

SUPPLEMENTARY MATERIAL

SOCIAL REVOLUTION AND AUTHORITARIAN DURABILITY

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Appendix A

Table A1: Correlation Table

	Rev	GDP	Growth	Pop	Oil/Gas	Party	Pers.	Mil.	Mon.	Communist
Rev	1	-0.014	-0.059	-0.012	0.005	0.345	-0.155	-0.123	-0.021	0.218
GDP	-0.014	1	0.176	0.251	0.599	-0.172	0.012	0.115	-0.094	-0.144
Growth	-0.059	0.176	1	0.057	0.185	-0.055	-0.131	0.159	-0.023	-0.133
Pop	-0.012	0.251	0.057	1	0.399	-0.060	0.027	0.066	0.089	-0.046
Oil/Gas	0.005	0.599	0.185	0.399	1	-0.076	0.106	-0.034	0.017	-0.072
Party	0.345	-0.172	-0.055	-0.060	-0.076	1	-0.228	-0.295	-0.050	0.346
Pers.	-0.155	0.012	-0.131	0.027	0.106	-0.228	1	-0.661	-0.112	0.010
Mil.	-0.123	0.115	0.159	0.066	-0.034	-0.295	-0.661	1	-0.065	-0.140
Mon.	-0.021	-0.094	-0.023	0.089	0.017	-0.050	-0.112	-0.065	1	-0.024
Communist	0.218	-0.144	-0.133	-0.046	-0.072	0.346	0.010	-0.140	-0.024	1
Foreign installed communist	-0.026	-0.162	-0.061	-0.022	-0.036	0.270	-0.051	-0.080	-0.013	0.568

Notes: An observation is an authoritarian regime. *Rev.* is a binary indicator for revolutionary regime. *GDP* denotes per capita GDP (logged) (source: Maddison 2018, as provided by Coppedge et al. 2019). *Growth* denotes GDP growth. *Pop.* denotes logged size of the population (source: COW NMC, v4.0, Singer 1988). *Oil/gas* denotes log(per capita value of oil and gas production +1) (Ross and Mahdavi 2015). *Party* is a binary indicator of whether the regime has a party element. *Pers.* is a binary indicator of whether the regime has a personalistic component. *Mil.* is a binary indicator of whether the regime is a pure military regime. *Mon.* is a binary indicator of whether the regime is a monarchy. *Communist* is a binary indicator of communist regime from Svoboda (2012). *Foreign installed communist* (binary) denotes communist regimes installed by a foreign power.

Table A2: Cox Regressions with Time-Varying Covariates, Multiple Imputation

	Non-stratified		Stratified		Controlling for regime type (post-treatment)		Controlling for communism (post-treatment)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Revolution	-1.399*** (0.334)	-1.355*** (0.334)	-1.715*** (0.392)	-1.651*** (0.380)	-0.932*** (0.357)	-1.165*** (0.407)	-1.017** (0.404)	-1.255*** (0.438)
Per Cap. GDP (log)	-0.119 (0.077)	-0.027 (0.098)	-0.053 (0.100)	-0.004 (0.106)	-0.125 (0.102)	-0.090 (0.109)	-0.103 (0.110)	-0.096 (0.111)
GDP Growth	-2.029*** (0.738)	-2.070*** (0.759)	-1.874** (0.902)	-2.387*** (0.832)	-2.176*** (0.795)	-2.541*** (0.881)	-2.548*** (0.877)	-2.540*** (0.879)
Population (log)	0.019 (0.043)	0.039 (0.045)	0.110** (0.048)	0.031 (0.049)	-0.054 (0.050)	-0.036 (0.052)	-0.033 (0.052)	-0.034 (0.052)
Oil and gas prod. per cap. (log)		-0.051* (0.028)	-0.026 (0.029)	-0.064** (0.029)	-0.014 (0.031)	-0.025 (0.032)	-0.026 (0.032)	-0.027 (0.031)
Party					-0.990*** (0.194)	-0.949*** (0.202)	-0.826*** (0.209)	-0.774*** (0.210)
Personalist					-0.184 (0.205)	-0.192 (0.213)	-0.198 (0.210)	-0.208 (0.211)
Military					0.794*** (0.232)	0.710*** (0.239)	0.689*** (0.239)	0.693*** (0.240)
Monarchy					-1.617*** (0.357)	-1.444*** (0.349)	-1.470*** (0.347)	-1.470*** (0.348)
Foreign installed communist								-0.846* (0.508)
Communist							-0.629** (0.268)	-0.230 (0.343)
Stratified by geographic region	No	No	Yes	No	No	No	No	No
Stratified by event number	No	No	No	Yes	No	Yes	Yes	Yes
N observations	5723	5723	5723	5723	5723	5723	5723	5723
N breakdowns	300	300	300	300	300	300	300	300
Multiple imputation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value of significance test:	0.000	0.000	0.000	0.000	0.006	0.002	0.008	0.003

