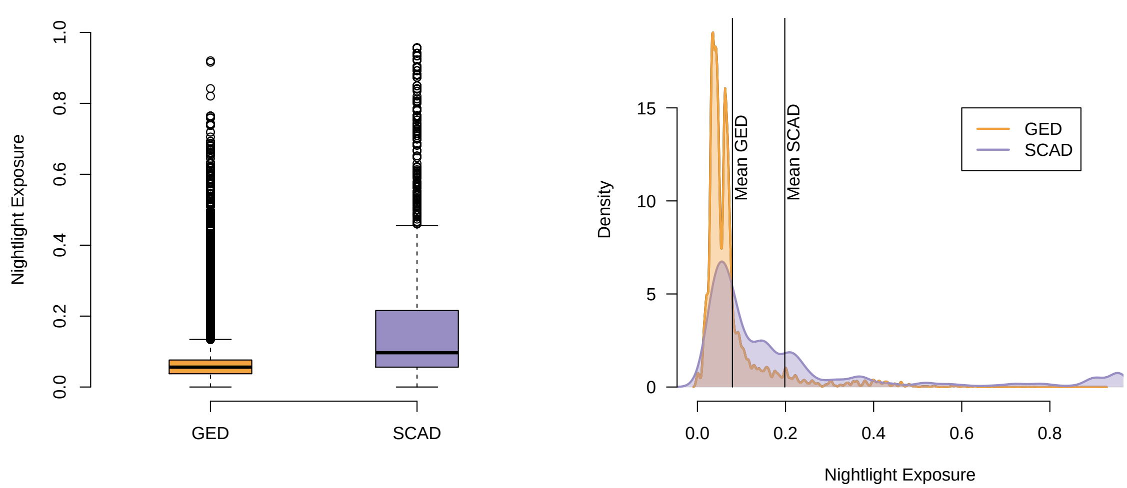
SUPPLEMENTARY APPENDIX FOR BORN WEAK, GROWING STRONG: ANTI-GOVERNMENT PROTESTS AS A SIGNAL OF REBEL STRENGTH IN THE CONTEXT OF CIVIL WARS

1. Appendix: SCAD Definitions

Organized Demonstrations: Distinct, continuous, and largely peaceful action directed toward members of a distinct “other” group or government authorities. In this event, clear leadership or organization(s) can be identified. **Spontaneous Demonstration:** Distinct, continuous, and largely peaceful action directed toward members of a distinct “other” group or government authorities. In this event, clear leadership or organization cannot be identified. **Organized Violent Riot:** Distinct, continuous and violent action directed toward members of a distinct “other” group or government authorities. The participants intend to cause physical injury and/or property damage. In this event, clear leadership or organization(s) can be identified. **Spontaneous Violent Riot:** Distinct, continuous and violent action directed toward members of a distinct “other” group or government authorities. The participants intend to cause physical injury and/or property damage. In this event, clear leadership or organization(s) cannot be identified. **Anti-Government Violence:** Distinct violent event waged primarily by a non-state group against government authorities or symbols of government authorities (e.g., transportation or other infrastructures). As distinguished from riots, the anti-government actor must have a semi-permanent or permanent militant wing or organization.

2. Appendix: Nightlight as a measure of economic development in locations of fighting versus protest.

Nightlight data is increasingly used to measure economic development in areas where little or no survey or census data exists about individuals’ income or regional development (Min, 2015; Weidmann and Schutte, 2017). If our assumption holds, we should see that locations of protest are associated with higher nightlight emissions than fighting locations.



(A) Boxplots (B) Density plots

Figure A1. Left panel: Boxplot compares nightlight exposure between GED fighting locations and SCAD locations. Right panel: Density plot compares nightlight exposure between GED fighting locations and SCAD locations.

We assign nightlight exposure data to SCAD and UCDP-GED events using DMSP-OLS Nighttime Lights Time Series provided by the PRIO-GRID project (Tollefsen, Strand and Buhaug, 2012). The PRIO-GRID project provides global data coverage on a 25 × 25km resolution for a large number of geo-spatial measures. We project the SCAD and UCDP-GED events onto the PRIO-GRID, extract the corresponding grid's mean nightlight value and assign it to the respective events. Using this procedure, we attain nightlight measures for all SCAD and UCDP-GED events, which we we compare in Figure A1. The left panel in Figure A1 compares the nightlight exposure between SCAD and UCDP-GED events using box plots, while the right panel provides more insights to the actual distribution of nightlight exposure in the two datasets. In line with our expectations, on average SCAD events are recorded in locations with higher nightlight exposure, which implies higher levels of economic development and urbanization compared to UCDP-GED event locations. The demonstrated differences are significantly different at standard levels of statistical significance (differences in mean t-test $p \leq 0.01$).

