

Climate Change, Economic Growth, and Conflict

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International Relations

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Why should we be interested?

- Claims by some policy-makers
- Echos in the scientific community
- Justifying major investment in mitigation and adaptation but speculative evidence could backfire
- Climate change mitigation and adaptation is important even if climate change does not cause political violence

State of the art

- Focus on civil war and migration
 - Effects of environmental degradation (simultaneity problem)
 - Tests mainly for direct effects of climate change on conflict (insufficient analysis of indirect effects)
 - Concentration on Africa
 - No research on the mitigating effects of political institutions
 - Very little research on sub-national level
 - Methodological challenges (simultaneity problems etc.)

Our research agenda

- Climate change => economic growth * political institutions => civil conflict
 - Specify a causal pathway leading from climate change through economic growth to civil conflict
 - Deal with the possibility that political institutions affect the impact of economic growth on conflict
 - Deal with endogeneity/simultaneity problem in the economic growth – civil conflict relationship

Our argument

- Climate change affects human wellbeing
- Focus on economic growth because climate change may
 - cause general economic disruption that reduce consumption
 - necessitate costly adaptation measures to protect against future adverse climatic conditions and extreme weather events that reduce investment
- Reduced economic growth due to climate change may increase the risk of civil conflict because of
 - low opportunity cost of rebellion
 - weaker state capacity to “invest in people” and to “provide for the people”
 - Democracy by “restraining the dark side of self-interest” mitigates the negative effects of declining economic growth on civil conflict

Research Design

- Two-stage least squares model
 - (1) $\text{growth}_{it} = \alpha_{1i} + \beta_{1,0}\Delta\text{Pre}_{it} + \beta_{1,2}\Delta\text{Temp}_{it} + c_1X_{it} + d_{1i}\text{year} + e_{1it}$
 - (2) $\text{conflict}_{it} = \alpha_{2i} + \gamma_{2,0}\text{growth}_{i,t-1} \text{ (predict)} + \gamma_{2,1}\text{democracy}_{i,t-1} + \gamma_{2,2}\text{growth}_{i,t-1} \text{ (predict)} * \text{democracy}_{i,t-1} + c_2Z_{it} + d_{2i}\text{year} + e_{2it}$
- (1) DV: Economic growth
- (1) IV: Geophysical manifestations of climatic change: temperature and precipitation
- (2) DV: Civil conflict
- (2) IV: Predicted economic growth (as affected by climate change and other variables)

Research Design

- Dependent variable:
 - Onset of civil conflict: at least 25 battle-related deaths; annual observations for 1951-2004, all countries
- Independent variables:
 - Climate change: **3 measures** from 2 datasets (CRU, GPCC)
 1. Standardized Precipitation Index, SPI 6 : dummy measuring precipitation variation
 2. Moving average: difference between the current year's precipitation (temperature) level and the average of the previous 30 years
 3. Annual growth rate in precipitation and temperature
 - Economic welfare: **economic growth** (even small growth effects can accumulate into large income effects in the future)
 - Political institutions: **democracy**; excludes the component “participation” of the Polity IV data which makes explicit reference to civil conflict

Research Design

- Other variables:
 - GDP_initial: initial income (convergence)
 - log of GDP per capita
 - Population growth and log of population
 - Ethnolinguistic fractionalization
 - Mountainous terrain: estimated % of mountainous terrain
 - Oil: > 1/3 export revenues from oil
- Time trend and country fixed effects
- Estimation technique:
 - 1st equation: OLS with PCSE and fevd estimator
 - 2nd equation: logit regression with bootstrapped standard errors

