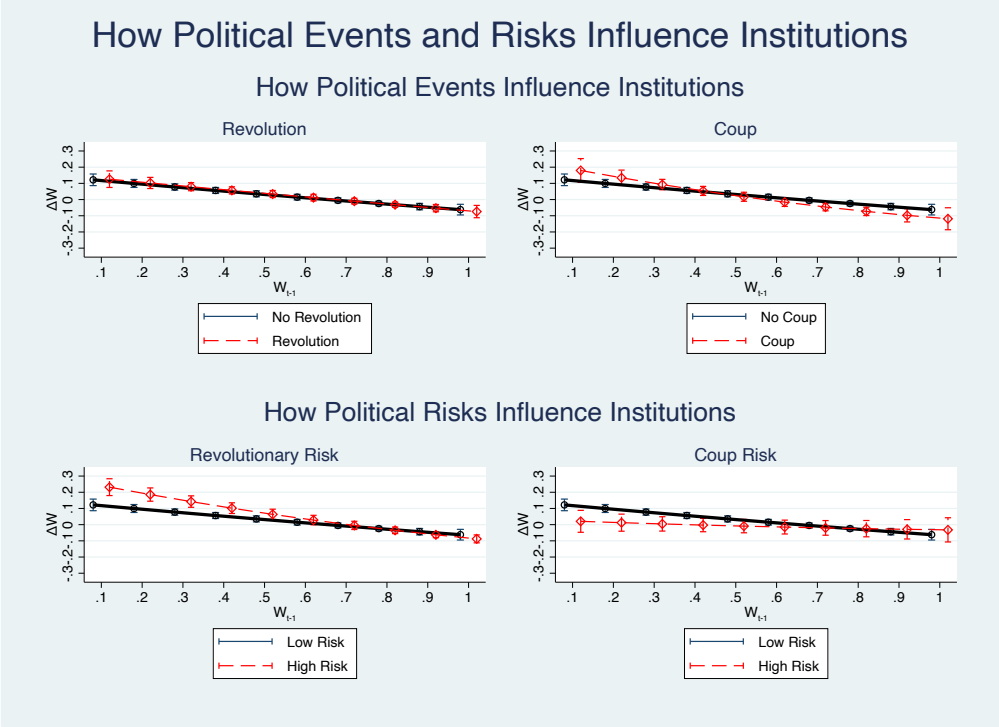
Table A6: How Leader Change, Revolution, Coup and the Threat of these Events Affect Institutional Change and Institutional Volatility (Risk estimated from logit specification with nation fixed effects in table A2)

