Supplemental Appendix For

Economic Crises, Civilian Mobilization, and Repression in Developing States

Contents

Summary and Descriptive Statistics **2**

Validating the Intermediary Mechanisms **5**

Sensitivity Analyses **9**

Robustness Models for Alternative Confounders, Data, and Coding Choices 9

Sensitivity to Different Repression Severity Thresholds 12

References **21**

This appendix proceeds in three parts. The first part reports summary statistics on all variables, a map of the urban areas analyzed, and a list of countries included in our sample. The second part reports a set of exercises designed to empirically validate the linkages between economic crises, urban infrastructure, mobilization, and repression. The third part reports a large number of robustness analyses, as well as logit model estimates (with and without country fixed effects) for higher repression severity threshold corresponding to Figure 2 of the main paper.

Summary and Descriptive Statistics

Table A1: Summary Statistics for Dependent and Independent Variables, 1993-2007 (Urban Sample)

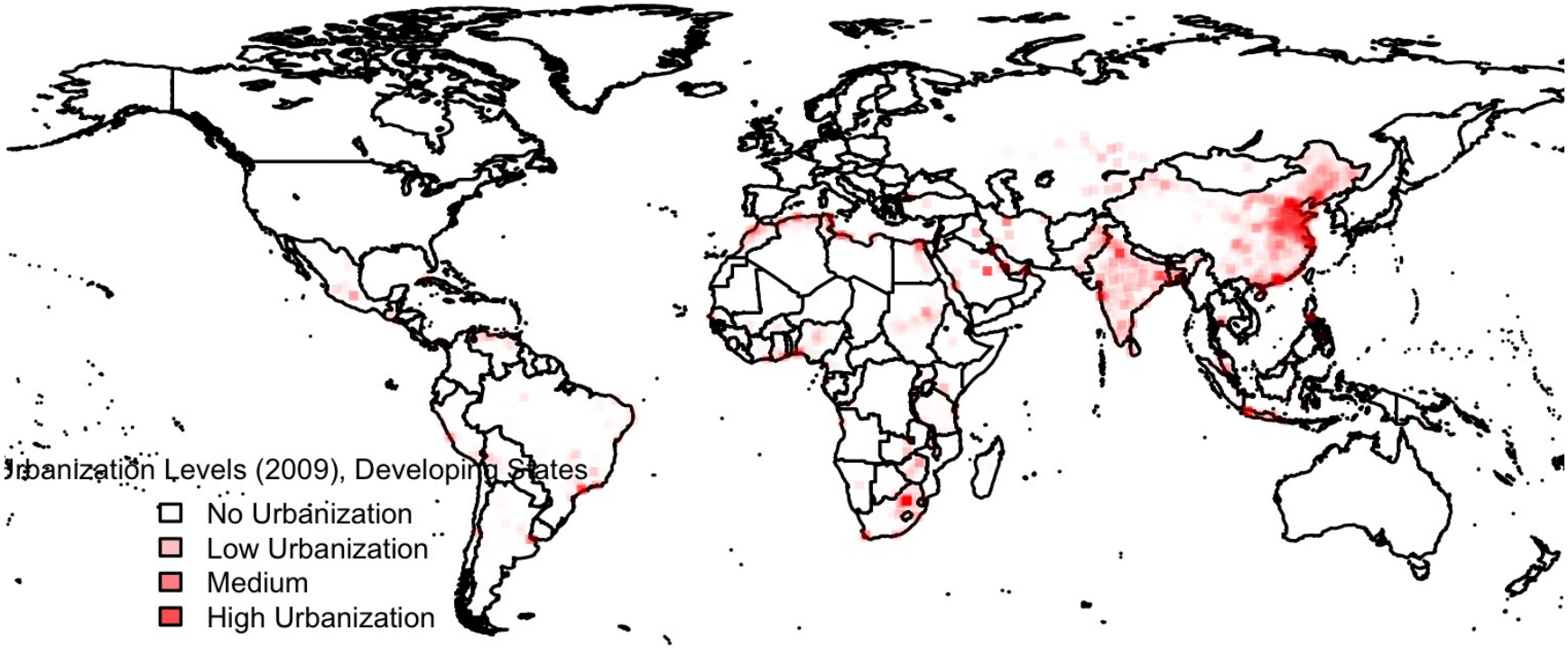
	Median	**Mean**	**Min**	**Max**	**Std. Dev.**
Cell level indicators					
Deaths by Government$_{it}$[1]	0	0.0104	0	11.406	0.185
Concentrated Urban Infrastructure$_{it-1}$	0.079	0.208	0	4.651	0.329
Population$_t$[1]	12.267	11.899	0	16.626	1.942
Deaths by Government$_{t-1}$[1]	0	0.012	0	11.406	0.188
Civil War$_t$	0	0.123	0	1	0.329
Ethnic exclusion$_t$	0	0.363	0	1	0.481
Drought$_{it}$	0.083	0.061	0	1.167	0.065
Temperature$_{it}$	18.735	17.206	-15.641	37.158	9.192
Precipitation$_{it}$[1]	5.218	5.074	0	7.570	1.056
Capital Distance$_i$[1]	6.553	6.369	1.607	8.239	1.051
Border Distance$_i$[1]	5.583	5.388	0.122	8.221	1.280
Mountains$_i$	0.52	0.281	0	1	0.361
Attacks by Government$_t$	0	0.017	0	47	0.411
Attacks by Government$_{t-1}$	0	0.018	0	47	0.436
ACLED Gov. Deaths$_{it}$[1]	0	0.191	0	9.169	0.747
ACLED Gov. Deaths$_{it-1}$[1]	0	0.186	0	9.169	0.743
SCAD Repression Deaths$_{it}$[1]	0	0.005	0	6.909	0.107
SCAD Repression Deaths$_{it-1}$[1]	0	0.005	0	6.909	0.111
NTL SD$_{it-1}$	2.985	4.454	0	26.118	4.708
Cell Area$_i$[1]	7.866	7.680	0.486	8.039	0.694
Travel Time$_i$[1]	5.288	5.334	2.079	8.813	0.783
Gold$_i$	0	0.002	0	1	0.049
Urbanized Area$_i$	0.222	0.992	0.002	0 51.549	2.391
Civilian Deaths Total$_{it-1}$[1]	0	0.025	0	11.406	0.280
Mobilization$_{it-1}$	0	0.205	0	1	0.404
Country level indicators					
Price Shock$_{jt-1}$	0	0.251	0	1	0.434
Polity2$_{jt}$	-6	-1.587	-10	10	6.569
Country Area$_j$[1]	7.846	7.658	0.485	8.037	0.643
New State$_{jt}$	0	0.0003	0	1	0.018
Oil Production$_{jt}$	18.028	15.731	0	19.980	5.729
Gas Production$_{jt}$	5.034	4.121	0	7.177	2.136
Price Shock (1.5 SD)$_{jt-1}$	0	0.082	0	1	0.275
Price Shock (all, 15th%)$_{jt-1}$	0	0.150	0	1	0.357
Price Shock (all, 25th%)$_{jt-1}$	0	0.248	0	1	0.432