Note:

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

An observation is an authoritarian regimes. Missing values were imputed using the Amelia routine (20 imputations). We used heteroskedasticity-consistent standard errors for each analysis and combined the results using Rubin's rules. Likelihood ratio tests were performed following Meng and Rubin (1992).

Table A3: Cox Regressions with Time-Varying Covariates, Listwise Deletion

	Non-stratified		Stratified		Controlling for regime type (post-treatment)		Controlling for communism (post-treatment)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Revolution	-1.224*** (0.334)	-1.226*** (0.340)	-1.468*** (0.394)	-1.464*** (0.386)	-1.035** (0.418)	-1.164*** (0.420)	-1.006** (0.423)	-1.233*** (0.463)
Per Cap. GDP (log)	-0.099 (0.079)	-0.120 (0.113)	-0.245** (0.119)	-0.087 (0.122)	-0.289** (0.122)	-0.205* (0.123)	-0.214* (0.124)	-0.207* (0.124)
GDP Growth	-1.882*** (0.721)	-1.483* (0.772)	-1.037 (0.899)	-1.852*** (0.840)	-1.097 (0.962)	-2.126** (0.920)	-2.158** (0.919)	-2.145** (0.923)
Population (log)	0.016 (0.047)	0.072 (0.054)	0.104* (0.057)	0.060 (0.059)	-0.011 (0.064)	-0.007 (0.061)	-0.004 (0.062)	-0.005 (0.061)
Oil and gas prod. per cap. (log)		-0.020 (0.032)	0.005 (0.033)	-0.037 (0.034)	0.004 (0.036)	-0.003 (0.035)	-0.005 (0.035)	-0.006 (0.035)
Party					-0.906*** (0.265)	-0.821*** (0.269)	-0.683** (0.282)	-0.646** (0.283)
Personalist					-0.353 (0.274)	-0.337 (0.292)	-0.321 (0.292)	-0.338 (0.295)
Military					0.554* (0.316)	0.658** (0.322)	0.653** (0.326)	0.647** (0.328)
Monarchy					-1.158** (0.559)	-1.012** (0.424)	-1.001** (0.421)	-1.010** (0.421)
Communist							-0.610** (0.307)	-0.222 (0.399)
Foreign installed communist								-0.781 (0.558)
Stratified by geographic region	No	No	Yes	No	No	No	No	No
Stratified by event number	No	No	No	Yes	Yes	Yes	Yes	Yes
N observations	4806	4182	4182	4182	4182	4182	4182	4182
N breakdowns	257	220	220	220	220	220	220	220
Multiple imputation	No	No	No	No	No	No	No	No
p-value of significance test:	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Note:

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

An observation is a country-year. All variables are lagged one year. We used listwise deletion to deal with missing observations.

Table A4: Robustness Tests, Cox Regressions After Discarding Longest Surviving Revolutionary Regimes

a) Without regime type controls

	N-1	N-2	N-3	N-4	N-5	N-6
	(1)	(2)	(3)	(4)	(5)	(6)
Revolution	-1.254*** (0.344)	-1.283*** (0.378)	-1.180*** (0.366)	-1.043*** (0.353)	-0.885*** (0.334)	-0.762** (0.318)
Per Capita GDP (log)	-0.001 (0.097)	-0.0003 (0.096)	-0.004 (0.096)	-0.006 (0.096)	0.003 (0.097)	0.001 (0.096)
GDP Growth (pct.)	0.124 (0.770)	0.135 (0.770)	0.153 (0.765)	0.179 (0.763)	0.181 (0.759)	0.203 (0.753)
Population (log)	-0.026 (0.064)	-0.027 (0.064)	-0.021 (0.065)	-0.020 (0.064)	-0.021 (0.064)	-0.021 (0.065)
Oil and gas prod. per cap. (log)	-0.047 (0.031)	-0.047 (0.030)	-0.048 (0.031)	-0.049 (0.031)	-0.052* (0.031)	-0.051 (0.031)
Stratified by geographic region	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
Stratified by event number	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
N observations	354	353	352	351	350	349
N breakdowns	299	298	298	298	298	298
Multiple imputation	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>p</i> -value of significance test:	0.000	0.000	0.000	0.001	0.007	0.026