3. Appendix: Probing the impact of GED events on SCAD events

Our theoretical model also provides empirical implications on the impact of GED events on SCAD events. We argue that strong rebel organizations are more likely to signal that middle-class individuals are facing a weak government, which leads individuals outside of the rebels' core to engage in anti-government behavior. Hence, we should observe that sustained fighting events, which arguably only strong rebels can engage in, are associated with an increase in protest, demonstration, and riot events. Using our yearly conflict dataset, we test whether changes in our measure of rebel organization strength impacts on SCAD event count. We include our three measures of rebel strength in the analysis.

We estimate five different models to estimate not only the effect of GED events on SCAD events, but also evaluate the robustness of the relationship. First, we estimate a basic negative binomial model controlling for GDP per capita, total population, Polity scores, count of other ongoing conflicts in the country, government military expenditure per capita, and conflict duration.[1] In the second model we include the lagged dependent variable (DV-lag) and in the third model country-fixed effects (FE). The fourth is a DV-lag FE model and in the final model we estimate a negative binomial random effects model. The results are reported in Table A1 and demonstrate that only changes in the number of PRIO-grids affected by fighting events between the government and rebel organizations have a positive effect on the number of SCAD events. This empirical pattern is consistent with the idea that rebel organizations that can sustain or maintain high intensity conflict with the government are more likely to trigger broader anti-government behavior.

4. Appendix: Proofs

A Markov perfect equilibrium is a subgame perfect equilibrium in which strategies depend only on the payoff relevant state of the game and not on time index or history. The only payoff relevant state in our model is π_t, beliefs about the probability $\alpha = \alpha_h$. Consider strategies that depend only on beliefs about the probability $\alpha = \alpha_h$. We will refer such strategies as threshold strategies. An equilibrium in threshold strategies is a Markov perfect equilibrium. There exists a Markov perfect equilibrium in our game. For example, $\pi_l = \pi_m = \pi_u = \pi_e = 1$ is a Markov perfect equilibrium. According to these threshold strategies, no agent participates in rebel activities and the elite does not concede when $\pi < 1$. Since participation is costly and an agent's participation does not change the continuation game, not participating is optimal when other agents do not participate in rebel activities. Then it is optimal for the elite not to concede when there is no participation.

Since $y_l = 0$, there is no opportunity cost of participating in rebel activities for lower-class agents. Participation may induce concession in the future, which benefits lower-class agents. Therefore $\pi_l = 0$ is always optimal for them. So, we will focus on equilibria with $\pi_l = 0$. Also,

[1]Measurement and sourced of all variables discussed in the previous analyses

Table A1. Negative binomial models assessing the relationship between changes in measures of rebel organization strength (Capital distance, PRIO grids affected, and event count) and current SCAD event counts.

	Base Model	DV-lag Model	FE Model	FE DV-lag Model	RE Model
	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-13.962^{***}	-8.344^{**}	176.435^{**}	184.320^{**}	-16.241^{***}
	(2.715)	(2.775)	(64.997)	(64.049)	(3.420)
ΔGED Event Count	-0.000	-0.003	-0.002	-0.001	-0.001
	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
ΔGED Capital Distance	-0.001	-0.000	-0.001	-0.001^{*}	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ΔGED PRIO grids affected	0.025^{*}	0.033^{**}	0.027^{***}	0.027^{***}	0.027^{*}
	(0.013)	(0.012)	(0.008)	(0.008)	(0.011)
GDP per capita$_{t-1}$(log)	0.491^{*}	0.343	3.737^{***}	4.047^{***}	0.597^{*}
	(0.194)	(0.187)	(0.816)	(0.801)	(0.253)
Population$_{t-1}$(log)	0.746^{***}	0.400^{*}	-11.992^{**}	-12.577^{**}	0.880^{***}
	(0.170)	(0.178)	(3.987)	(3.933)	(0.211)
Xpolity$_{t-1}$	0.201^{***}	0.113	0.240	0.250^{*}	0.149^{*}
	(0.060)	(0.061)	(0.128)	(0.127)	(0.074)
Conflict Duration	-0.020	-0.001	0.267^{**}	0.285^{**}	-0.026^{*}
	(0.011)	(0.011)	(0.102)	(0.101)	(0.013)
Ongoing Conflicts	0.037	0.077	-0.372	-0.293	-0.536
	(0.294)	(0.277)	(0.529)	(0.509)	(0.455)
Military Expenditure per capita$_{t-1}$	-8.682	-6.805	-9.062	-8.620	-8.639
	(4.657)	(4.370)	(6.740)	(6.657)	(5.502)
SCAD Events$_{t-1}$		0.130^{***}		-0.030	
		(0.027)		(0.027)	
AIC	522.939	508.087	501.638	106.000	515.250
BIC	554.311	542.312	649.944	257.158	552.326
Log Likelihood	-250.469	-242.044	-198.819	0.000	-244.625
Deviance	137.742	135.046	136.444	141.417	
Num. obs.	128	128	128	128	128
Variance: PAID.factor					0.391
Variance: year.factor					0.188
Dispersion: parameter					4.579
Dispersion: SD					2.757
Num. groups: PAID.factor					42
Num. groups: year.factor					21