	(1) Events	(2) Risk	(3) Both
D2W			
W_{t-1}	-0.312***	-0.423***	-0.313*
	(0.0461)	(0.122)	(0.126)
W^2_{t-1}	0.0649	0.194*	0.116
	(0.0399)	(0.0979)	(0.101)
Leader Change	0.134**		0.152***
	(0.0436)		(0.0438)
W_{t-1} *Leader Change	-0.312*		-0.369**
	(0.126)		(0.127)
W^2_{t-1} *Leader Change	0.183*		0.226*
	(0.0893)		(0.0901)
Revolution	0.0408+		0.00476
	(0.0244)		(0.0256)
W_{t-1} *Revolution	-0.109		-0.00723
	(0.0848)		(0.0886)
W^2_{t-1} *Revolution	0.0549		-0.00958
	(0.0694)		(0.0719)
Coup	0.0650		0.0832+
	(0.0486)		(0.0484)
W_{t-1} *Coup	-0.248		-0.266
	(0.187)		(0.186)
W^2_{t-1} *Coup	0.138		0.126
	(0.168)		(0.167)
Growth	-0.00260***	-0.00340***	-0.00340***
	(0.000558)	(0.000710)	(0.000709)
W_{t-1} *Growth	0.00455***	0.00526***	0.00505***
	(0.000921)	(0.00127)	(0.00126)
Log(GPDpc$_{t-1}$)	0.00118	0.00310	0.00369
	(0.00502)	(0.00669)	(0.00669)
Log(Population$_{t-1}$)	0.0228**	0.00886	0.0123
	(0.00842)	(0.00890)	(0.00895)
$\widehat{LeaderChange}$		0.000720	-0.00530
		(0.00988)	(0.00997)
W^2_{t-1} *$\widehat{LeaderChange}$		-0.0131	0.00501
		(0.0329)	(0.0336)
W^2_{t-1} *$\widehat{LeaderChange}$		0.00566	-0.00895
		(0.0266)	(0.0273)
$\widehat{Revolution}$		0.0331***	0.0323***
		(0.00832)	(0.00883)
W_{t-1} *$\widehat{Revolution}$		-0.0646*	-0.0638*
		(0.0257)	(0.0275)
W^2_{t-1} *$\widehat{Revolution}$		0.0254	0.0253
		(0.0206)	(0.0219)
$\widehat{Coup}$		-0.0283*	-0.0305**
		(0.0113)	(0.0115)
W_{t-1} *$\widehat{Coup}$		0.0274	0.0365
		(0.0323)	(0.0327)
W^2_{t-1} *$\widehat{Coup}$		0.00829	0.00185
		(0.0242)	(0.0245)
lnsigma2			
Leader Change	0.679	0.685	0.724
	(0.536)	(0.528)	(0.541)
W_{t-1} *Leader Change	1.634	2.436	1.493
	(1.995)	(1.976)	(2.021)
W^2_{t-1} *Leader Change	-2.581	-3.629*	-2.502
	(1.730)	(1.728)	(1.759)
$\widehat{LeaderChange}$	-0.240	-0.116	-0.166
	(0.167)	(0.169)	(0.168)
W^2_{t-1} *$\widehat{LeaderChange}$	3.576***	2.877***	3.174***
	(0.698)	(0.708)	(0.707)
W^2_{t-1} *$\widehat{LeaderChange}$	-3.582***	-2.720***	-3.103***
	(0.670)	(0.683)	(0.684)
W_{t-1}	10.25***	9.232***	9.985***
	(1.795)	(1.821)	(1.811)
W^2_{t-1}	-13.33***	-12.05***	-12.95***
	(1.618)	(1.648)	(1.642)
Observations	3620	3620	3620
Fixed Effects	70	70	70
R2	0.2518	0.2286	0.2583
loglike.	4353.4248	4355.0991	4382.5991
AIC	-8510.8495	-8514.1983	-8551.1982

Standard errors in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A9: How Revolutions, Coup and the Risk of these Events Affect Political Institutions (Graphs based on model 3 in table A6 in which the risk measures are predicted from basic logit analyses without country fixed effects in table A2)



3.3 Analyses with Institutions Measured Using Polity

Table A7 reports analyses analogous to the results in table 3 with Polity being used instead of W as the institutional measure (Marshall, Gurr and Jaggers, 2016). The risks of leader change, revolution and coup are predicted from analyses reported in table A3. Figures A10 and A11 are analogous to figures 3 and 4 and are generated using model 3 from table A7.

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Table A7: How Leader Change, Revolution, Coup and the Threat of these Events Affect Institutional Change and Institutional Volatility (Polity is used as the measure of institutions. The risks are obtained from the fixed effects regression results reported in table A3)