b) With regime type controls

	N-1	N-2	N-3	N-4	N-5	N-6
	(1)	(2)	(3)	(4)	(5)	(6)
Revolution	-0.835** (0.387)	-0.865** (0.421)	-0.768* (0.414)	-0.619 (0.405)	-0.482 (0.411)	-0.345 (0.399)
Per Capita GDP (log)	-0.127 (0.102)	-0.126 (0.102)	-0.130 (0.102)	-0.133 (0.103)	-0.122 (0.104)	-0.126 (0.103)
GDP Growth (pct.)	-0.070 (0.783)	-0.061 (0.785)	-0.032 (0.784)	0.009 (0.783)	0.025 (0.778)	0.061 (0.776)
Population (log)	-0.079 (0.061)	-0.078 (0.060)	-0.072 (0.061)	-0.072 (0.061)	-0.073 (0.061)	-0.073 (0.061)
Oil and gas prod. per cap. (log)	-0.0004 (0.035)	-0.001 (0.035)	-0.002 (0.035)	-0.004 (0.035)	-0.008 (0.036)	-0.006 (0.036)
Party	-1.015*** (0.223)	-1.031*** (0.222)	-1.032*** (0.223)	-1.031*** (0.223)	-1.007*** (0.225)	-1.005*** (0.225)
Military	0.740*** (0.262)	0.723*** (0.260)	0.720*** (0.260)	0.722*** (0.261)	0.754*** (0.264)	0.756*** (0.264)
Monarchy	-1.607*** (0.397)	-1.606*** (0.388)	-1.606*** (0.389)	-1.608*** (0.390)	-1.576*** (0.393)	-1.580*** (0.393)
Personalist	-0.191 (0.226)	-0.206 (0.224)	-0.207 (0.224)	-0.206 (0.224)	-0.168 (0.230)	-0.168 (0.230)
Stratified by geographic region	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
Stratified by event number	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>No</i>
N observations	354	353	352	351	350	349
N breakdowns	299	298	298	298	298	298
Multiple imputation	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>p</i> -value of significance test:	0.017	0.016	0.033	0.094	0.209	0.382

Note:

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

An observation is an authoritarian regime. All variables except revolution are measured one year before regime onset. Model 1 shows results after discarding, Mexico (1915-2000). Model 2 is after discarding, Mexico (1915-2000) and the U.S.S.R. (1917-1991). Model 3 is after discarding, Mexico (1915-2000), the U.S.S.R. (1917-1991), and China (1949-). Model 4 is after discarding Mexico (1915-2000), the U.S.S.R. (1917-1991), China (1949-) and Vietnam (1954-). Model 5 is after discarding Mexico (1915-2000), the U.S.S.R. (1917-1991), China (1949-), Vietnam (1954-) and Cuba (1959-). Model 6 is after discarding Mexico (1915-2000), the U.S.S.R. (1917-1991), China (1949-), Vietnam (1954-), Cuba (1959-), and Algeria (1962-). Results are shown without (top) and with (bottom) controls for regime type. Missing values were imputed using the Amelia routine (20 imputations). We used heteroskedasticity-consistent standard errors for each analysis and combined the results using Rubin's rules.