[1] Natural log.

Table A2: List of all Countries Analyzed

Bahamas	Cuba	Haiti	Dominican Republic	Jamaica	Trinidad
Tobago	Barbados	Mexico	Belize	Guatemala	Honduras
El Salvador	Nicaragua	Costa Rica	Panama	Colombia	Venezuela
Guyana	Suriname	Ecuador	Peru	Brazil	Bolivia
Paraguay	Chile	Argentina	Uruguay	Azerbaijan	Guinea-Bissau
Gambia	Mali	Senegal	Benin	Mauritania	Niger
Côte d'Ivoire	Guinea	Burkina Faso	Liberia	Sierra Leone	Ghana
Togo	Cameroon	Nigeria	Gabon	Central African Republic	Chad
Congo – Brazzaville	Congo – Kinshasa	Uganda	Kenya	Tanzania	Burundi
Rwanda	Somalia	Djibouti	Ethiopia	Eritrea	Angola
Mozambique	Zambia	Zimbabwe	Malawi	South Africa	Namibia
Lesotho	Botswana	Swaziland	Madagascar	Morocco	Algeria
Tunisia	Libya	Sudan	Iran	Turkey	Iraq
Egypt	Lebanon	Jordan	Saudi Arabia	Kuwait	Bahrain
Qatar	United Arab Emirates	Oman	Afghanistan	Turkmenistan	Kyrgyzstan
Kazakhstan	China	Mongolia	India	Pakistan	Bangladesh
Myanmar (Burma)	Sri Lanka	Nepal	Thailand	Cambodia	Laos
Vietnam	Malaysia	Philippines	Indonesia	Papua New Guinea	

Figure A1: Urbanization Levels (2009) by 0.5∘ Grid Cell, Countries Analyzed



Validating the Intermediary Mechanisms

Systematically testing the theoretical mechanism that citizens in urban areas with concentrated infrastructure will believe *ex ante* during a severe shock that other citizens will be likely to mobilize against the government is challenging, as data to operationalize their perceptions is not (to our knowledge) publicly available. However, the Armed Conflict Location and Events Dataset (ACLED) (Raleigh et al., 2010) provides an exceptional coverage of a large number of political violence event types. We thus rely on ACLED for our validation exercises, subsetting all demonstration events, i.e., any event recorded as "riots" or "protests" for the 1997–2007 period for all African states.[1] We then merge into this dataset information on relevant variables from the data used in our empirical section, which we discuss in detail in the main paper, and lag our mobilization variable by one year to account for the lagged impact of *Concentrated Urban Infrastructure*$_{it-1}$, *Price Shock*$_{jt-1}$, and their interaction on repression via affecting civilian mobilization (forcing us to omit 1997 from our analysis).

We use the resulting dataset to conduct two validation exercises to test the linkages hypothesized between urban infrastructure, exogenous price shocks, civilian mobilization and repression in Table A3. In the first exercise, we estimate a probit model of *Concentrated Urban Infrastructure*$_{it-1}$, *Price Shock*$_{jt-1}$, and their interaction on *Mobilization*$_{it-1}$, accounting for some key potential confounders at the grid cell level (discussed in detail in the main paper), as well as all grid cell- and year-constant factors (using fixed effects by grid cell and year) and any heterogeneities at the country level (by clustering our standard errors by country).[2] We begin with a baseline model that includes only our main explanatory variables of interest in addition to fixed effects by grid cell and year and country-clustered standard errors. We then add some key controls to the next (full) specification. In both models, while the coefficients on neither *Concentrated Urban Infrastructure*$_{it-1}$ nor *Price Shock*$_{jt-1}$ are sta-

[1] ACLED also covers some Middle Eastern and Asian states, but only starting 2010 (and in some cases much later), whereas Bazzi and Blattman's (2014) commodity price shock indicator covers only the period up to and including 2007.

[2] Results remain practically unchanged when we use logit instead of probit. However, we chose to report the probit estimates as these directly correspond to the first stage in the Heckman model used in the second exercise.

tistically significant, the interactive term is positive and statistically significant (to at least the $p < .05$ level), suggesting that during times of price shocks, areas with more developed urban infrastructure are notably at a higher risk of experiencing civilian mobilization, as suggested by our theory.

