Web Appendix: Temperature Shocks and Economic Growth

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Appendix I: Climate Data

Our primary source for climate data is the *Terrestrial Air Temperature and Precipitation: 1900-2006 Gridded Monthly Time Series*, Version 1.01 (2007), compiled by Kenji Matsuura and Cort Willmott in conjunction with NASA. The data are available at http://climate.geog.udel.edu/~climate/html_pages/download.html. This dataset combines station data on mean air temperature and precipitation from a number of sources, with the primary source being the Global Historical Climatology Network (Peterson and Vose, 1997).

Matsuura and Willmott interpolate monthly averages of air temperature and precipitation to a 0.5 degree by 0.5 degree latitude/longitude grid. The gridded fields were estimated from monthly weather-station averages using a combination of spatial interpolation methods: digital-elevation-model (DEM) assisted interpolation (temperature only; Willmott and Matsuura, 1995); traditional interpolation (Willmott et al., 1985); and climatologically aided interpolation (CAI) (Willmott and Robeson, 1995). An average of twenty nearby stations influenced each grid-node estimate.

We calculate the average yearly temperature and precipitation within each country using geospatial software. We investigate several weighting schemes: landmass area, population, urban population, and rural population. Landmass weights weight each temperature or precipitation cell by the fraction of the country's landmass it covers. Urban (rural) population weights limit the sample to urban (rural) areas. Population and urban extents data for 1990 are at a resolution of 30 arc seconds (approximately one kilometer at the equator) and were produced by Columbia University's Center for International Earth Science Information Network (SEDAC, 2004).

Appendix II: Dynamic Regression Models

This section discusses and estimates a more general econometric model for identifying growth effects in the context of a dynamic panel growth regression, following the derivation in Bond et al. (2007). To begin, consider a general dynamic growth equation for the log-level of per-capita output:

$$y_{it} = A_{it} + \alpha_1 y_{it-1} + ... + \alpha_p y_{it-p} + \beta_0 T_{it} + \beta_1 T_{it-1} + ... + \beta_p T_{it-p} + \varepsilon_{it} \qquad \text{(A1.1)}$$

This equation generalizes equation (1) in the text by adding *p* lags of temperature, allowing output to depend on *p* lags of past output, and adding an error term.

We assume that A_{it} evolves according to a generalized version of the dynamic process specified in (2) with *p* lags, i.e.

$$\Delta A_{it} = g_i + \gamma_0 T_{it} + ... + \gamma_p T_{it-p} \qquad \text{(A1.2)}$$

This form allows both current and lagged temperature to affect the growth rate of *A*.

Substituting (A1.2) into the first differenced version of (A1.1) yields a dynamic panel estimation equation of the form:

$$\Delta y_{it} = g_i + \alpha_1 \Delta y_{it-1} + \ldots + \alpha_p \Delta y_{it-p} + \gamma_0 T_{it} + \ldots + \gamma_p T_{it-p} + \beta_0 \Delta T_{it} + \beta_1 \Delta T_{it-1} + \ldots + \beta_p \Delta T_{it-p} + \Delta\varepsilon_{it} \tag{A1.3}$$

Rewriting the ΔT terms as T terms yields

$$\Delta y_{it} = g_i + \alpha_1 \Delta y_{it-1} + \ldots + \alpha_p \Delta y_{it-p} + (\gamma_o + \beta_0) T_{it} + (\gamma_1 + \beta_1 - \beta_0) T_{it-1} + \ldots + (\gamma_p + \beta_p - \beta_{p-1}) T_{it-p} - \beta_p T_{t-p-1} + \Delta\varepsilon_{it} \tag{A1.4}$$

or, relabeling the coefficients on T,

$$\Delta y_{it} = g_i + \alpha_1 \Delta y_{it-1} + \ldots + \alpha_p \Delta y_{it-p} + \sum_{j=0}^{p+1} \rho_j T_{ij} + \Delta\varepsilon_{it} \tag{A1.5}$$

To find the growth effect, consider what happens if temperature is constant and growth is in steady-state, i.e., $\Delta y_{it-j} = \Delta y$ and $T_{ij} = T$. Solving equation (A1.5) shows that

$$\Delta y_i = \frac{g_i}{1 - \alpha_1 - \ldots - \alpha_p} + \frac{\sum_{j=0}^{p+1} \rho_j}{1 - \alpha_1 - \ldots - \alpha_p} T_i \tag{A1.6}$$

so that the growth effect of temperature is simply $\frac{\sum_{j=0}^{p+1} \rho_j}{1 - \alpha_1 - \ldots - \alpha_p}$. From (A1.4), it is also clear that this is identical to $\frac{\sum_{j=0}^{p} \gamma_j}{1 - \alpha_1 - \ldots - \alpha_p}$, since the β terms all cancel.