Table A5: Robustness, Cox Regressions After Including Finland (1918) and Hungary (1919)

	Non-stratified		Stratified		Controlling for regime type (post-treatment)		Controlling for communism (post-treatment)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Revolution	-1.064*** (0.309)	-1.041*** (0.314)	-1.387*** (0.387)	-1.290*** (0.346)	-0.657* (0.357)	-0.798** (0.381)	-0.666* (0.384)	-0.870** (0.423)
Per Capita GDP (log)	-0.076 (0.081)	0.008 (0.097)	-0.024 (0.103)	0.025 (0.100)	-0.115 (0.102)	-0.083 (0.105)	-0.091 (0.106)	-0.088 (0.107)
GDP Growth (pct.)	0.056 (0.759)	0.066 (0.764)	0.092 (0.826)	0.387 (0.825)	-0.116 (0.778)	-0.078 (0.835)	-0.019 (0.826)	0.014 (0.833)
Population (log)	-0.052 (0.062)	-0.031 (0.065)	0.034 (0.065)	-0.016 (0.060)	-0.083 (0.061)	-0.061 (0.060)	-0.056 (0.061)	-0.057 (0.061)
Oil and gas prod. per cap. (log)		-0.050 (0.031)	-0.033 (0.034)	-0.062* (0.032)	-0.005 (0.036)	-0.016 (0.036)	-0.019 (0.036)	-0.018 (0.036)
Party					-1.000*** (0.219)	-0.973*** (0.234)	-0.875*** (0.235)	-0.828*** (0.236)
Personalist					-0.190 (0.221)	-0.204 (0.222)	-0.208 (0.219)	-0.223 (0.219)
Military					0.731*** (0.256)	0.644** (0.262)	0.626** (0.263)	0.625** (0.262)
Monarchy					-1.633*** (0.398)	-1.470*** (0.393)	-1.489*** (0.397)	-1.491*** (0.398)
Foreign installed communist								-0.741* (0.429)
Communist							-0.499** (0.204)	-0.163 (0.244)
Stratified by geographic region	No	No	Yes	No	No	No	No	No
Stratified by event number	No	No	No	Yes	No	Yes	Yes	Yes
N observations	357	357	357	357	357	357	357	357
N breakdowns	302	302	302	302	302	302	302	302
Multiple imputation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p-value of significance test:	0.000	0.000	0.000	0.000	0.040	0.018	0.057	0.021

Note:

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

An observation is an authoritarian regime. Control variables are measured one year before the onset of the regime. The analysis includes Finland (1918-1918) and Hungary (1919-1919). These cases do not enter the dataset of authoritarian regimes in the main analysis because these governments were not in power on January of the next calendar year. Missing values were imputed using the Amelia routine (20 imputations). We used heteroskedasticity-consistent standard errors for each analysis and combined the results using Rubin's rules.

Table A6: Cox Regressions with Bootstrapped Standard Errors

	(1)	(2)	(3)
Revolution	-0.998** (0.458)	-0.849* (0.468)	-1.062** (0.497)
Party	-1.012*** (0.244)	-0.903*** (0.246)	-0.874*** (0.247)
Personalist	-0.209 (0.238)	-0.213 (0.240)	-0.228 (0.242)
Military	0.655** (0.278)	0.646** (0.281)	0.640** (0.281)
Monarchy	-1.684*** (0.446)	-1.703*** (0.455)	-1.721*** (0.459)
Communist		-0.533** (0.213)	-0.174 (0.285)
Foreign installed communist			-0.700 (0.538)
N observations	355	355	355
N breakdowns	300	300	300
Stratified by geographic region	<i>No</i>	<i>No</i>	<i>No</i>
Stratified by event number	<i>No</i>	<i>No</i>	<i>No</i>
<i>p</i> -value of significance test:	0.002	0.011	0.017

Note:

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

An observation is an authoritarian regime. The standard errors were computed with the bootstrap (100,000 replicates).

Table A7: Robustness, Stratified Cox Regressions by Country

	(1)	(2)
Revolution	-1.539** (0.635)	-1.538** (0.636)
Per Capita GDP (log)	-0.017 (0.159)	-0.024 (0.182)
GDP Growth (pct.)	0.080 (1.176)	0.066 (1.185)
Population (log)	0.074 (0.097)	0.074 (0.100)
Oil and gas prod. per cap. (log)		0.005 (0.050)
Stratified by geographic region	<i>No</i>	<i>No</i>
Stratified by event number	<i>No</i>	<i>No</i>
N observations	355	355
N breakdowns	300	300
Multiple imputation	<i>Yes</i>	<i>Yes</i>
<i>p</i> -value of significance test:	0.004	0.004
<i>Note:</i>	* <i>p</i> <0.1; ** <i>p</i> <0.05; *** <i>p</i> <0.01	

Baseline hazards are stratified by country. An observation is an authoritarian regime. Control variables are measured one year before the beginning of the regime. Missing values were imputed using the Amelia routine (20 imputations). We used heteroskedasticity-consistent standard errors for each analysis and combined the results using Rubin's rules.