To provide additional verification not only of the linkages between urban infrastructure, economic shocks and mobilization, but also whether a higher probability of mobilization impacts the risk of repression, in the second stage we rely on a Heckman selection model (Heckman, 1977). The Heckman model allows one to test the effect of covariates on a particular outcome, conditional on the probability of another outcome occurring first. This is done by estimating first a probit model for the first outcome – in our case, $Mobilization_{it-1}$ – followed by an OLS model of a second outcome, $Government\ Killings_{it}$ in our case. A requirement of this model is that at least one variable will appear only in the selection/probit stage to satisfy the exclusion restriction, in effect serving as an instrument. To this end, we use most controls – excluding key controls for population and civil war, which could affect repression as well as protest – as selection variates that, in addition to our main variables of interest and their interaction, can determine repression at year t via affecting the potential for civilian mobilization at $t-1$. Note that technical limitations prevented us from including fixed effects by grid cell in the Heckman model, although this is not necessarily a concern considering that such models often suffer from estimation biases when unit-of-analysis fixed effect are included (Greene, 2002). As a result, we only include fixed effects by year and country-clustered standard errors in these models.

As Table A3 illustrates, and in line with our key empirical models in the main paper and theoretical argument more broadly, in the absence of urban infrastructure, $Price\ Shock_{jt-1}$ has a negative and statistically significant association with the probability of civilian mobilization, and no notable effect on the probability of repression. However, as the positive and statistically significant (to at least the $p < .05$ level) coefficient on $Concentrated\ Urban\ Infrastructure_{it-1} \times Price\ Shock_{jt-1}$ illustrates, price shock's effects become noticeable and

positive as urban infrastructure levels increase. In particular, *Concentrated Urban Infrastructure*$_{it-1}$ $\times$ *Price Shock*$_{jt-1}$ notably increases both the probability of civilians will mobilize in a given African urban grid cell i during a given year $t-1$; and the risk of repression at year t,*conditional on civilian mobilization occurring at* $t-1$. The results in Table A3 thus provide useful empirical evidence for the mechanism linking economic crises, urban infrastructure, mobilization, and repression that underlies the main research hypothesis we test globally in the empirical section of our main paper.

Table A3: Civilian Mobilization and Killings by Government Forces, 1998-2007

	Probit (Mobilization$_{it-1}$)		**Heckman**	
	Baseline	**Full**	**Mobilization$_{it-1}$**	**Government Killings$_{it}$**
Concentrated Urban Infrastructure$_{it-1}$	0.292	-0.032	0.453***	−0.098***
	(0.364)	(0.372)	(0.046)	(0.032)
Price Shock$_{jt-1}$	0.129	-0.119	-0.172**	−0.003
	(0.108)	(0.122)	(0.067)	(0.076)
Concentrated Urban Infrastructure$_{it-1}$ × Price Shock$_{jt-1}$	0.259**	0.382***	0.179**	0.097**
	(0.127)	(0.137)	(0.077)	(0.044)
Population$_{it}$[1]	–	-2.815***	0.479***	0.306***
		(0.653)	(0.016)	(0.027)
Civil War$_{it}$	–	0.376**	-0.321***	0.646***
		(0.154)	(0.050)	(0.053)
Government Killings$_{it-1}$[1]	–	-0.125**	0.193***	–
		(0.063)	(0.035)	
Ethnic exclusion (y/n)$_{it}$	–	0.578***	-0.112***	–
		(0.135)	(0.038)	
Drought$_{it}$	–	0.237	-0.552**	–
		(0.440)	(0.217)	
Temperature$_{it}$	–	-0.030	-0.003	–
		(0.081)	(0.005)	
Precipitation$_{it}$[1]	–	0.472***	0.326***	–
		(0.124)	(0.025)	
Capital Distance$_{i}$[1]	–	–	-0.289***	–
			(0.014)	
Constant	−0.736*	32.014***	-6.126***	−1.306***
	(0.416)	(8.309)	(0.484)	(0.412)
FEs	Grid cell+year	Grid cell+year	Year	Year
Observations	15,147	13,128	13,128	
Akaike Information Criterion	5,805.35	5,127.26		
ρ			0.253	
Inverse Mills Ratio			0.206***	
			(0.052)	

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year and geospatial level are not reported.

[1] Natural log

Sensitivity Analyses

Robustness Models for Alternative Confounders, Data, and Coding Choices

To evaluate the sensitivity of our findings to alternative confounders, data, and coding choices, we estimate below several robustness models corresponding to the main paper's three full specifications: (i) with fixed effects by year only, (ii) with fixed effects by country and year, and (iii) fixed effects by grid cell and year (where again, all grid cell constant variables are omitted). These models are reported in Tables A4–A11, and discussed in detail below.

We begin by operationalizing our dependent variable and its lag as the yearly (t) *count of one-sided attacks by government forces* against civilians in a given urban cell i in which there was at least one casualty instead of the number of civilian deaths. To code this variable, $Government\ Attacks_{it}$, we rely again on the UCDP GED (Sundberg and Melander, 2013), which – as mentioned in the main paper, covers the entire terrestrial globe between 1989 and 2017 (with the exception of Syria).

In Table A5, we then operatonalize our dependent variable as the count of civilians killed by government forces, as done in our main models, this time using the Armed Conflict Location and Events Dataset (ACLED) (Raleigh et al., 2010) instead of UCDP GED. Recall, as we mentioned in the previous section, that ACLED only covers African countries during our period of interest and does not start recording incidence until 1997, which – after we lag the dependent variable to correspond to our full models – leaves us with a much more limited sample than our main analysis (only African states and only for the 1998–2007 period). Nevertheless, even after losing about 75% of our observations in the process, the positive and statistically significant coefficient of our interaction term holds in all models, suggesting our results are not driven by our decision to operationalize our dependent variable in terms of casualty rates rather than incidence rates or by our reliance on a specific dataset to code repression.