As noted by Bond et al. (2007), estimation of (A1.5) is complicated by the fact that the error term, $\Delta\varepsilon_{it}$, is correlated with the lagged dependent variable, Δy_{it-1}. Bond at al. suggest instrumenting for Δy_{it-1} with further lags of growth. However, since growth is only very weakly serially correlated (the correlation of growth and lagged growth is only 0.07), these instruments are very weak.

Given these issues, as well as the very low serial correlation in growth, we focus in the text on (4), which imposes $\alpha_j = 0$ for all *j*. However, for completeness, Appendix Table 1 presents estimates of the growth effect for poor countries under a variety of alternative empirical specifications that estimate α flexibly. For convenience, the first row of Appendix Table 1 replicates the equivalent results from Table 3, which imposes $\alpha_j = 0$ for all *j*. The second row of Appendix Table 1 report estimates of (A1.5) with 1 lag of growth. The reported coefficients are the implied growth effects for poor countries from equation (A1.6). The third and fourth rows of Appendix Table 1 estimate (A1.5) with *p* lags of growth, where *p = 1* in column (1), *p = 4* in column (2) and *p = 9* in column (3), which means that a total of 1, 5 and 10 lags of temperature, respectively, are included in the regression. The third row presents OLS results and the fourth row presents results instrumenting for the first lag of growth with the *p+1* lag.

Broadly speaking, these results are very similar to the main results shown in the paper. If anything, the estimated growth effects from the dynamic panel specifications tend to be slightly larger in magnitude than the results that do not include lags of growth. As expected given the low serial correlation of growth, the IV results are less precisely estimated than the OLS results, although the 10 lag IV results remain statistically significant.

As an additional check on the empirical specification, we have run Monte Carlo analyses of (4) using actual output and climate data to ensure that this econometric specification provides correct inference and unbiased estimates. Specifically, in each Monte Carlo iteration, we randomly reassigned the temperature series from one to country to another country's real output series, and then tested for temperature effects in model (4). With random reassignment, we rejected the null of no climate effects at the 5% significance level approximately 4% of the time, suggesting that our inference is accurate against the null hypothesis of no climate effects and, if anything, is slightly conservative.

Finally, in additional simulations, we again randomly reassigned the real climate series of one country to the real output series of another country, but then adjusted each output series according to assumed growth and level effects of temperature. These Monte Carlos showed that the distributed lag coefficients, and the cumulated lags, provided unbiased estimates for both level effects and growth effects of temperature. These Monte Carlo results are summarized in Tables A2 through A4.

Table A1: Dynamic Panel Estimates

	Implied growth effects for poor countries		
	(1)	(2)	(3)
	1 lag	5 lag	10 lags
Panel A: WDI growth data			
No lagged growth effects	-0.983**	-1.041**	-0.858
	(0.374)	(0.480)	(0.592)
1 lag of growth, OLS	-0.952**	-1.192**	-1.042
	(0.412)	(0.529)	(0.676)
p lags of growth, OLS		-1.281***	-0.806
		(0.496)	(0.763)
p lags of growth, IV	-0.982**	-0.806	-0.710
	(0.439)	(0.671)	(0.768)
Panel B: PWT growth data			
No lagged growth effects	-1.275*	-1.662**	-1.946**
	(0.681)	(0.728)	(0.869)
1 lag of growth, OLS	-1.397*	-1.794**	-2.058**
	(0.726)	(0.748)	(0.894)
p lags of growth, OLS		-1.780**	-2.382***
		(0.807)	(0.877)
p lags of growth, IV	-1.745	-1.275	-2.004**
	(1.174)	(1.053)	(0.806)