Table 1: Climate Change and Economic Growth

	world, SPI	africa, SPI	world, gpcc ma	africa, gpcc ma
SPI	-0.403 (0.407)	-0.590 (0.880)		
temperature ma30			-0.203 (0.189)	-0.856 (0.475)*
precipitation ma30			0.000 (0.001)	0.002 (0.002)
xpolity, lagged	-0.044 (0.029)	-0.026 (0.080)	-0.036 (0.033)	0.008 (0.076)
pop growth	13.096 (9.077)	28.714 (29.063)	15.965 (15.011)	48.524 (53.879)
log population, lagged	-7.102 (0.617)***	-6.456 (2.667)**	-4.613 (0.690)***	-4.933 (3.317)
log gdp/capita, lagged	-5.913 (0.663)***	-5.843 (1.165)***	-5.417 (0.960)***	-5.579 (1.967)***
trend	0.211 (0.021)***	0.170 (0.072)**	0.158 (0.029)***	0.146 (0.103)
oil	3.726 (0.385)***	6.388 (0.641)***	2.925 (0.574)***	4.845 (0.391)***
ethnic fractionalization	-0.777 (0.483)	2.282 (1.046)**	-2.237 (0.606)***	-2.093 (1.313)
mountainous terrain	0.601 (0.060)***	1.680 (0.123)***	0.265 (0.065)***	1.471 (0.105)***
GDP_initial	0.000 (0.000)	0.002 (0.000)***	0.000 (0.000)***	0.002 (0.000)***
North Africa	-5.283 (0.270)***		-5.570 (0.182)***	
Sub Saharan Africa	-17.514 (0.263)***		-14.109 (0.429)***	
East Asia	-1.653 (0.335)***		-2.165 (0.151)***	
West Asia	-4.309 (0.340)***		-5.247 (0.185)***	
Middle East	-12.244 (0.428)***		-9.662 (0.333)***	
Latin America	-10.402 (0.123)***		-8.526 (0.125)***	
North America	15.157 (0.277)***		10.763 (0.185)***	
η	0.954 (0.006)***	0.943 (0.031)***	0.986 (0.018)***	0.959 (0.051)***
Constant	115.984 (0.215)***	88.334 (0.491)***	90.542 (0.204)***	76.499 (0.498)***
Observations	5281	1599	5074	1464
R2	0.11	0.09	0.11	0.10

Table2: Predicted Economic Growth and Civil Conflict

	world conflict, SPI	africa conflict, SPI	world conflict, gpcc_ma	africa conflict, gpcc_ma
predicted growth, lag	-0.098 (0.049)**	-0.200 (0.136)	-0.103 (0.062)*	-0.148 (0.121)
xpolity, lagged	-0.005 (0.032)	0.063 (0.054)	-0.004 (0.031)	0.066 (0.056)
polity*growth	0.017 (0.011)	-0.021 (0.041)	0.018 (0.010)*	-0.013 (0.033)
pop growth	-4.986 (7.784)	14.027 (7.169)*	-5.404 (8.110)	17.121 (12.058)
log population, lagged	0.225 (0.075)***	0.065 (0.162)	0.223 (0.076)***	0.066 (0.182)
log gdp/capita, lagged	-0.433 (0.182)**	-0.466 (0.420)	-0.464 (0.193)**	-0.587 (0.463)
oil	0.630 (0.298)**	0.431 (0.654)	0.653 (0.336)*	0.482 (0.611)
ethnic fraction	0.961 (0.443)**	0.460 (0.756)	1.070 (0.656)	0.256 (0.658)
mountainous terrain	0.074 (0.075)	0.216 (0.132)	0.045 (0.095)	0.203 (0.164)
GDP_initial	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
North Africa	0.456 (0.541)		0.373 (0.575)	
Sub Saharan Africa	-0.298 (0.607)		-0.494 (0.618)	
East Asia	-0.466 (0.422)		-0.508 (0.495)	
West Asia	0.078 (0.530)		-0.017 (0.519)	
Middle East	0.113 (0.664)		0.086 (0.731)	
Latin America	0.349 (0.417)		0.334 (0.466)	
peace years	-0.050 (0.048)	0.039 (0.131)	-0.042 (0.048)	0.055 (0.119)
peace years^2	0.004 (0.003)	-0.002 (0.008)	0.003 (0.003)	-0.003 (0.008)
peace years^3	-0.000 (0.000)*	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Constant	-2.722 (1.580)*	-2.136 (3.206)	-2.368 (1.907)	-1.297 (3.944)
Observations	5103	1582	4902	1450
Log likelihood	-518.19	-211.05	-498.83	-195.01
Pseudo R2	0.08	0.05	0.09	0.04

Figure 1: Effects of Predicted Economic Growth on Civil Conflict at Different Levels of Democracy (SPI 6 in first stage of model)