We then report a set of models that employ the Social Conflict Analysis Database (SCAD)

Version 3.3 dataset (Salehyan et al., 2012) for operationalizing our dependent variable in Table A6. Briefly, we operationalize this variable (and its one-year lag) as the number of civilians killed by government specifically repressing riots, i.e. a dangerous form of mobilization, aimed against the regime. The resulting dependent variable hence provides another effective way of testing for the possibility that during economic crises repression arises as a specific response to dangerous civilians mobilization as implied by our theory, in addition to the exercises reported in Table A3. It important to stress that in this analysis we, again, about 75% of our observations, and that while our results hold in the year only and year and country fixed effects models, the interaction term's coefficient is not significant in the grid cell and year fixed effects model, although it still maintains the (expected) positive sign.

Proceeding to Table A7, we introduce a number of additional potential confounders into our models (again, note that grid cell constant variables are omitted from the grid cell fixed effects models). Here, we add indicators for (i) variability of nighttime light emissions measured in cell i during year t to ensure our findings are based on true urban nighttime light emissions rather than errors of measurement, (ii) proximity of each urban grid cell to the equator (measured as the log sized of the grid cell), (iii) the extent of the cell's area that is urbanized (instead of urban infrastructure concentrations, specifically), (iv) whether gold was accessible in grid cell i, (v) (log) travel time from grid cell i to the nearest city with at least 50,000 inhabitants, (vi) the (log) total number of civilians killed in a given grid cell i due to political violence by all armed actors the previous year $t-1$, (vii) whether a given country j was a new state (formed in year t), and country j's (viii) oil and (ix) gas production in year t (to account for the impact of natural resources).

The next three tables then illustrate our results are not driven by the coding decisions underlying *Price Shock*$_{jt-1}$. To this end, Table A8 operationalizes *Price Shock*$_{jt-1}$ using a threshold of 1.5 standard deviations below the mean of Bazzi and Blattman's (2014) exogenous price variable (instead of 1 SD as was done in the original variable) to dichotomize our measure of price shocks. Table A9 then operationalizes *Price Shock*$_{jt-1}$ as the lower 15th

percentile of *all price shock levels globally* – that is, a score on Bazzi and Blattman's 2014 exogenous price shock indicator of less than -0.325. In Table A10, we then opertationalize $Price\ Shock_{jt-1}$ in a similar manner, this time using the lower 25th percentile as a threshold, i.e., as all country years that scored below -0.234 on Bazzi and Blattman's 2014 exogenous price shock indicator.

Finally, in Table A11 we report two robustness models – with and without key controls – that include cell fixed effects and their interactions with cubic splines of time trend, which allows us to identify unit-specific time trends. This specification is empirically analogous to a synthetic control method (Abadie, Diamond and Hainmueller, 2010) and used in other recent studies with a similar subnational focus (e.g., Carey and Horiuchi, 2017; Xu, 2017). Importantly, the sign and significance of our variables of interest hold in both specifications. This not only illustrates a very high standard of robustness for our theory, but also provides additional evidence to suggest our findings are *causal*, namely that our interaction provides a quasi-treatment with respect to government repression. Indeed, our findings crucially hold across *every model and nearly every specification* in Tables A4–A11 (to at least the $p < 0.1$ levels), suggesting a robust and causal viability of our broad theoretical argument.

Sensitivity to Different Repression Severity Thresholds

Finally, recall that in the main paper we plotted the increase in the size of the coefficient of *Concentrated Urban Infrastructure*$_{it-1}$ × *Price Shock*$_{jt-1}$ across four different thresholds of repression severity: (i) one civilian death, (ii) five civilian deaths, (iii) 15 civilians deaths, and (iv) 30 civilian deaths (each given a score of one, zero otherwise). Accordingly, we report the estimates of the four logit models – corresponding to the full specification with fixed effects by year – for each threshold dependent variable in Table A12 below, followed by similar four logit models that add country fixed effects in Table A13.[3]

[3]We attempted to run these models with grid cells fixed effects in addition to year fixed effects, but convergence proving challenging, resulting in coefficient values and statistical significance scores that were orders of magnitudes above the values reported in Table A12–A13, suggesting these models were sensitive to the rarity of events in these dependent variables, as discussed in the main paper.

Table A4: Determinants of Incidents of Attacks against Civilians by Government Forces, 1994-2007

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.019***	0.029***	0.014
	(0.005)	(0.006)	(0.024)
Price Shock$_{jt-1}$	−0.008	−0.014**	−0.015
	(0.006)	(0.006)	(0.012)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.033***	0.032***	0.030*
	(0.010)	(0.010)	(0.018)
Government Attacks$_{it-1}$	0.351***	0.322***	0.039
	(0.003)	(0.003)	(0.083)
Population$_{it}$[1]	0.003***	0.005***	0.033
	(0.001)	(0.001)	(0.043)
Civil War$_{it}$	0.036***	0.050***	0.062**
	(0.005)	(0.006)	(0.030)
Ethnic exclusion (y/n)$_{it}$	0.016***	0.010***	0.005
	(0.003)	(0.003)	(0.023)
Drought$_{it}$	0.036*	0.017	0.001
	(0.020)	(0.020)	(0.028)
Temperature$_{it}$	0.0001	−0.0001	0.003
	(0.0002)	(0.0003)	(0.004)
Precipitation$_{it}$[1]	0.007***	−0.005**	0.003
	(0.002)	(0.002)	(0.007)
Capital Distance$_{i}$[1]	−0.012***	−0.006***	–
	(0.001)	(0.002)	
Border Distance$_{i}$[1]	−0.006***	−0.003*	–
	(0.001)	(0.001)	
Mountains$_{i}$	0.012***	0.017***	–
	(0.004)	(0.004)	
Polity2$_{jt}$	−0.001***	0.0001	0.004
	(0.0003)	(0.001)	(0.004)
Polity2$^2_{jt}$	−0.0002**	−0.00001	−0.0003
	(0.0001)	(0.0001)	(0.0005)
Country Area$_{j}$[1]	−0.012***	−0.003	–
	(0.004)	(0.004)	
Constant	0.172***	0.042	–
	(0.031)	(0.036)	
FEs	Year	Country and year	Grid cell and year
Observations	68,074	68,074	69,935
R^2	0.158	0.179	0.244
Adjusted R^2	0.158	0.178	0.185