	(1) Events	(2) Risk	(3) Both
D2W			
Polity_{t-1}	-0.0715***	0.00293	0.000340
	(0.0194)	(0.0317)	(0.0317)
Polity^2_{t-1}	-0.00490	-0.0672*	-0.0631*
	(0.0177)	(0.0288)	(0.0288)
Leader Change	0.0423**		0.0430**
	(0.0154)		(0.0156)
Polity_{t-1} *Leader Change	-0.0973*		-0.0923+
	(0.0492)		(0.0497)
Polity^2_{t-1} *Leader Change	0.0563		0.0504
	(0.0376)		(0.0378)
Revolution	0.0409***		0.0217*
	(0.00887)		(0.00947)
Polity_{t-1} *Revolution	-0.0947*		-0.0784+
	(0.0408)		(0.0437)
Polity^2_{t-1} *Revolution	0.0470		0.0529
	(0.0360)		(0.0384)
Coup	0.0329+		0.0448*
	(0.0194)		(0.0194)
Polity_{t-1} *Coup	-0.281**		-0.264*
	(0.107)		(0.106)
Polity^2_{t-1} *Coup	0.224*		0.193+
	(0.101)		(0.100)
Growth	-0.000405**	-0.000704**	-0.000769***
	(0.000150)	(0.000229)	(0.000230)
Polity_{t-1} *Growth	0.000403	0.000675+	0.000728*
	(0.000252)	(0.000346)	(0.000346)
$\text{Log(GPDpc}_{t-1})$	-0.00892***	-0.00999***	-0.0104***
	(0.00242)	(0.00303)	(0.00303)
$\text{Log(Population}_{t-1})$	0.0118***	0.00943	0.00868
	(0.00355)	(0.00574)	(0.00576)
$\widehat{LeaderChange}$		0.00294	-0.00842
		(0.0398)	(0.0401)
Polity^2_{t-1} *$\widehat{LeaderChange}$		-0.207	-0.163
		(0.138)	(0.141)
Polity^2_{t-1} *$\widehat{LeaderChange}$		0.202+	0.169
		(0.119)	(0.121)
$\widehat{Revolution}$		0.0720	0.0456
		(0.0443)	(0.0452)
Polity_{t-1} *$\widehat{Revolution}$		0.0590	0.165
		(0.113)	(0.122)
Polity^2_{t-1} *$\widehat{Revolution}$		-0.364***	-0.444***
		(0.103)	(0.111)
$\widehat{Coup}$		-0.0116	-0.0344
		(0.128)	(0.128)
Polity_{t-1} *$\widehat{Coup}$		-1.082**	-0.953**
		(0.348)	(0.353)
Polity^2_{t-1} *$\widehat{Coup}$		1.446***	1.343***
		(0.315)	(0.320)
lnsigma2			
Leader Change	0.988***	1.045***	1.060***
	(0.171)	(0.172)	(0.172)
Polity_{t-1} *Leader Change	-0.0357	0.0424	-0.336
	(0.879)	(0.878)	(0.881)
Polity^2_{t-1} *Leader Change	-0.539	-0.618	-0.323
	(0.805)	(0.802)	(0.804)
$\widehat{LeaderChange}$	1.298*	0.899	1.081+
	(0.552)	(0.556)	(0.557)
Polity^2_{t-1} *$\widehat{LeaderChange}$	30.11***	31.51***	30.26***
	(2.828)	(2.822)	(2.828)
Polity^2_{t-1} *$\widehat{LeaderChange}$	-33.15***	-34.43***	-33.21***
	(2.540)	(2.524)	(2.529)
Polity_{t-1}	0.553	0.306	0.564
	(0.513)	(0.510)	(0.513)
Polity^2_{t-1}	-2.519***	-2.266***	-2.506***
	(0.482)	(0.479)	(0.481)
Observations	7001	7001	7001
Fixed Effects	156	156	156
R2	0.1118	0.1217	0.1391
loglike.	10400.0859	10464.1720	10498.2531
AIC	-20432.1719	-20560.3439	-20610.5063

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A10: How Deposition Risk and Leader Change Affect the Volatility of Political Institutions (Institutions are measured using Polity. The graphs are based on model3 in table A7, in which the risks measures are predicted from analyses in table A3).