Table A8: Cox Regression of Coup Attempts

Revolution	-0.563** (0.270)
Per Cap. GDP (log)	-0.142 (0.098)
GDP Growth	-1.381** (0.630)
Population (log)	-0.067 (0.047)
Oil and gas prod. per cap. (log)	0.021 (0.029)
Stratified by geographic region	<i>No</i>
Stratified by event number	<i>No</i>
N observations	4665
N events	270
Multiple imputation	<i>Yes</i>
<i>p</i> -value of significance test:	0.026
<i>Note:</i>	* <i>p</i> <0.1; ** <i>p</i> <0.05; *** <i>p</i> <0.01

An observation is a country-year. A failure event is any country and year during which at least one coup attempt occurred. Control variables are lagged one year. The data on coup attempts are from Powell and Thyne, v2017.11.28. The time variable is the number of years since last coup attempt or the beginning of the regime. The last row shows the *p*-value of a likelihood ratio test under the null hypothesis that *revolution* does not improve the fit of the model relative to an equivalent model that does not control for revolution. Missing values were imputed using the Amelia routine (20 imputations). We used heteroskedasticity-consistent standard errors for each analysis and combined the results using Rubin's rules.

Sensitivity to alternative codings

We redid the analysis after changing the codings for plausibly liminal cases. We generated 31 alternative datasets that correspond to all combinations of the following recodings: treating South Yemen (1967-1990) as revolutionary; treating Rwanda (1994-) as non-revolutionary; treating North Korea (1948-) as revolutionary; treating Zimbabwe (1980-) as revolutionary; treating the coup of 1992 as regime breakdown in Algeria; including revolutionary Finland and Hungary in the regime dataset. Figures A1, A2, and A3 show revolution coefficient estimates along with 90% (thick line) and 95% (narrow line) intervals from Cox regressions that use these 31 alternative datasets.¹ Figure A1 uses the benchmark model specification (Model 2, Table 3), Figure A2 controls for regime type (Model 6, Table 3) and Figure A3 controls for regime type and communism (Model 8, Table 3).

¹In the figures below, *NK* refers to North Korea, *SY* refers to South Yemen, *RW* refers to Rwanda, *ZM* refers to Zimbabwe, *HU/FI* refers to Hungary and Finland. Thus the label *NK+SY+RW* indicates that North Korea, South Yemen, and Rwanda were recoded.