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A5: Determinants of Killings of Civilians by Government Forces, ACLED Repression, 1998-2007

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.045*	0.081***	−0.176**
	(0.024)	(0.028)	(0.083)
Price Shock$_{jt-1}$	−0.011	−0.022	−0.028
	(0.025)	(0.025)	(0.036)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.109***	0.099**	0.071*
	(0.041)	(0.041)	(0.041)
ACLED Gov. Deaths$_{it-1}$	0.412***	0.367***	0.105***
	(0.009)	(0.009)	(0.039)
Population$_{it}$[1]	0.035***	0.038***	−0.074
	(0.005)	(0.006)	(0.288)
Civil War$_{it}$	0.287***	0.259***	0.324***
	(0.019)	(0.025)	(0.061)
Ethnic exclusion (y/n)$_{it}$	0.102***	0.086***	0.165
	(0.015)	(0.017)	(0.117)
Drought$_{it}$	0.079	0.127	−0.027
	(0.085)	(0.086)	(0.197)
Temperature$_{it}$	0.004*	−0.001	0.036
	(0.002)	(0.003)	(0.022)
Precipitation$_{it}$[1]	0.017**	0.016	−0.013
	(0.008)	(0.012)	(0.028)
Capital Distance$_{i}$[1]	−0.024***	0.001	–
	(0.008)	(0.009)	
Border Distance$_{i}$[1]	−0.033***	−0.024***	–
	(0.006)	(0.007)	
Mountains$_{i}$	0.088***	0.069**	–
	(0.027)	(0.030)	
Polity2$_{jt}$	0.004**	0.013***	0.018**
	(0.002)	(0.004)	(0.008)
Polity2$^2_{jt}$	−0.001***	−0.002***	−0.003**
	(0.0003)	(0.001)	(0.002)
Country Area$_{j}$[1]	−0.067***	−0.062***	–
	(0.017)	(0.018)	
Constant	0.408**	0.701**	–
	(0.204)	(0.291)	
FEs	Year	Country and year	Grid cell and year
Observations	10,762	10,762	10,782
R^2	0.264	0.282	0.430
Adjusted R^2	0.262	0.278	0.365

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A6: Determinants of Killings of Civilians by Government Forces, SCAD Repression of Riots, 1994-2007

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.002	0.001	−0.020
	(0.004)	(0.004)	(0.027)
Price Shock$_{jt-1}$	−0.001	−0.002	−0.001
	(0.003)	(0.003)	(0.002)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.012**	0.012**	0.009
	(0.006)	(0.006)	(0.012)
SCAD Repression Deaths$_{it-1}$	0.114***	0.108***	0.019
	(0.007)	(0.007)	(0.037)
Population$_{it}$[1]	0.002***	0.003***	0.012
	(0.001)	(0.001)	(0.026)
Civil War$_{it}$	0.002	−0.0001	−0.001
	(0.002)	(0.003)	(0.003)
Ethnic exclusion (y/n)$_{it}$	−0.0005	−0.002	−0.003
	(0.002)	(0.002)	(0.008)
Drought$_{it}$	−0.002	−0.007	−0.020*
	(0.012)	(0.012)	(0.012)
Temperature$_{it}$	0.001***	0.001**	0.005*
	(0.0003)	(0.0004)	(0.003)
Precipitation$_{it}$[1]	0.0004	−0.001	−0.002
	(0.001)	(0.002)	(0.002)
Capital Distance$_{i}$[1]	−0.001	−0.003**	–
	(0.001)	(0.001)	
Border Distance$_{i}$[1]	0.00003	−0.001	–
	(0.001)	(0.001)	
Mountains$_{i}$	0.002	0.001	–
	(0.004)	(0.004)	
Polity2$_{jt}$	0.0003	0.001**	0.001*
	(0.0002)	(0.0004)	(0.001)
Polity2$^2_{jt}$	−0.0001	−0.0001*	−0.0002***
	(0.00004)	(0.0001)	(0.0001)
Country Area$_{j}$[1]	−0.008***	−0.007***	
	(0.002)	(0.002)	
Constant	0.027	0.077**	–
	(0.027)	(0.039)	
FEs	Year	Country and year	Grid cell and year
Observations	14,314	14,314	14,720
R^2	0.025	0.031	0.119
Adjusted R^2	0.023	0.027	0.049

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A7: Determinants of Killings of Civilians by Government Forces, 1994-2007 – Controls