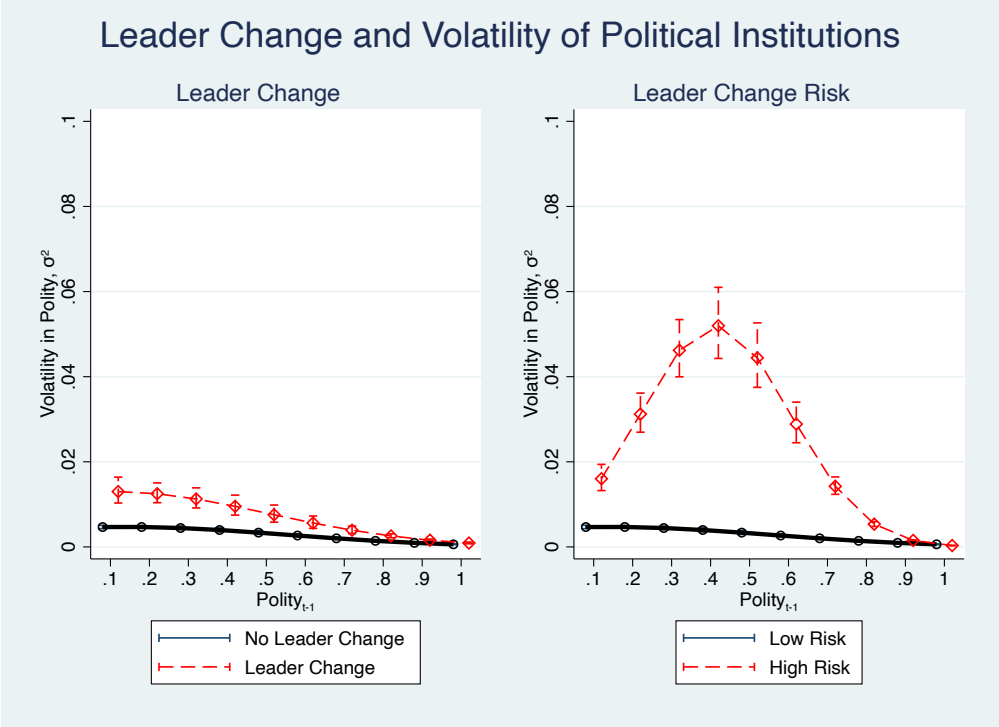
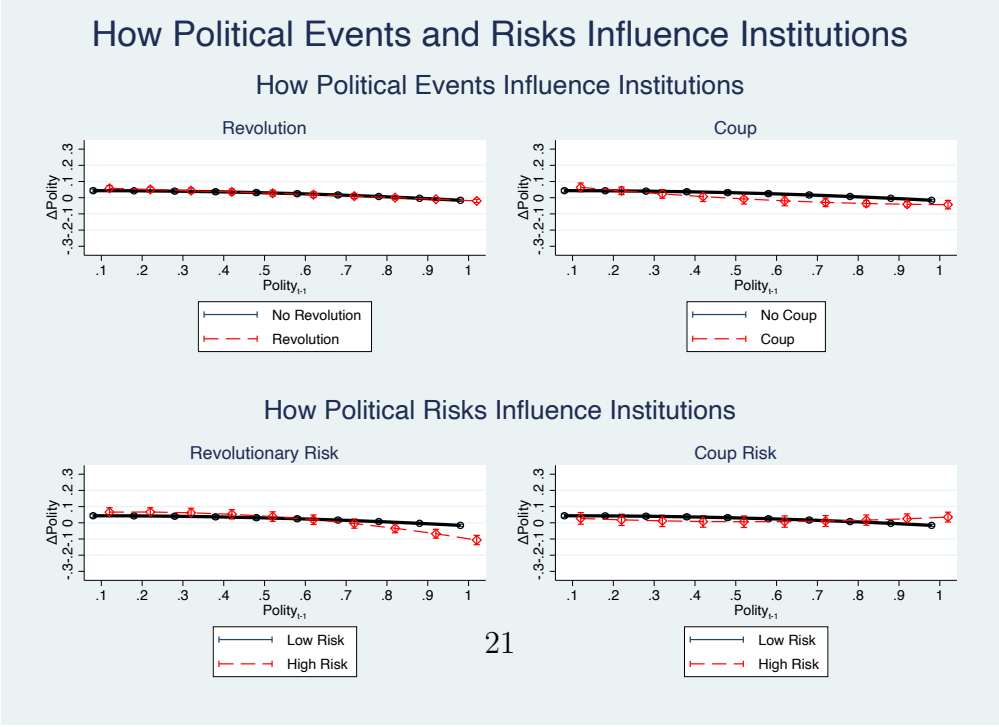