Figure A1: Cox models, alternative codings, benchmark model specification

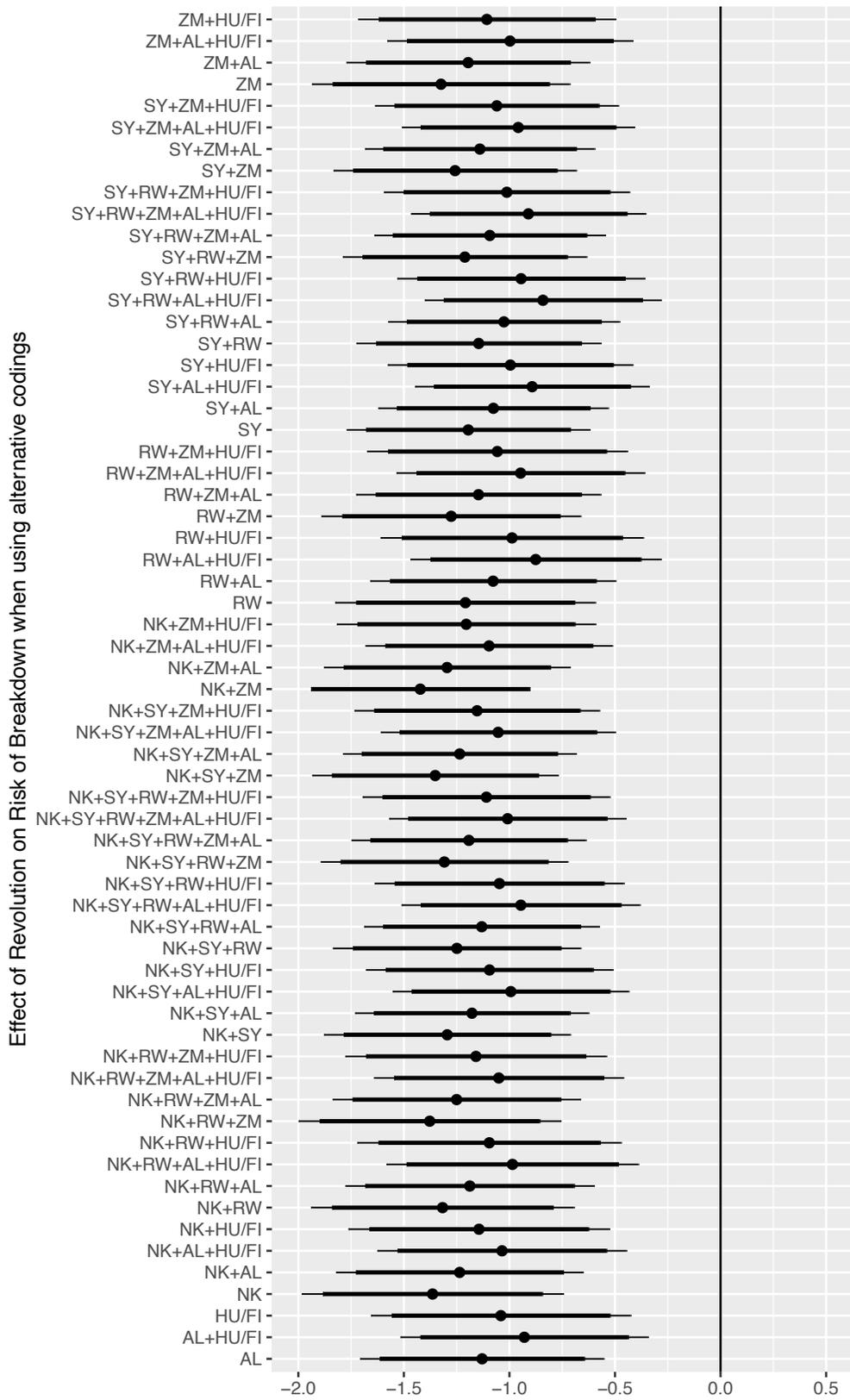


Figure A2: Cox models, alternative