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

$c < (1-\delta)y_u$ implies that life time benefit of a concession to an upper-class opposition agent is less than the income that he has to give up in order to participate in rebel activities, so upper-class opposition will never participate in rebel activities, i.e. $\pi_u = 1$. In the rest of the appendix, we will characterize equilibria with $\pi_l = 0$ and $\pi_u = 1$.

Proof of Proposition 1

Proof. If no middle-class opposition participates in equilibrium, then it is optimal for the elite to not concede, so $\pi_m = \pi_e = 1$ and $\pi_m \leq \pi_e$ holds in this equilibrium. Consider any other threshold equilibrium with $\pi_m < 1$. Suppose that $\pi_e < \pi_m$. Consider the elite strategy at the threshold belief $\pi = \pi_e$. If the elite plays according to the threshold π_e, then it concedes when $\pi = \pi_e$ and its payoff is $-c$. Consider an alternative strategy of not conceding this period and conceding next period. Since $\pi_e < \pi_m$, the middle-class agents do not participate in rebel activities this period. So, the maximum expected cost from a rebel activity this period is $\alpha_h \lambda_l \psi < c$. The elite bears the cost of c from concession from the next period on. So the maximum cost of the alternative strategy is $(1-\delta)\alpha_h\lambda_l\psi+\delta c$. That is the elite's minimum expected payoff from this strategy can be computed as

$$-(1-\delta)\alpha_h\lambda_l\psi-\delta c$$

If the elite concedes today, his payoff is $-c$. Since

$$-(1-\delta)\alpha_h\lambda_l\psi-\delta c>-c$$

equivalently $\alpha_h\lambda_l\psi<c$, this is a profitable deviation. This is a contradiction, therefore $\pi_e<\pi_m$ cannot hold in equilibrium. This completes the proof. □

Given thresholds π_l,π_m,π_e, let $U_\omega(\pi)$ be the expected payoff of ω-class opposition agents when the belief is given by π and they play according to the threshold π_ω. Similarly let $U_e(\pi)$ be the elite's expected payoffs, given the threshold strategies and the belief.

The payoffs from threshold strategies can be written recursively. Given a common belief π, $\alpha(\pi)=\pi\alpha_h+(1-\pi)\alpha_l$ is the expected probability of success. Agents update their beliefs as follows. If people observe a successful rebel activity, then

$$\pi'(\pi)=\frac{\pi\alpha_h}{\pi\alpha_h+(1-\pi)\alpha_l}\equiv\pi^s(\pi)>\pi$$

and if they do not observe a failure, then

$$\pi'(\pi)=\frac{\pi(1-\alpha_h)}{\pi(1-\alpha_h)+(1-\pi)(1-\alpha_l)}\equiv\pi^f(\pi)<\pi$$

Consider player strategies that are given by the thresholds $\pi_l=0,\pi_u=1$, π_m and $\pi_e\geq\pi_m$. λ is the size of the participants in rebel activities, which is induced by the belief π:

$$\lambda(\pi)=\begin{cases}\lambda_l \text{ if } \pi<\pi_m\\ \lambda_l+\lambda_m \text{ if } \pi\geq\pi_m\end{cases}$$

The payoff to the elite from playing the threshold strategy $\pi_e\geq\pi_m$ can be computed recursively as follows:

$$U_e(\pi)=\begin{cases}-(1-\delta)\alpha(\pi)\lambda_l\psi+\delta EU_e(\pi'(\pi)) \text{ if } \pi<\pi_m\\ -(1-\delta)\alpha(\pi)(\lambda_l+\lambda_m)\psi+\delta EU_e(\pi'(\pi)) \text{ if } \pi_m\leq\pi<\pi_e\\ -c \text{ if } \pi\geq\pi_e\end{cases}$$

where

$$EU_e(\pi'(\pi))=\alpha(\pi)U_e(\pi^s(\pi))+(1-\alpha(\pi))U_e(\pi^f(\pi))$$

is the expected continuation payoff from the next period on.