Figure A11: How Revolutions, Coup and the Risk of these Events Affect Political Institutions (Institutions are measured using Polity.The graphs are based on model3 in table A7, in which the risks measures are predicted from analyses in table A3)



3.4 Replication Using NAVCO Data on Mass Campaigns Against the Government

The NAVCO project (Chenoweth and Lewis, 2013) examines mass campaigns against governments. In this section we substitute the Banks measure of Revolution for the presence of campaign against the government. Table A8 examines how institutions, leader characteristics and other conditions affect whether a campaign against the government occurs. Figure A12 graphically illustrates how protest, leader health and tenure affect the likelihood of a NAVCO campaign under different institutional settings.

Figure A12: How Protest, Health and Tenure Affect the Occurrence of NAVCO Campaigns (Fixed effects regression. Figures based on models in table A8)

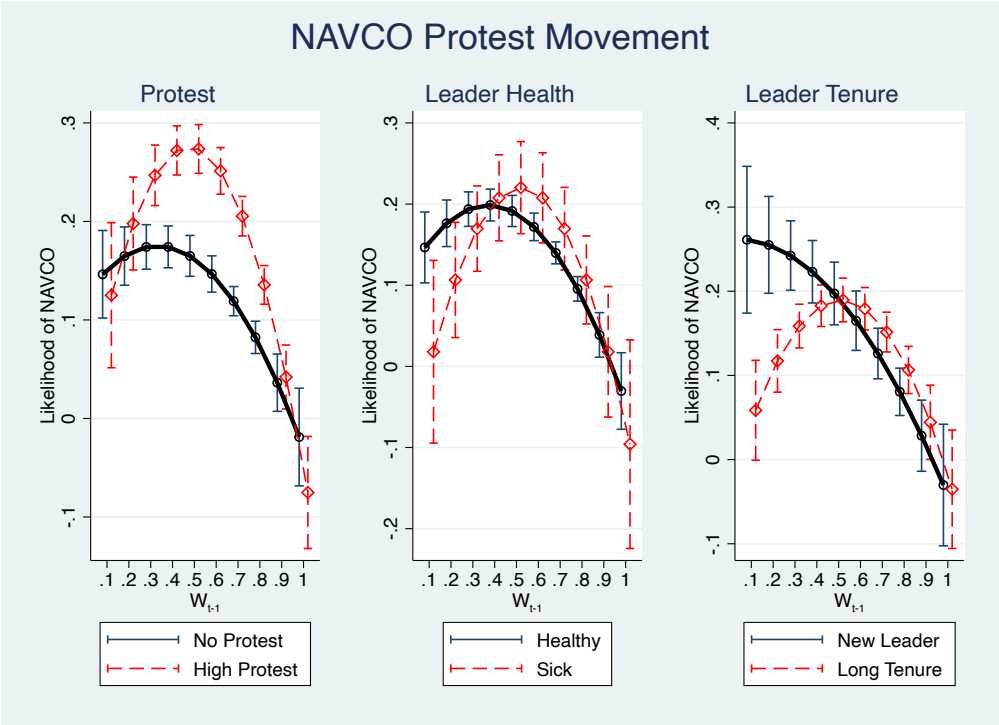


Table A9 examines how the presence of a NAVCO campaign and the risk of a NAVCO campaign affect institutional volatility and directional changes in W. The fixed effect regression analyses in this table are analogous to model 3 in table 2 and models 1, 2 and 3 in table 1. Figure A13 graphical illustrate how the occurrence and risk of a NAVCO campaign affect directional change in W. The impact of leader change and coup (and the risk of these events) are similar to those reported in figures **??** and **??** and so are not shown here.