codings, controlling for regime type

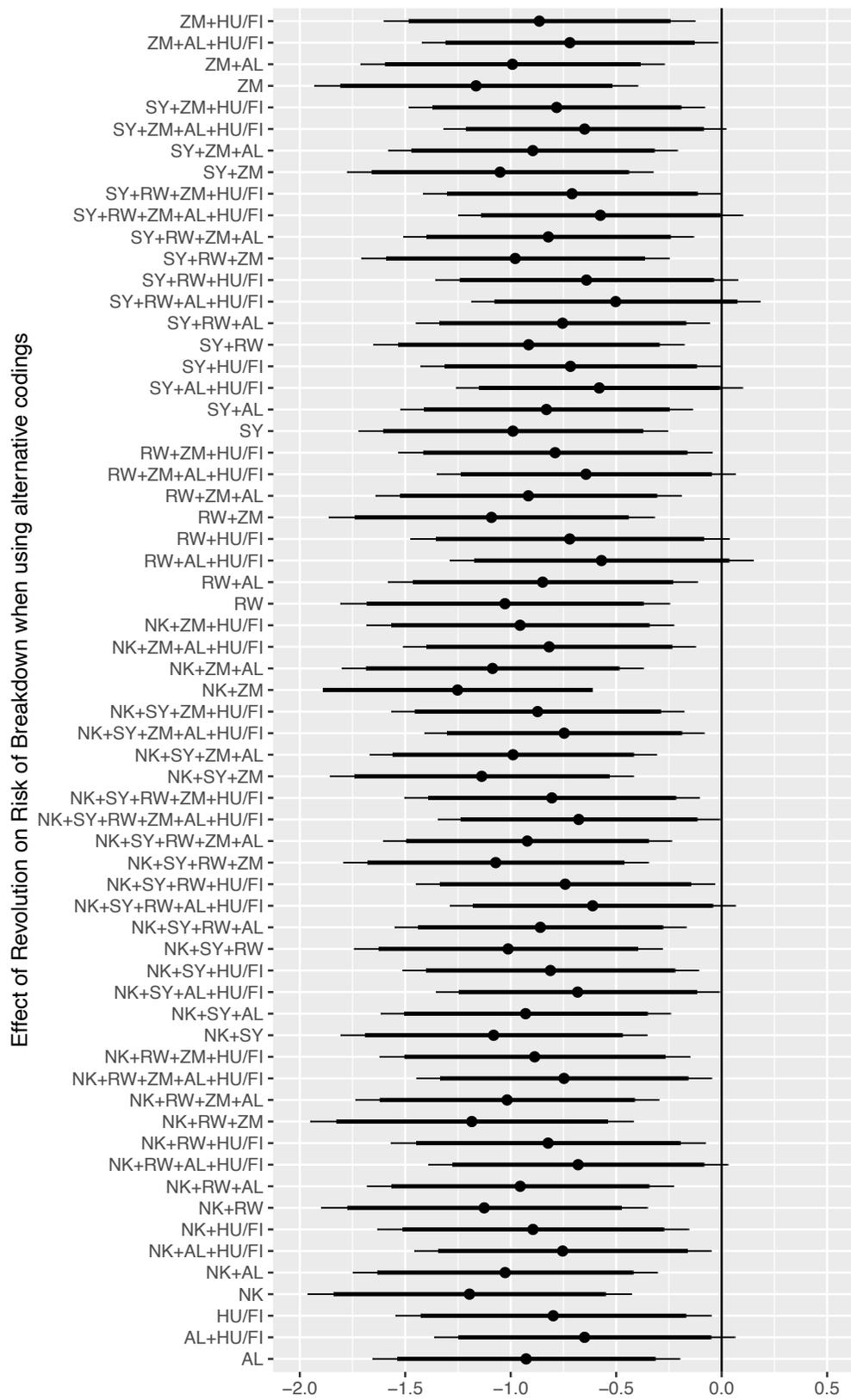


Figure A3: Cox models, alternative codings, controlling for regime type and communism