The first line in $U_e(\pi)$ is the elite's payoff when beliefs are low, $\pi<\pi_m$, so that the middle-class does not participate in rebel activities. The first term is the expected cost from lower-class activities and the second term is the expected payoff from tomorrow on. Given the current period beliefs π, the activities succeed with probability $\alpha(\pi)$ and the beliefs are updated to $\pi^s(\pi)$ the next period so that the elite's continuation payoff is given by $U_e(\pi^s(\pi))$. The activities fail with probability $1-\alpha(\pi)$; in this case the beliefs are updated to $U_e(\pi^f(\pi))$ and the elite's continuation payoff is given by $U_e(\pi^f(\pi))$. Therefore, the expected payoff $EU_e(\pi'(\pi))$ is calculated as above.

The second line in $U_e(\pi)$ is the elite's payoff when beliefs are such that $\pi_m\leq\pi<\pi_e$ so that both lower and middle-classes participate in rebel activities but the elite does not concede. The expected cost of the activities becomes $-(1-\delta)\alpha(\pi)(\lambda_l+\lambda_m)\psi$ in this case. Finally, the third is the elite's payoff when beliefs are such that $\pi_e\leq\pi$ so that the elite concedes.

Let

$$u_{threshold}=\lim_{\pi\uparrow\pi_e}U_e(\pi)$$

be the limit payoff to the elite when the beliefs approach to the elite's threshold from below. If $u_{threshold} < -c$, the elite can increase their payoff by slightly lowering their threshold. Similarly, if $w_{threshold} > -c$, the elite can improve their payoff by slightly increasing their threshold. So, optimality requires that

$$u_{threshold} = -c$$

The payoff function of the middle-class opposition agents, $U_m(\pi)$, can be computed similarly as

$$U_m(\pi) = \begin{cases} (1-\delta)y_h + \delta EU_m(\pi'(\pi)) \text{ if } \pi < \pi_m \\ \delta EU_m(\pi'(\pi)) \text{ if } \pi_m \leq \pi < \pi_e \\ y_h + c \text{ if } \pi \geq \pi_e \end{cases}$$

where

$$EU_m(\pi'(\pi)) = \alpha(\pi)U_m(\pi^s(\pi)) + (1-\alpha(\pi))U_m(\pi^f(\pi))$$

When $\pi \geq \pi_m$, the threshold strategy dictates participation by a middle class agent. Alternatively, he can choose not to participate. In this case, given the strategies of other players, nobody will participate in rebellious activities any longer so there will be no concession in the future. So, her continuation payoff from such deviation is y_h. Therefore, optimality of π_m implies that

$$U_m(\pi_m) = \delta EU_m(\pi'(\pi_m)) \geq y_h$$

Proof of Proposition 2

Proof. Suppose that there exists an equilibrium with $\pi_l = 0$, $\pi_u = 1$ and $\pi_m < 1$. Then $\pi_m \leq \pi_e$ by Proposition 1. To the contrary, suppose that the elite does not concede in the equilibrium, i.e. $\pi_e = 1$. Then U_e can be written recursively as follows:

$$U_e(\pi) = \begin{cases} -(1-\delta)\alpha(\pi)\lambda_l\psi + \delta EU_e(\pi'(\pi)) \text{ if } \pi < \pi_m \\ -(1-\delta)\alpha(\pi)(\lambda_l+\lambda_m)\psi + \delta EU_e(\pi'(\pi)) \text{ if } \pi_m \leq \pi < 1 \\ -c \text{ if } \pi = 1 \end{cases}$$

where

$$EU_e(\pi'(\pi)) = \alpha(\pi)U_e(\pi^s(\pi)) + (1-\alpha(\pi))U_e(\pi^f(\pi))$$

We can prove that $U_e(\pi) \geq U_e(\pi')$ for all $\pi < \pi' < 1$ as follows. Start with a function W_n such that $W_n(\pi) \geq W_n(\pi')$ for all $\pi < \pi' < 1$. Produce W_{n+1} as follows:

$$W_{n+1}(\pi) = \begin{cases} -(1-\delta)\alpha(\pi)\lambda_l\psi + \delta EW_n(\pi'(\pi)) \text{ if } \pi < \pi_m \\ -(1-\delta)\alpha(\pi)(\lambda_l+\lambda_m)\psi + \delta EW_n(\pi'(\pi)) \text{ if } \pi_m \leq \pi < 1 \\ -c \text{ if } \pi = 1 \end{cases}$$

where

$$EW_n(\pi'(\pi)) = \alpha(\pi)W_n(\pi^s(\pi)) + (1-\alpha(\pi))W_n(\pi^f(\pi))$$

W_{n+1} satisfies $W_{n+1}(\pi) \geq W_{n+1}(\pi')$ for all $\pi < \pi' < 1$ and W_n converges to U_e as n goes to infinity. So $U_e(\pi) \geq U_e(\pi')$ for all $\pi < \pi' < 1$ is satisfied in the limit.