Table A8: How Protest, Health and Tenure Affect the Risk of a Protest Campaign Against the Government (NAVCO) (Fixed effects regression analyses)

	(1) NAVCO Campaign
W_{t-1}	-0.192
	(0.257)
W^2_{t-1}	-0.115
	(0.227)
$Protest_{t-1}$	-0.0697^{+}
	(0.0412)
W_{t-1} *$Protest_{t-1}$	0.589***
	(0.152)
W^2_{t-1} *$Protest_{t-1}$	-0.563***
	(0.128)
Sick	-0.200*
	(0.0844)
W_{t-1} *Sick	0.781*
	(0.358)
W^2_{t-1} *Sick	-0.647*
	(0.328)
Log(Tenure)	-0.0927**
	(0.0297)
W_{t-1} *Log(tenure)	0.269*
	(0.117)
W^2_{t-1} *Log(tenure)	-0.178^{+}
	(0.103)
Age	-0.000963*
	(0.000467)
$Log(GPDpc_{t-1})$	-0.0673***
	(0.0152)
$Log(Population_{t-1})$	0.0751*
	(0.0319)
Growth	-0.00378**
	(0.00144)
W_{t-1} *Growth	0.000320
	(0.00273)
Observations	5237
Nations	162
R2	0.0771

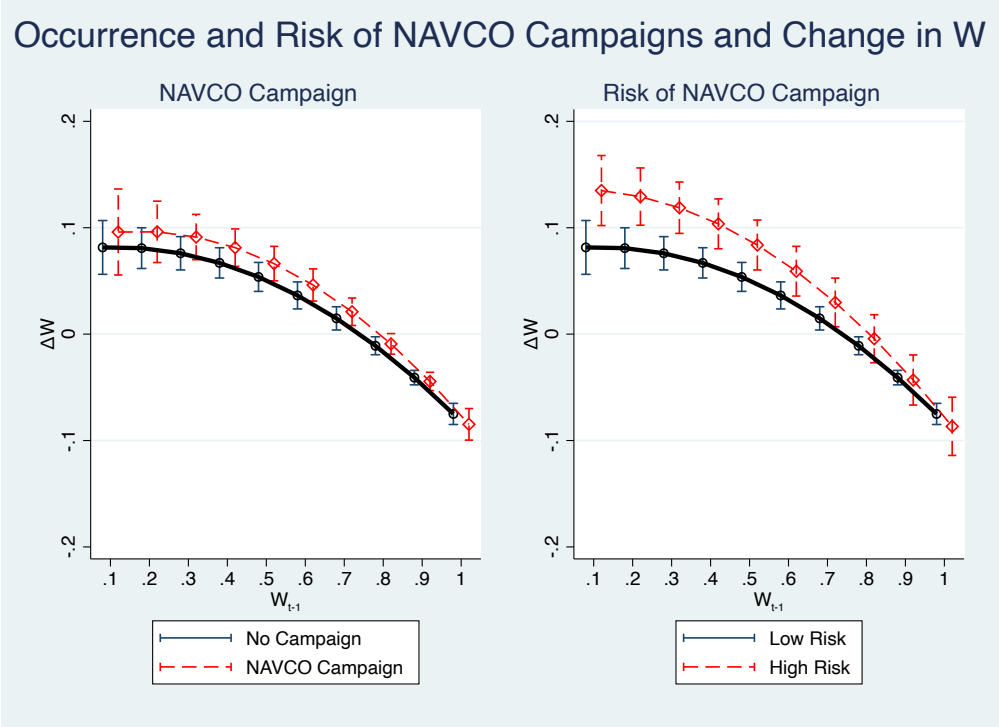
Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A9: How Leader Change, Revolution, Coup and the Threat of these Events Affect Institutional Change and Institutional Volatility (Revolutions and revolution risk is measured using the NAVCO project's definition of Campaigns. The revolutionary risks are estimates from the fixed effects regression analyses show in table A8)