Notes: Each reported coefficient is the estimated growth effect of temperature in poor countries, calculated using equation (A1.6), from a separate regression of the form in equation (A1.5). The underlying equations include country fixed effects, region × time fixed effects, poor x year FE, temperature and precipitation interacted with poor/rich dummies, and the number of lags of temperature and precipitation shown in the column. Robust standard errors are in parentheses, adjusted for clustering at the country level. Note that the estimates in the first row exactly replicate the 'sum of all temp. coefficients in poor countries' shown in columns (7), (9), and (10) of Table 3. In row 2, the equation includes 1 lag of growth as an independent variable. In row 3, the equation includes 4 lags of growth in column (2) and 9 lags of growth in column (3). In row 4, the equation includes 4 lags of growth in column (2), with the 1st lag instrumented using the 5th lag, and 9 lags of growth in column (3), with the 1st lag instrumented using the 10th lag.

Table A2-4: Monte Carlo Simulations

Table A2: Growth effect is -.02; Level effect is 0

	First-differenced Model		Levels Model	
	True Parameter	Estimated Parameter	True Parameter	Estimated Parameter
Tit	-.020	-.019 (.006)	-.020	-.011 (.013)
Tit-1	0	-.000 (.007)	-.020	-.013 (.012)
Tit-2	0	.000 (.006)	-.020	-.011 (.012)
Tit-3	0	.000 (.007)	-.020	-.011 (.013)
Sum(Tit to Tit-10)	-.020	-.020 (.013)	-.220	-.103 (.080)
Sum(Tit-2 to Tit-10)	0	.000 (.013)	-.180	-.078 (.069)

Table A3: Growth effect is 0; Level effect is -.02

	First-differenced Model		Levels Model	
	True Parameter	Estimated Parameter	True Parameter	Estimated Parameter
Tit	-.020	-.019 (.006)	-.020	-.019 (.013)
Tit-1	+.020	+.020 (.007)	0	.001 (.012)
Tit-2	0	.000 (.006)	0	.001 (.012)
Tit-3	0	.000 (.007)	0	.001 (.013)
Sum(Tit to Tit-10)	0	.000 (.013)	-.020	-.011 (.080)
Sum(Tit-2 to Tit-10)	0	-.000 (.013)	0	.001 (.069)

Table A4: Growth effect is -.02; Level effect is -.02

	First-differenced Model		Levels Model	
	True Parameter	Estimated Parameter	True Parameter	Estimated Parameter
Tit	-.040	-.039 (.006)	-.040	-.032 (.013)
Tit-1	+.020	+.020 (.007)	-.020	-.013 (.012)
Tit-2	0	-.000 (.006)	-.020	-.011 (.012)
Tit-3	0	-.000 (.007)	-.020	-.011 (.013)
Sum(Tit to Tit-10)	-.020	-.020 (.013)	-.240	-.123 (.080)
Sum(Tit-2 to Tit-10)	0	-.000 (.013)	-.180	-.078 (.069)

Note: Estimated Parameter column presents the mean and, in parentheses, the standard deviation of the estimate across 500 Monte Carlo runs.

Appendix III: Supplemental Analyses

Section 1: Log Temperature and Precipitation

Tables 2, 4, and 7 of the paper are repeated below – in Tables A5 through A7 - using the natural log of temperature and precipitation instead of the linear versions of these variables. The observation count differs slightly from that in the main text, as Mongolia is dropped from the sample since its average temperature in degrees C is negative. The summary of results is as follows:

1. Using log temperature typically produces more significant results than using linear temperature. The gain in significance is about "one star" on average (i.e., results previously significant at 5% are now significant at 1%, etc).

2. The effect on rich countries continues to be far more modest than in poor countries, but the rich country effect now tends to be mildly significant (e.g. see Tables A5 and A6).

3. Results continue to be very robust to different samples and specifications (Table A6). The robustness patterns appear very similar to those with linear temperature.

4. The medium run effects using log temperature are consistent with those using linear temperature, and tend to increase in statistical significance.