Consider $\pi = 1 - \varepsilon > \pi_m$ for ε positive and arbitrarily small. Then $\pi^s(\pi)$ and $\pi^f(\pi)$ are arbitrarily close to 1 and $\alpha(\pi)$, $\alpha(\pi^s(\pi))$ and $\alpha(\pi^f(\pi))$ are arbitrarily close to α_h. Also

$$U_e(\pi) = -(1-\delta)\alpha(\pi)(\lambda_l+\lambda_m)\psi + \delta EU_e(\pi'(\pi))$$

where

$$EU_e(\pi'(\pi)) = \alpha(\pi)U_e(\pi^s(\pi)) + (1-\alpha(\pi))U_e(\pi^f(\pi)) \leq U_e(\pi^f(\pi)) \leq -\alpha(\pi^f(\pi))\lambda_l\psi$$

The first inequality follows from $\pi^f(\pi) < \pi^s(\pi)$ so that $U_e(\pi^f(\pi)) > U_e(\pi^s(\pi))$ as proven above. The second inequality follows from the fact that $\alpha(\pi^f(\pi))\lambda_l\psi$ is a lower bound for the cost that the elite bears when the beliefs are given by $\pi^f(\pi)$. This lower bound is achieved when only the lower-class participates in rebel activities forever. Note that the lower-class always participates in rebel activities since $\pi_l = 0$, so this cost is accounted for in $U_e(\pi^f(\pi))$. In addition, $U_e(\pi^f(\pi))$ accounts for the costs of middle-class participation so that $U_e(\pi^f(\pi)) \leq -\alpha(\pi^f(\pi))\lambda_l\psi$.

Substitute $EU_e(\pi'(\pi)) \leq -\alpha(\pi^f(\pi))\lambda_l\psi$ in the expression of $U_e(\pi)$ above to obtain

$$U_e(\pi) \leq -(1-\delta)\alpha(\pi)(\lambda_l + \lambda_m)\psi - \delta\alpha(\pi^f(\pi))\lambda_l\psi$$

$\pi^f(\pi)$ goes to 1 and $\alpha(\pi)$ goes to α_h as π goes to 1. So the right hand side of this inequality goes to $-\alpha_h\psi(\lambda_l + (1-\delta)\lambda_m)$ as π goes to 1. By Assumption 5, $\alpha_h\psi(\lambda_l + (1-\delta)\lambda_m) > c$. So there exists a positive and small enough ε such that

$$U_e(\pi) \leq -(1-\delta)\alpha(\pi)(\lambda_l + \lambda_m)\psi - \delta\alpha(\pi^f(\pi))\lambda_l\psi \approx -\alpha_h\psi(\lambda_l + (1-\delta)\lambda_m) < -c$$

This implies that the payoff from concession when $\pi = 1 - \varepsilon$ is higher than the payoff from no concession at all. Therefore $\pi_e = 1$ cannot be a best response to $\pi_m < 1$. □

The following proposition is a middle step before the existence proof. It asserts that if π_m is close to 1, then the elite's best response is $\pi_e = \pi_m$, i.e. the elite concedes exactly when the middle-class participates.

Proposition 1. *Let π_e be best response for the ruling elite. Then $\pi_e = \pi_m$ for some $\pi_m < 1$.*

Proof of Proposition 1

Proof. Let π_e be a best response to $\pi_m < 1$. Then $\pi_m \leq \pi_e < 1$ by Propositions 1 and 2. Suppose that $\pi_m < \pi_e$ for all $\pi_m < 1$. Consider $\pi_m = 1 - \varepsilon$ for a positive and arbitrarily small ε and $\pi = \pi_m + \epsilon$ for ϵ such that $\pi \in (\pi_m, \pi_e)$. Then

$$U_e(\pi) = -(1-\delta)\alpha(\pi)(\lambda_l + \lambda_m)\psi + \delta EW(\pi'(\pi))$$

where

$$EU_e(\pi'(\pi)) = \alpha(\pi)U_e(\pi^s(\pi)) + (1-\alpha(\pi))U_e(\pi^f(\pi)) \leq U_e(\pi^f(\pi))$$