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.003	0.004	−0.002
	(0.005)	(0.005)	(0.016)
Price Shock$_{jt-1}$	−0.014***	−0.018***	−0.019
	(0.004)	(0.004)	(0.012)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.028***	0.028***	0.026**
	(0.005)	(0.005)	(0.013)
Government Killings$_{it-1}$[1]	0.176***	0.147***	0.051
	(0.005)	(0.005)	(0.036)
Population$_{it}$[1]	0.003***	0.003***	0.011
	(0.001)	(0.001)	(0.022)
Civil War$_{it}$	0.048***	0.059***	0.081**
	(0.003)	(0.004)	(0.032)
Ethnic exclusion (y/n)$_{it}$	0.013***	0.007***	0.015
	(0.002)	(0.002)	(0.018)
Drought$_{it}$	0.048***	0.036***	0.029
	(0.011)	(0.011)	(0.043)
Temperature$_{it}$	−0.0001	−0.0002	0.004
	(0.0001)	(0.0002)	(0.003)
Precipitation$_{it}$[1]	0.006***	−0.001	0.004
	(0.001)	(0.001)	(0.005)
NTL SD$_{it-1}$	0.001***	0.002***	0.003
	(0.0004)	(0.0004)	(0.003)
Civilian Deaths Total$_{it-1}$[1]	0.021***	−0.001	−0.028
	(0.004)	(0.004)	(0.021)
Capital Distance$_{i}$[1]	−0.007***	−0.002*	–
	(0.001)	(0.001)	
Border Distance$_{i}$[1]	−0.001	−0.001	–
	(0.001)	(0.001)	
Mountains$_{i}$	0.002	0.006**	–
	(0.002)	(0.003)	
Travel Time$_{i}$[1]	0.008***	0.004**	–
	(0.002)	(0.002)	
Cell Area$_{i}$[1]	0.072***	0.015	–
	(0.010)	(0.011)	
Gold$_{i}$	−0.021	0.002	–
	(0.016)	(0.016)	
Degree Urbanized$_{i}$	−0.0003	−0.001	–
	(0.0004)	(0.0004)	
Polity2$_{jt}$	−0.001***	−0.0003	0.001
	(0.0002)	(0.0004)	(0.001)
Polity2$^2_{jt}$	−0.0002***	−0.0001	−0.0001
	(0.00004)	(0.0001)	(0.0003)
New State$_{jt}$	−0.043	−0.018	−0.012
	(0.038)	(0.038)	(0.016)
Oil Production$_{jt}$	−0.0003	0.001	0.001
	(0.0002)	(0.001)	(0.002)
Gas Production$_{jt}$	−0.001**	0.001	−0.001
	(0.001)	(0.002)	(0.008)
Country Area$_{j}$[1]	−0.079***	−0.017	–
	(0.010)	(0.011)	
Constant	0.049**	−0.028	–
	(0.019)	(0.028)	
FEs	Year	Country and year	Grid cell and year
Observations	67,730	67,730	69,586
R^2	0.065	0.106	0.199
Adjusted R^2	0.065	0.104	0.136

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A8: Determinants of Killings of Civilians by Government Forces, 1994-2007 – Higher Shock Threshold

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.008***	0.018***	0.028
	(0.003)	(0.003)	(0.020)
Price Shock$_{jt-1}$	−0.024***	−0.020***	−0.017*
	(0.005)	(0.005)	(0.010)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.060***	0.061***	0.060**
	(0.009)	(0.009)	(0.024)
Government Killings$_{it-1}$[1]	0.199***	0.146***	0.023
	(0.004)	(0.004)	(0.030)
Population$_{it}$[1]	0.002***	0.003***	0.003
	(0.001)	(0.001)	(0.018)
Civil War$_{it}$	0.049***	0.059***	0.078**
	(0.003)	(0.003)	(0.030)
Ethnic exclusion (y/n)$_{it}$	0.013***	0.007***	0.014
	(0.002)	(0.002)	(0.018)
Drought$_{it}$	0.051***	0.037***	0.029
	(0.011)	(0.011)	(0.044)
Temperature$_{it}$	0.0001	−0.0002	0.003
	(0.0001)	(0.0002)	(0.003)
Precipitation$_{it}$[1]	0.006***	−0.002	0.004
	(0.001)	(0.001)	(0.004)
Capital Distance$_{i}$[1]	−0.008***	−0.001	–
	(0.001)	(0.001)	
Border Distance$_{i}$[1]	−0.006***	−0.002**	–
	(0.001)	(0.001)	
Mountains$_{i}$	0.008***	0.008***	–
	(0.002)	(0.002)	
Polity2$_{jt}$	−0.001***	−0.0004	0.001
	(0.0002)	(0.0004)	(0.001)
Polity2$^2_{jt}$	−0.0002***	−0.0001	−0.0001
	(0.00004)	(0.0001)	(0.0003)
Country Area$_{j}$[1]	−0.009***	−0.003	–
	(0.002)	(0.002)	
Constant	0.122***	0.020	–
	(0.017)	(0.020)	
FEs	Year	Country and year	Grid cell and year
Observations	68,074	68,074	69,935
R^2	0.064	0.105	0.199
Adjusted R^2	0.063	0.104	0.136

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A9: Determinants of Killings of Civilians by Government Forces, 1994-2007 – 15th Lowest Percentile Shock Threshold

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.006**	0.016***	0.024
	(0.003)	(0.003)	(0.020)
Price Shock$_{jt-1}$	−0.005*	−0.013***	−0.009
	(0.003)	(0.003)	(0.007)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.042***	0.048***	0.036**
	(0.006)	(0.006)	(0.015)
Government Killings$_{it-1}$[1]	0.199***	0.146***	0.023
	(0.004)	(0.004)	(0.030)
Population$_{it}$[1]	0.002***	0.003***	0.003
	(0.001)	(0.001)	(0.018)
Civil War$_{it}$	0.049***	0.059***	0.078***
	(0.003)	(0.003)	(0.030)
Ethnic exclusion (y/n)$_{it}$	0.013***	0.007***	0.014
	(0.002)	(0.002)	(0.017)
Drought$_{it}$	0.050***	0.036***	0.029
	(0.011)	(0.011)	(0.044)
Temperature$_{it}$	0.0001	−0.0002	0.003
	(0.0001)	(0.0002)	(0.003)
Precipitation$_{it}$[1]	0.006***	−0.002	0.003
	(0.001)	(0.001)	(0.004)
Capital Distance$_{i}$[1]	−0.008***	−0.001	–
	(0.001)	(0.001)	
Border Distance$_{i}$[1]	−0.006***	−0.002**	–
	(0.001)	(0.001)	
Mountains$_{i}$	0.008***	0.008***	–
	(0.002)	(0.002)	
Polity2$_{jt}$	−0.001***	−0.0004	0.001
	(0.0002)	(0.0004)	(0.001)
Polity2$^2_{jt}$	−0.0002***	−0.0001	−0.0001
	(0.00004)	(0.0001)	(0.0003)
Country Area$_{j}$[1]	−0.008***	−0.003	–
	(0.002)	(0.002)	
Constant	0.118***	0.020	–
	(0.017)	(0.020)	
FEs	Year	Country and year	Grid cell and year
Observations	68,074	68,074	69,935
R^2	0.064	0.105	0.198
Adjusted R^2	0.063	0.104	0.136