Table A5: Log weather variables baseline

	(1)	(2)	(3)	(4)	(5)
Temperature	0.311	1.540*	1.540*	1.494*	1.273
	(1.036)	(0.798)	(0.798)	(0.784)	(0.777)
Temperature interacted with…					
Poor country dummy		-20.146***	-19.331***	-20.077***	-17.690**
		(6.178)	(6.375)	(6.184)	(7.182)
Hot country dummy				5.195	
				(10.668)	
Agricultural country dummy					-1.755
					(6.521)
Precipitation			-0.076	-0.816	-0.132
			(0.635)	(0.591)	(0.714)
Precipitation interacted with…					
Poor country dummy			0.766	0.917	1.909
			(1.030)	(0.992)	(1.274)
Hot country dummy				1.256	
				(0.996)	
Agricultural country dummy					-0.742
					(1.209)
Observations	5982	5982	5982	5982	5432
R-squared	0.14	0.15	0.15	0.15	0.15
Temperature effect in poor countries		-18.606***	-17.791***	-18.582***	-16.417**
		(6.086)	(6.291)	(6.049)	(7.202)
Precipitation effect in poor countries			0.690	0.102	1.777
			(0.771)	(0.861)	(1.257)

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A6: Log weather variables robustness

	(1) Baseline	(2) Country FE and Region×Yr FE only	(3) Country FE and Year FE only	(4) All FE and country specific trends	(5) Balanced sample: 1971 - 2003	(6) Add countries with < 20 years of data	(7) GDP data from World Devel. Indicators	(8) Area-weighted climate data	(9) Sub-Saharan Africa Only	(10) Sub-Saharan Africa Excluded
Panel A: No lags										
Temp. immediate– Poor	-17.791***	-14.316***	-18.724***	-12.108**	-21.816**	-17.382***	-23.505***	-0.594	-29.539*	-11.235*
	(6.291)	(5.189)	(4.374)	(5.656)	(10.352)	(6.125)	(6.543)	(0.708)	(14.871)	(6.515)
Temp. immediate– Rich	1.540*	0.795	0.453	1.986**	0.697	3.021**	1.408	0.766**	-0.597	1.640**
	(0.798)	(0.755)	(0.714)	(0.771)	(1.575)	(1.247)	(0.948)	(0.333)	(41.778)	(0.777)
Precip. immediate– Poor	0.690	0.331	0.833	0.679	1.026	0.153	1.983**	1.490*	2.439	-0.540
	(0.771)	(0.871)	(0.855)	(0.830)	(1.006)	(0.764)	(0.862)	(0.865)	(1.546)	(0.869)
Precip. immediate– Rich	-0.076	-0.003	0.446	-0.781	-0.162	0.227	-0.874	0.157	3.453	-0.200
	(0.635)	(0.631)	(0.570)	(0.535)	(0.735)	(0.619)	(0.529)	(0.674)	(3.177)	(0.606)
Observations	5982	5982	5982	5982	3169	6315	4906	5937	1809	4173
Panel B: 5 lags										
Temp. cumulative– Poor	-30.589**	-22.647*	-24.214*	-11.873	-42.216**	-22.197*	-18.185	-27.842*	-33.617*	-20.659
	(14.085)	(13.118)	(12.287)	(16.743)	(20.119)	(11.909)	(11.076)	(14.250)	(18.755)	(23.899)
Temp. cumulative– Rich	-0.047	-1.741	-3.443**	-0.482	0.252	-0.019	-0.237	-1.236	49.411	-0.325
	(1.726)	(1.750)	(1.686)	(2.129)	(2.280)	(1.756)	(1.475)	(1.845)	(74.289)	(1.652)
Precip. cumulative– Poor	0.950	0.318	0.713	1.164	1.014	-0.684	3.608*	1.343	4.535	-0.995
	(1.650)	(1.661)	(1.789)	(1.697)	(1.948)	(1.228)	(1.885)	(1.591)	(3.918)	(1.701)
Precip. cumulative– Rich	-0.861	-0.549	0.425	-3.675***	-2.702**	0.517	-1.903*	-0.742	14.265	-0.937
	(1.198)	(1.140)	(1.072)	(1.400)	(1.223)	(1.226)	(1.079)	(1.235)	(12.098)	(1.052)
Observations	5752	5752	5752	5752	3168	5996	4897	5690	1785	3967
Panel C: 10 lags										
Temp. cumulative– Poor	-43.978***	-42.098***	-44.235***	-25.158	-59.809**	-39.295***	-15.369	-39.748**	-38.293	-37.151
	(15.550)	(14.851)	(16.055)	(22.351)	(22.976)	(12.783)	(13.846)	(15.463)	(25.700)	(23.622)
Temp. cumulative– Rich	0.650	0.107	-3.794	-0.230	2.361	0.825	1.074	0.097	87.241	-0.026
	(2.464)	(2.619)	(3.010)	(5.061)	(4.016)	(2.546)	(1.903)	(2.503)	(111.892)	(2.424)
Precip. cumulative– Poor	-1.382	-2.223	-1.570	-2.631	-3.947	-3.163*	4.013*	-0.937	-0.133	-2.047
	(2.146)	(2.172)	(2.219)	(2.480)	(2.746)	(1.756)	(2.268)	(2.047)	(4.000)	(2.755)
Precip. cumulative– Rich	-0.063	-0.068	0.598	-5.664**	-2.106	1.436	0.042	0.147	10.456	0.494
	(1.750)	(1.513)	(1.400)	(2.537)	(1.919)	(2.029)	(1.918)	(1.757)	(15.394)	(1.632)
Observations	5416	5416	5416	5416	3166	5530	4887	5361	1737	3679