As in the proof of Proposition 2, $U_e(\pi^f(\pi)) \leq -\alpha(\pi^f(\pi))\lambda_l\psi$ implies

$$U_e(\pi) \leq -(1-\delta)\alpha(\pi)(\lambda_l + \lambda_m)\psi - \delta\alpha(\pi^f(\pi))\lambda_l\psi$$

$\pi^f(\pi)$ goes to 1 and $\alpha(\pi)$ goes to α_h as π goes to 1. If we choose ε arbitrarily small, the right hand side of this inequality goes to $-\alpha_h\psi(\lambda_l + (1-\delta)\lambda_m)$ as π goes to 1. By assumption $-\alpha_h\psi(\lambda_l + (1-\delta)\lambda_m) > c$. So, there exists a positive and small enough ε such that

$$U_e(\pi) \leq -(1-\delta)\alpha(\pi)(\lambda_l + \lambda_m)\psi - \delta\alpha(\pi^f(\pi))\lambda_l\psi \approx -\alpha_h\psi(\lambda_l + (1-\delta)\lambda_m) < -c$$

So the payoff from concession when $\pi = \pi_m$ is higher than the payoff from not conceding when $\pi = \pi_m$. Therefore $\pi_m < \pi_e$ for all $\pi_m < 1$ cannot hold, so that $\pi_e = \pi_m$ for large enough $\pi_m < 1$. □

Proof of Proposition 3

Proof. Consider any $\pi_m < 1$ such that the elite's best response satisfies $\pi_e = \pi_m$. Such π_m exists by Proposition 1. We will prove that $(\pi_l = 0, \pi_u = 1, \pi_m, \pi_e = \pi_m)$ is an equilibrium. Since π_e is a best response to π_m, we only need to prove that π_m is also a best response. Suppose that middle-class agents participate when $\pi \geq \pi_m$. Given the strategies of all other agents, consider a middle-class opposition agent. If he participates when $\pi \geq \pi_m$, then the elite concedes and the agent achieves an extra payoff of c forever. If he does not participate, nobody will participate in rebel activities forever, and anticipating this, the elite will not concede because the elite would suffer the cost of rebellious activities for just one period, which is less than the cost of concession by Assumption 4. This means that the middle-class agent would save the one period income of y_m but lose the life-long stream of c by not participating. Since $(1-\delta)y_m < c$ by Assumption

3, the middle-class agent would be worse off by not participating. Therefore, participation when $\pi = \pi_m$ is a best response for the agent given that the other middle-class agents in the opposition also follow the π_m threshold strategy, so a non-trivial equilibrium with $\pi_m \leq \pi_e < 1$ exists. □

Proposition 2. *The elite's best response threshold strategy is a non-decreasing function of the opposition's threshold strategy.*

Proof of Proposition 2

Proof. Let π_e be the elite's best responses to the opposition's threshold strategy π_m. For any $\pi_e \geq \pi_m$, U_e can be computed recursively as follows:

$$U_e(\pi) = \begin{cases} -(1-\delta)\alpha(\pi)\lambda_l\psi + \delta E U_e(\pi'(\pi)) \text{ if } \pi < \pi_m \\ -(1-\delta)\alpha(\pi)(\lambda_l + \lambda_m)\psi + \delta E U_e(\pi'(\pi)) \text{ if } \pi_m \leq \pi < \pi_e \\ -c \text{ if } \pi \geq \pi_e \end{cases}$$

As we argued above, optimality in equilibrium requires that $\lim_{\pi \uparrow \pi_e} U_e(\pi) = -c$. If π_m increases, then $U_e(\pi)$ increases for all $\pi < \pi_e$ and $\lim_{\pi \uparrow \pi_e} U_e(\pi) > -c$ holds. This implies that the elite's best response increases with π_m. □

Proposition 3 asserts existence of equilibrium with middle-class participation in rebel activities. However, there may be multiple such equilibria. We define a minimum threshold equilibrium $(\pi_l, \pi_m, \pi_u, \pi_e)$ as being such that $\pi_l = 0, \pi_u = 1$ and there is no other threshold equilibrium $(\pi'_l, \pi'_m, \pi'_u, \pi'_e)$ with $\pi'_l = 0, \pi'_u = 1$ and $\pi'_m < \pi_m$. By definition a minimum threshold equilibrium is unique. It is also interesting from a substantive point of view because concession is obtained the earliest in that equilibrium. We compute the minimum threshold equilibrium numerically for various parameter values.