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A10: Determinants of Killings of Civilians by Government Forces, 1994-2007 – 25th Lowest Percentile Shock Threshold

	Standard	**CFEs**	**GFEs**
Concentrated Urban Infrastructure$_{it-1}$	0.006**	0.017***	0.023
	(0.003)	(0.003)	(0.019)
Price Shock$_{jt-1}$	−0.007**	−0.010***	−0.009
	(0.003)	(0.003)	(0.011)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.025***	0.024***	0.022*
	(0.005)	(0.005)	(0.012)
Government Killings$_{it-1}$[1]	0.199***	0.146***	0.023
	(0.004)	(0.004)	(0.030)
Population$_{it}$[1]	0.002***	0.003***	0.006
	(0.001)	(0.001)	(0.021)
Civil War$_{it}$	0.049***	0.059***	0.078***
	(0.003)	(0.003)	(0.030)
Ethnic exclusion (y/n)$_{it}$	0.013***	0.007***	0.014
	(0.002)	(0.002)	(0.017)
Drought$_{it}$	0.051***	0.037***	0.029
	(0.011)	(0.011)	(0.044)
Temperature$_{it}$	0.00004	−0.0002	0.003
	(0.0001)	(0.0002)	(0.003)
Precipitation$_{it}$[1]	0.006***	−0.002	0.003
	(0.001)	(0.001)	(0.005)
Capital Distance$_{i}$[1]	−0.008***	−0.001	–
	(0.001)	(0.001)	
Border Distance$_{i}$[1]	−0.006***	−0.002**	–
	(0.001)	(0.001)	
Mountains$_{i}$	0.008***	0.008***	–
	(0.002)	(0.002)	
Polity2$_{jt}$	−0.001***	−0.0004	0.001
	(0.0002)	(0.0004)	(0.001)
Polity2$^2_{jt}$	−0.0002***	−0.0001	−0.0001
	(0.00004)	(0.0001)	(0.0003)
Country Area$_{j}$[1]	−0.009***	−0.003	–
	(0.002)	(0.002)	
Constant	0.123***	0.024	–
	(0.017)	(0.020)	
FEs	Year	Country and year	Grid cell and year
Observations	68,074	68,074	69,935
R^2	0.063	0.105	0.198
Adjusted R^2	0.063	0.103	0.135

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year, country, and geospatial level are not reported.

[1] Natural log

Table A11: Determinants of Killings of Civilians by Government Forces, 1994-2007 – Spline × GFE Interactions

	Baseline	**Controls**
Concentrated Urban Infrastructure$_{it-1}$	-0.008	-0.017
	(0.013)	(0.013)
Price Shock$_{jt-1}$	-0.003	-0.002
	(0.002)	(0.002)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.020***	0.022***
	(0.005)	(0.005)
DV_{it-1}	–	-0.047***
		(0.004)
Population$_{it}$ [1]	–	0.075***
		(0.017)
t_t	-0.005**	-0.008***
	(0.003)	(0.003)
t_t^2	0.001*	0.001**
	(0.0003)	(0.0003)
t_t^3	-1.96e-05	-3.16e-05
	(4.51e-05)	(4.51e-05)
Constant	12.02***	12.67***
	(1.583)	(1.588)
Observations	77,042	77,042
R^2	0.263	0.265
Adjusted R^2	0.140	0.142

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by grid cell and interaction with t^3 are not reported.

[1] Natural log

References

Abadie, Alberto, Alexis Diamond and Jens Hainmueller. 2010. "Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program." *Journal of the American statistical Association* 105(490):493–505.

Bazzi, Samuel and Christopher Blattman. 2014. "Economic shocks and conflict: Evidence from commodity prices." *American Economic Journal: Macroeconomics* 6(4):1–38.

Carey, John M and Yusaku Horiuchi. 2017. "Compulsory voting and income inequality: evidence for Lijphart's proposition from Venezuela." *Latin American Politics and Society* 59(2):122–144.

Greene, William H. 2002. "The behavior of the fixed effects estimator in nonlinear models." NYU Working Paper No. EC-02-05.

Heckman, James J. 1977. Sample selection bias as a specification error (with an application to the estimation of labor supply functions). Technical report National Bureau of Economic Research.

Raleigh, Clionadh, Andrew Linke, Håvard Hegre and Joakim Karlsen. 2010. "Introducing ACLED: an armed conflict location and event dataset: special data feature." *Journal of peace research* 47(5):651–660.

Salehyan, Idean, Cullen S Hendrix, Jesse Hamner, Christina Case, Christopher Linebarger, Emily Stull and Jennifer Williams. 2012. "Social conflict in Africa: A new database." *International Interactions* 38(4):503–511.

Sundberg, Ralph and Erik Melander. 2013. "Introducing the UCDP georeferenced event dataset." *Journal of Peace Research* 50(4):523–532.

Xu, Yiqing. 2017. "Generalized synthetic control method: Causal inference with interactive fixed effects models." *Political Analysis* 25(1):57–76.