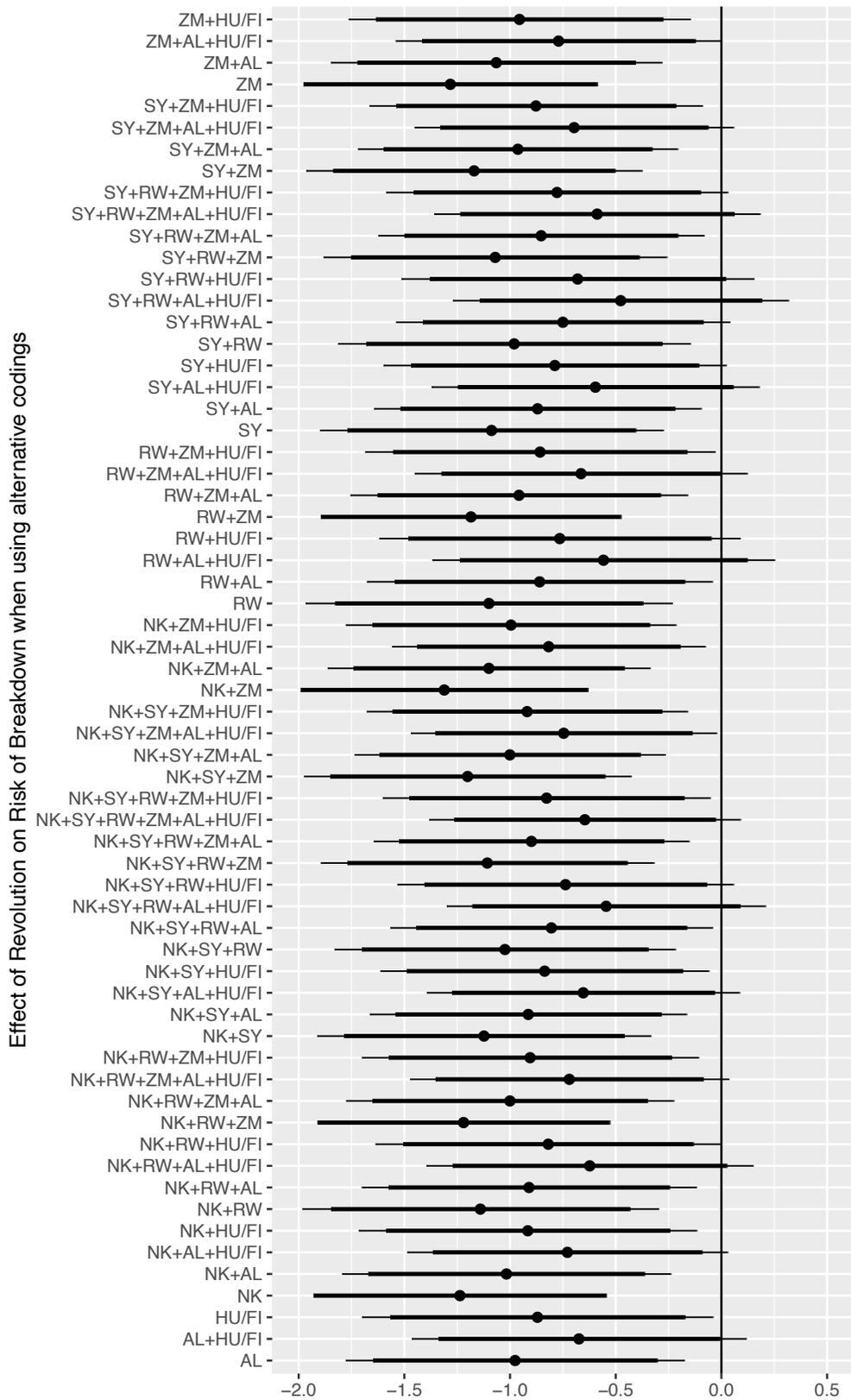


Figure A4: Covariate Balance Before and After Adjustment

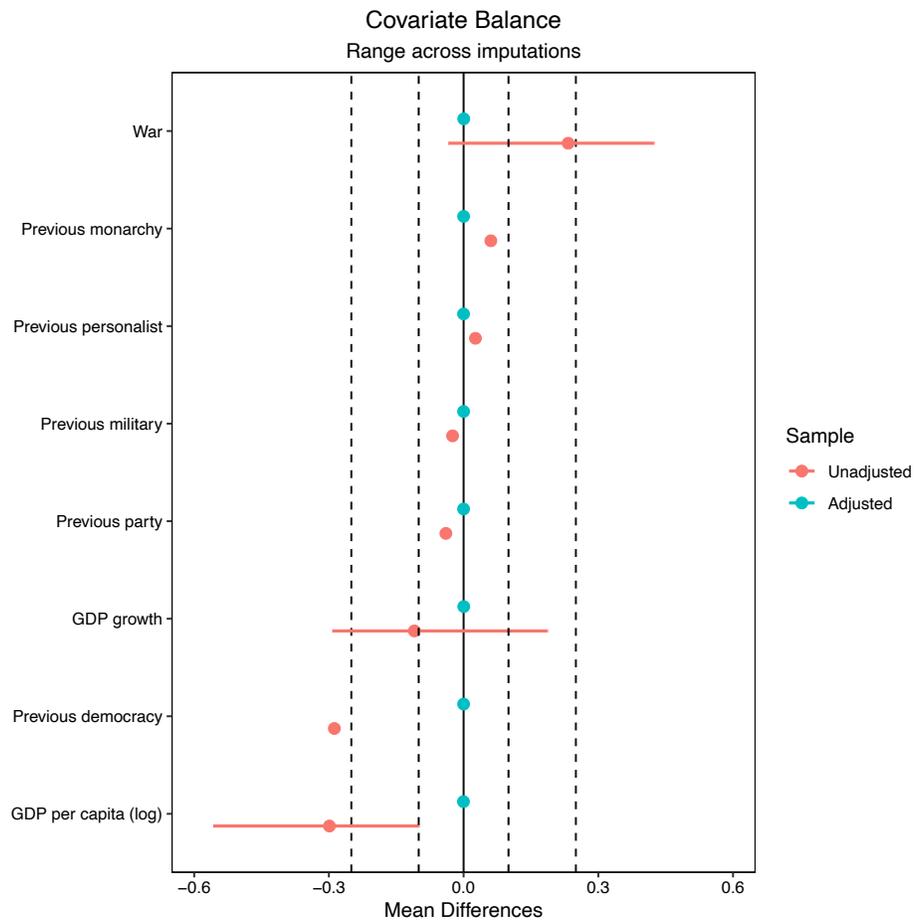


Figure A5: Effect of Revolution on Military Size, Synthetic Control Method