5. Appendix: Tables

Table B1. Summary statistics for yearly peace agreement analysis.

Statistic	N	Mean	St. Dev.	Min	Max
Conflict Duration	137	10.796	11.469	2	40
Anti-government SCAD Events	137	2.358	3.447	0	21
GED fighting events count	137	42.416	50.314	1	286
Mean GED Capital Distance	137	513.207	386.814	3.986	1,309.770
Prio Grids affected by GED Fighting Events	137	13.723	13.832	1	78
GDP per capita	137	6.778	0.650	4.764	7.823
Population	137	16.352	0.863	14.605	17.775
Xpolity	137	−1.285	1.948	−3	5
Conflict Duration	137	25.555	11.347	1	43
Other conflicts	137	1.204	0.405	1	2
Military Expenditure per capita	137	0.017	0.037	−0.00000	0.329

Table B2. Proportionality test for Model 1 (Table 1). Testing a non-zero slope of Schoenfeld residuals as a function of time, where ρ if the coefficient of the slope. A χ^2 test is used as a statistical test of whether ρ is different from zero. All p-values indicate that we cannot reject the null hypothesis, which indicates that the model does not violate the proportionality assumption.

	ρ	χ^2	p
SCAD Events$_{t-1}$	0.074	0.221	0.638
GED Event Count$_{t-1}$	0.059	0.087	0.768
GED Capital Distance$_{t-1}$	0.076	0.107	0.743
GED PRIO grids affected$_{t-1}$	0.176	0.822	0.365
GDP per capita$_{t-1}$(log)	−0.103	0.338	0.561
Population$_{t-1}$(log)	−0.112	0.435	0.510
Xpolity$_{t-1}$	−0.034	0.047	0.829
Conflict Duration	−0.014	0.011	0.917
Ongoing Conflicts	−0.109	0.255	0.613
Military expenditure per capita$_{t-1}$	−0.183	0.619	0.432
GLOBAL		1.727	0.998

Table B3. Peace Agreement Models. Cox proportional hazard model estimates. Outcome variable is the time to peace agreement. Model includes all relevant variables interacted with the log of time.

	Dependent variable:	
	Time to peace agreement	
	Model 1	Model 2
SCAD Events$_{t-1}$	0.206***	0.310**
	(0.089)	(0.138)
SCAD Events$_{t-1}$×ln(time)	−0.187***	−0.244*
	(0.103)	(0.158)
GED Event Count$_{t-1}$		−0.014
		(0.013)
GED Event Count$_{t-1}$×ln(time)		0.008
		(0.007)
GED Capital Distance$_{t-1}$		−0.001
		(0.002)
GED Capital Distance$_{t-1}$×ln(time)		0.0001
		(0.001)
GED PRIO grids affected$_{t-1}$		0.019
		(0.066)
GED PRIO grids affected$_{t-1}$×ln(time)		−0.004
		(0.034)
GDP per capita$_{t-1}$(log)		−0.603*
		(0.363)
Population$_{t-1}(log)$		−0.282
		(0.373)
Xpolity$_{t-1}$		−0.199**
		(0.123)
Conflict Duration		0.030
		(0.024)
Ongoing Conflicts		−0.345
		(0.846)
Military expenditure per capita$_{t-1}$		6.714*
		(5.857)
Observations	153	137
Log Likelihood	-103.459	-92.449
Wald Test	55.750*** (df = 2)	617.460*** (df = 14)
LR Test	5.566 (df = 2)	15.636 (df = 14)
Score (Logrank) Test	6.311* (df = 2)	15.083 (df = 14)
Note:		*p<0.05; **p<0.01; ***p<0.001

TABLE B4. Negotiation onset model: Logit regression estimates for the negotiation onset model including all relevant variables interacted with the month count (time) of the respective spell.