Table A12: Logit Models of Different Repression Severity Thresholds, 1994-2007 – Year Fixed Effects Only

	1 Death	**5 Deaths**	**15 Deaths**	**30 Deaths**
Concentrated Urban Infrastructure$_{it-1}$	0.764***	0.352	−0.688	−1.505
	(0.141)	(0.266)	(0.589)	(1.006)
Price Shock$_{jt-1}$	−0.112	−0.602*	−0.523	−0.947*
	(0.211)	(0.327)	(0.416)	(0.510)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.528**	0.986***	1.829***	2.360**
	(0.206)	(0.349)	(0.657)	(1.124)
DV_{it-1}	2.645***	1.932***	1.933***	1.356**
	(0.148)	(0.280)	(0.398)	(0.530)
Population$_{it}$[1]	0.368***	0.550***	0.615***	0.636***
	(0.057)	(0.098)	(0.132)	(0.168)
Civil War$_{it}$	1.511***	2.182***	2.674***	3.123***
	(0.128)	(0.198)	(0.276)	(0.379)
Ethnic exclusion (y/n)$_{it}$	0.460***	0.996***	0.775***	0.810**
	(0.124)	(0.203)	(0.268)	(0.341)
Drought$_{it}$	1.632**	2.205**	3.187***	4.108***
	(0.672)	(0.990)	(1.198)	(1.337)
Temperature$_{it}$	0.202***	0.202***	0.218***	0.207***
	(0.020)	(0.033)	(0.045)	(0.055)
Precipitation$_{it}$[1]	0.343***	0.431***	0.413**	0.378*
	(0.081)	(0.125)	(0.168)	(0.213)
Capital Distance$_i$[1]	−0.149***	−0.250***	−0.181	−0.188
	(0.049)	(0.079)	(0.112)	(0.146)
Border Distance$_i$[1]	−0.243***	−0.254***	−0.349***	−0.398***
	(0.044)	(0.071)	(0.093)	(0.115)
Mountains$_i$	1.095***	0.967***	1.018**	1.069*
	(0.233)	(0.374)	(0.497)	(0.599)
Polity2$_{jt}$	−0.042***	−0.110***	−0.144***	−0.174***
	(0.015)	(0.023)	(0.032)	(0.044)
$Polity2^2_{jt}$	−0.020***	−0.025***	−0.026***	−0.028***
	(0.003)	(0.005)	(0.007)	(0.009)
Country Area$_j$[1]	−0.388***	−0.315	−0.339	−0.494
	(0.131)	(0.245)	(0.334)	(0.414)
Constant	−9.934***	−14.005***	−15.610***	−14.639***
	(1.360)	(2.418)	(3.342)	(4.157)
FEs	Year	Year	Year	Year
Observations		68,074		
Log Likelihood	−1,456.497	−639.146	−391.959	−267.209
Akaike Inf. Crit.	2,974.995	1,340.292	845.919	596.417

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year are not reported.

[1] Natural log

Table A13: Logit Models of Different Repression Severity Thresholds, 1994-2007 – Country and Year Fixed Effects

	1 Death	**5 Deaths**	**15 Deaths**	**30 Deaths**
Concentrated Urban Infrastructure$_{it-1}$	0.834***	0.557	−0.004	−0.676
	(0.184)	(0.352)	(0.612)	(1.056)
Price Shock$_{jt-1}$	−0.059	−0.254	−0.056	−0.335
	(0.214)	(0.326)	(0.412)	(0.501)
Concentrated Urban Infrastructure$_{it-1}$ × *Price Shock*$_{jt-1}$	0.489**	0.913**	1.362**	2.020*
	(0.229)	(0.366)	(0.597)	(1.040)
DV_{it-1}	1.302***	0.870***	1.009***	0.696
	(0.159)	(0.279)	(0.382)	(0.516)
Population$_{it}$[1]	0.704***	0.830***	0.895***	0.769***
	(0.075)	(0.134)	(0.179)	(0.213)
Civil War$_{it}$	1.829***	2.265***	2.512***	2.894***
	(0.205)	(0.303)	(0.395)	(0.511)
Ethnic exclusion (y/n)$_{it}$	0.368**	0.619**	0.725**	0.767
	(0.156)	(0.258)	(0.347)	(0.476)
Drought$_{it}$	1.949***	2.534**	4.083***	6.124***
	(0.738)	(1.071)	(1.524)	(1.855)
Temperature$_{it}$	−0.0003	−0.117*	−0.070	0.026
	(0.036)	(0.067)	(0.097)	(0.120)
Precipitation$_{it}$[1]	0.107	0.231	−0.159	0.092
	(0.162)	(0.266)	(0.339)	(0.418)
Capital Distance$_i$[1]	0.185**	0.091	0.286	0.195
	(0.077)	(0.129)	(0.191)	(0.224)
Border Distance$_i$[1]	−0.041	0.095	0.058	0.100
	(0.072)	(0.119)	(0.156)	(0.180)
Mountains$_i$	0.311	0.273	0.255	−0.078
	(0.293)	(0.517)	(0.703)	(0.860)
Polity2$_{jt}$	0.051**	−0.040	−0.063	−0.109
	(0.025)	(0.041)	(0.056)	(0.086)
$Polity2^2_{jt}$	−0.011**	−0.016**	−0.005	−0.017
	(0.005)	(0.008)	(0.011)	(0.016)
Country Area$_j$[1]	−0.521***	−0.467*	−0.422	−0.655
	(0.139)	(0.280)	(0.394)	(0.480)
Constant	−14.096***	1,609,328,877.000	−33.214	−33.900
	(2.047)	(827,104,536,306.000)	(2,387.002)	(6,337.863)
FEs	Country+year	Country+year	Country+year	Country+year
Observations		68,074		
Log Likelihood	−1,188.107	−532.909	−318.977	−216.149
Akaike Inf. Crit.	2,598.214	1,289.819	859.953	654.299

*p<0.1; **p<0.05; ***p<0.01.

Variable coefficients are reported with standard errors clustered by country in parentheses. Fixed effects by year and country are not reported.

[1] Natural log