	(1) Both	(2) Events	(3) Risks	(4) Both
D2W				
W_{t-1}	-0.186***	-0.169***	-0.0329	-0.0356
	(0.0357)	(0.0337)	(0.0553)	(0.0551)
W^2_{t-1}	-0.00818	-0.0206	-0.139**	-0.135**
	(0.0324)	(0.0277)	(0.0455)	(0.0452)
Leader Change	0.00125	0.0784**		0.0836**
	(0.00144)	(0.0271)		(0.0270)
Revolution	0.000773	0.0451*		0.0128
	(0.00229)	(0.0206)		(0.0224)
Coup	-0.0600***	0.116*		0.0929*
	(0.00650)	(0.0456)		(0.0463)
$\widehat{LeaderChange}$	0.0137*		-0.00874	-0.0452
	(0.00586)		(0.0857)	(0.0880)
$\widehat{Revolution}$	0.148***		0.129**	0.116*
	(0.0198)		(0.0463)	(0.0484)
$\widehat{Coup}$	-0.273***		0.685***	0.579***
	(0.0410)		(0.155)	(0.157)
W_{t-1} *Leader Change		-0.161*		-0.182**
		(0.0689)		(0.0685)
W^2_{t-1} *Leader Change		0.0814+		0.0978*
		(0.0446)		(0.0443)
W_{t-1} *Revolution		-0.0793		0.0215
		(0.0691)		(0.0742)
W^2_{t-1} *Revolution		0.0281		-0.0440
		(0.0542)		(0.0576)
W_{t-1} *Coup		-0.492**		-0.362*
		(0.172)		(0.173)
W^2_{t-1} *Coup		0.301*		0.183
		(0.148)		(0.148)
Growth		-0.000158	-0.00233***	-0.00227***
		(0.000218)	(0.000377)	(0.000379)
W_{t-1} *Growth		-0.0000293	0.00239***	0.00232***
		(0.000359)	(0.000469)	(0.000472)
Log(GPDpc$_{t-1}$)		-0.00911**	-0.00756*	-0.00705*
		(0.00278)	(0.00318)	(0.00318)
Log(Population$_{t-1}$)		0.0329***	0.0221***	0.0233***
		(0.00420)	(0.00562)	(0.00561)
W^2_{t-1} *$\widehat{LeaderChange}$			-0.0613	0.0356
			(0.232)	(0.242)
W^2_{t-1} *$\widehat{LeaderChange}$			0.0722	0.0117
			(0.162)	(0.170)
W_{t-1} *$\widehat{Revolution}$			-0.122	-0.0848
			(0.126)	(0.133)
W^2_{t-1} *$\widehat{Revolution}$			-0.0277	-0.0551
			(0.102)	(0.107)
W_{t-1} *$\widehat{Coup}$			-4.433***	-4.010***
			(0.477)	(0.487)
W^2_{t-1} *$\widehat{Coup}$			4.093***	3.762***
			(0.374)	(0.381)
lnsigma2				
$\widehat{LeaderChange}$	3.978***	-15.32***	-18.39***	-17.78***
	(0.234)	(1.267)	(1.312)	(1.308)
Leader Change	0.495***	0.793*	0.223	0.677+
	(0.0563)	(0.378)	(0.371)	(0.391)
W_{t-1}	9.793***	-4.528***	-6.046***	-5.832***
	(0.485)	(0.839)	(0.844)	(0.846)
W^2_{t-1}	-13.83***	0.113	1.424+	1.320+
	(0.441)	(0.770)	(0.770)	(0.772)
W_{t-1} *Leader Change		0.939	4.238**	1.569
		(1.455)	(1.463)	(1.532)
W^2_{t-1} *Leader Change		-1.872	-5.123***	-2.484+
		(1.255)	(1.277)	(1.331)
W^2_{t-1} *$\widehat{LeaderChange}$		92.20***	104.1***	102.2***
		(5.014)	(5.160)	(5.123)
W^2_{t-1} *$\widehat{LeaderChange}$		-85.57***	-95.20***	-94.40***
		(4.314)	(4.424)	(4.385)
Observations	5202	5202	5202	5202
Fixed Effects	162	160	160	160
R2	0.2647	0.2045	0.2004	0.2277
loglike.	7503.5885	7818.0417	7840.3458	7900.0791
AIC	-14653.1769	-15260.0835	-15304.6916	-15406.1583

Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure A13: How NAVCO Campaigns and the Risk of Such Campaigns Affects Directional Change in Institutions. The graphs are based on model 4 in table A9, in which the risks measures are predicted from analyses in table A8)



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