	Dependent variable:
	Negotiation onset
SCAD Events$_{t-1}$	0.670***
	(0.202)
SCAD Events$_{t-1}$×Month in Episode	−0.010**
	(0.004)
GED Event Count$_{t-1}$	0.019
	(0.065)
GED Event Count$_{t-1}$×Month in Episode	−0.0002
	(0.001)
GED Capital Distance$_{t-1}$	0.001
	(0.0004)
GED Capital Distance$_{t-1}$×Month in Episode	−0.00000
	(0.00001)
GED PRIO grids affected$_{t-1}$	0.043
	(0.114)
GED PRIO grids affected$_{t-1}$×Month in Episode	−0.001
	(0.002)
Success$_{t_1}$	0.384**
	(0.137)
Success$_{t_1}$×Month in Episode	−0.012*
	(0.005)
Rebel Strength	0.629***
	(0.150)
Main Group	0.606
	(0.332)
Rebel Support	0.957***
	(0.224)
Polity	0.119***
	(0.036)
Battle Deaths (log)	−0.055
	(0.093)
Episode	−1.183**
	(0.384)
Month in Episode	0.044**
	(0.017)
Month in Episode^2	−0.001*
	(0.0002)
Month in Episode^3	0.00000*
	(0.00000)
Territorial Conflict	−0.146
	(0.723)
Ethnic Conflict	1.379***
	(0.287)
Third Party	1.805***
	(0.384)
Count Rebel Organizations	0.330*
	(0.158)
GDP per capita	0.0004**
	(0.0001)
Population	−0.000
	(0.000)
Military expenditure per capita	2.076
	(2.604)
Count Conflicts	1.097*
	(0.450)
Intercept	−8.244***
	(1.106)
Observations	1,364
Log Likelihood	-437.930
Akaike Inf. Crit.	931.861
Note:	*p<0.05; **p<0.01; ***p<0.001

TABLE B5. Negotiation onset and outcome models: Logit regression estimates (Model 1) for the negotiation onset model. Table also provides Negative Binomial regression estimates for the strong number of concessions model (Model 2) and the weak concessions model (Model 3).

	Dependent variable:		
	Negotiation onset	Number of strong concessions	Number of weak concessions
	logistic	*negative binomial*	*negative binomial*
	Model 1	Model 2	Model 3
SCAD Events$_{t-1}$	0.665***	0.812**	0.631*
	(0.200)	(0.283)	(0.265)
SCAD Events$_{t-1}$×Month in Episode	−0.010**	−0.010	−0.009*
	(0.004)	(0.006)	(0.005)
GED Event Count$_{t-1}$	0.011	−0.068	−0.048
	(0.034)	(0.050)	(0.043)
GED Capital Distance$_{t-1}$	0.001*	0.0004	0.001*
	(0.0003)	(0.0005)	(0.0004)
GED PRIO grids affected$_{t-1}$	0.017	0.117	0.081
	(0.063)	(0.088)	(0.077)
Success$_{t_1}$	0.418**	0.337*	0.411**
	(0.134)	(0.150)	(0.137)
Success$_{t_1}$×Month in Episode	−0.013**	−0.014*	−0.017**
	(0.005)	(0.007)	(0.007)
Rebel Strength	0.623***	0.928***	0.805***
	(0.149)	(0.206)	(0.183)
Main Group	0.598	−0.043	−0.212
	(0.329)	(0.419)	(0.379)
Rebel Support	0.944***	0.655*	0.742**
	(0.223)	(0.308)	(0.277)
Polity	0.123***	0.096*	0.077
	(0.034)	(0.049)	(0.042)
Battle Deaths (log)	−0.056	0.229	0.281*
	(0.092)	(0.130)	(0.115)
Episode	−1.150**	−0.602	−0.693
	(0.376)	(0.443)	(0.406)
Month in Episode	0.042*	0.020	0.018
	(0.016)	(0.023)	(0.020)
Month in Episode^2	−0.001*	−0.0003	−0.0003
	(0.0002)	(0.0004)	(0.0003)
Month in Episode^3	0.00000*	0.00000	0.00000
	(0.00000)	(0.00000)	(0.00000)
Territorial Conflict	−0.157	0.507	0.670
	(0.713)	(0.978)	(0.828)
Ethnic Conflict	1.357***	0.182	0.309
	(0.286)	(0.336)	(0.306)
Third Party	1.799***	0.714	0.846*
	(0.383)	(0.423)	(0.369)
Count rebel organizations	0.325*	0.399	0.093
	(0.157)	(0.231)	(0.206)
GDP per capita	0.0004**	0.001**	0.0005**
	(0.0001)	(0.0002)	(0.0002)
Population	−0.000	−0.00000**	−0.00000***
	(0.000)	(0.00000)	(0.000)
Military expenditure per capita	2.419	0.950	0.071
	(2.566)	(3.580)	(3.145)
Ongoing Conflicts	1.022*	0.462	0.813
	(0.443)	(0.655)	(0.561)
Intercept	−7.983***	−7.703***	−7.563***
	(1.057)	(1.366)	(1.204)
Observations	1,364	1,364	1,364
Log Likelihood	-438.483	-356.386	-453.436
θ		0.174*** (0.039)	0.211*** (0.041)
Akaike Inf. Crit.	926.965	762.772	956.871

Note: *p<0.05; **p<0.01; ***p<0.001

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