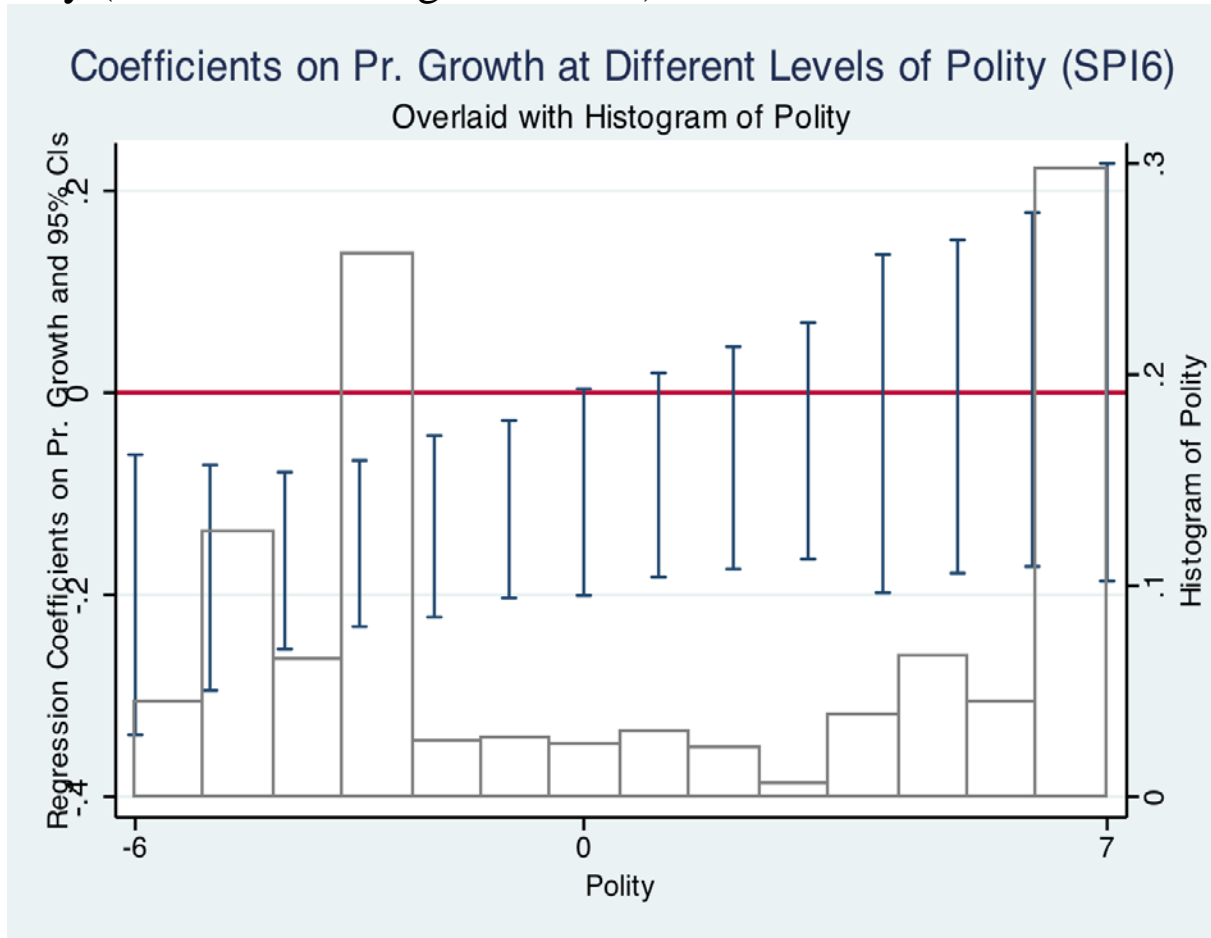
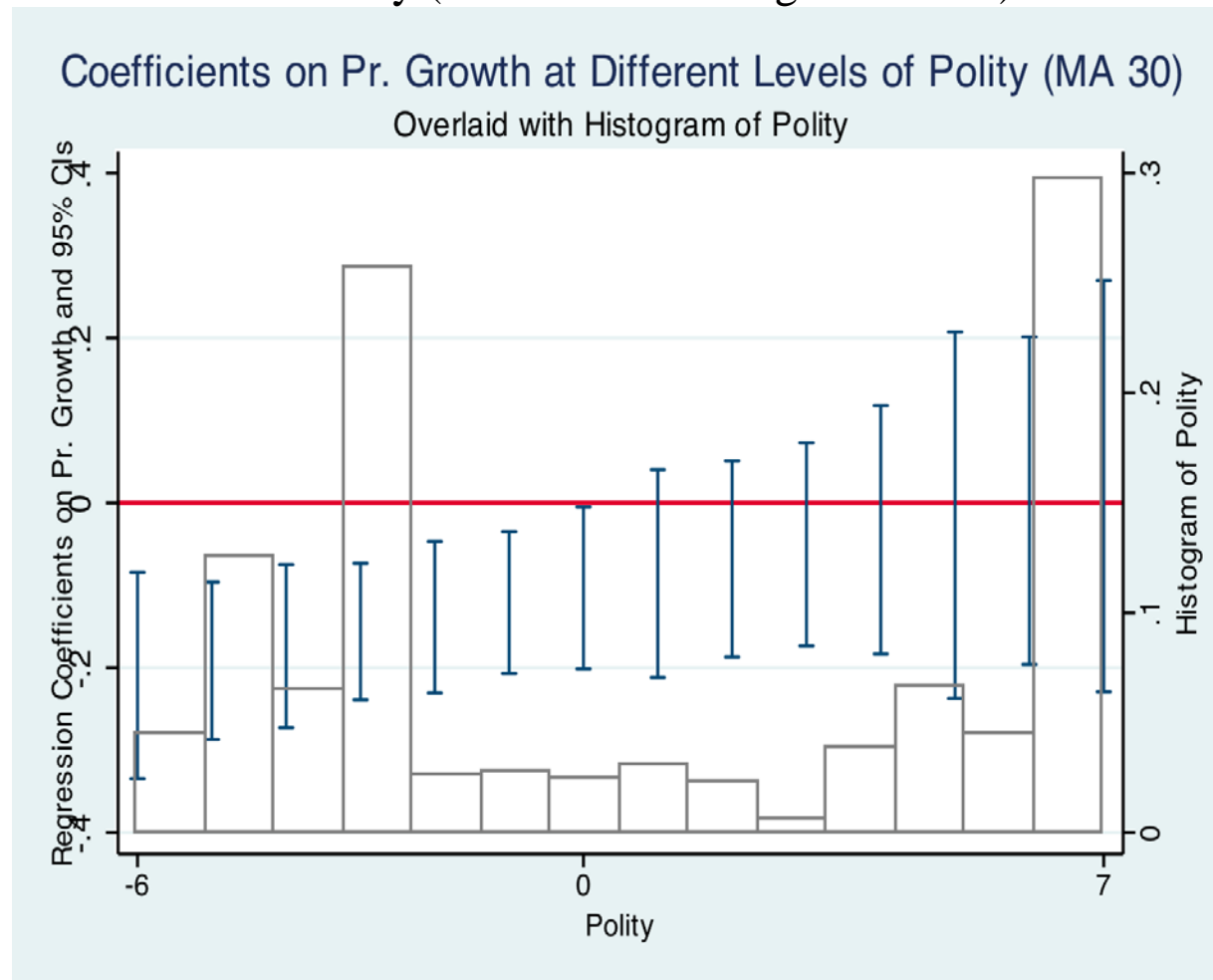


Figure 2: Effects of Predicted Economic Growth on Civil Conflict at Different Levels of Democracy (MA 30 in first stage of model)



Summary of results

- Climate change–conflict hypothesis rests on rather shaky empirical foundations. No effect of climate change on civil conflict
- Effect of climate change on economic growth depends a lot on the particular climate indicator used
- Democracy mitigates the effect of economic growth on civil conflict
- Evidence of an interaction effect between economic and institutional causes of civil conflict (previous research shows direct effect of economic growth on civil conflict regardless of institutional characteristics)

Implications

- Even though climate-induced risks of civil conflict could potentially provide a powerful justification for greater investment in mitigation and adaptation efforts, climate policy can easily be justified with other reasons.
- Much bigger changes in temperature and precipitation, compared to those observed in our sample period, which are predicted for many parts of the world in the next decades, will make it harder for countries to adapt. If so, negative growth effects of climatic change are likely to become more visible within the foreseeable future.
- Investing in democratic institutions and measures that promote economic growth (preferably in a climate-friendly way) can qualify as a no-regrets policy. They are useful with or without a climate-conflict effect.