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Except where noted in the text, panel A follows the same specification as column (5) of Table 2, panel B follows the same specification as column (9) of Table 3, and panel C follows the same specification as column (10) of Table 3. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A7: Log weather variables, Changes in growth and climate in the medium-run

	Dependent variable: change in mean growth rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline Sample	Alternative comparison years					Africa Only	Excluding Africa	WDI data
Change in Temperature	0.709	4.399	-1.100	-1.098	10.495	1.788	-51.878	4.999	-0.703
	(5.449)	(7.232)	(3.417)	(3.978)	(9.424)	(6.160)	(42.102)	(7.428)	(5.288)
Change in Temperature	-84.049***	-81.139***	-68.539***	-36.695	-80.493**	-31.689	-0.824	-79.845**	-37.568
X Poor Country	(22.591)	(24.765)	(20.245)	(25.310)	(31.438)	(41.211)	(63.170)	(32.079)	(24.625)
Change in Precipitation	6.287*	6.261*	4.513*	0.062	5.019	2.477	6.796	6.172*	0.540
	(3.263)	(3.194)	(2.604)	(1.518)	(3.132)	(2.750)	(21.669)	(3.282)	(3.072)
Change in Precipitation	-6.181	-7.800*	-5.207	2.597	-4.360	-3.165	2.717	-9.308*	-1.187
X Poor Country	(4.736)	(4.519)	(3.824)	(3.357)	(4.350)	(3.702)	(23.656)	(4.837)	(4.302)
Region FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Early Period	1970-1985	1970-1985	1970-1987	1961-1970	1971-1980	1981-1990	1970-1985	1970-1985	1970-1985
Late Period	1986-2000	1986-2000	1988-2003	1991-2000	1991-2000	1991-2000	1986-2000	1986-2000	1986-2000
Observations	133	133	133	93	133	133	41	92	120
R-squared	0.13	0.20	0.18	0.11	0.16	0.13	0.11	0.28	0.10
Tem effect poor countries	-83.34***	-76.74***	-69.64***	-37.79	-70.00**	-29.90	-52.70	-74.85**	-38.27
SE1	(21.92)	(24.15)	(20.22)	(24.98)	(30.65)	(42.00)	(47.09)	(32.07)	(24.14)
Pre effect poor countries	0.107	-1.539	-0.694	2.659	0.658	-0.688	9.513	-3.136	-0.646
SE2	(3.433)	(3.124)	(2.711	(2.832)	(3.231)	(2.579)	(9.490)	(3.443)	(2.498)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the log mean value in the Late Period and the log mean value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Section 2: Temperature and Precipitation Anomalies

Tables 2, 4, and 7 are repeated below – in Tables A8 through A10 - using temperature and precipitation anomalies, where temperature and precipitation are each normalized by subtracting the country mean and dividing by the standard deviation. The summary of results is as follows:

1. The anomalies specification and the specification using linear temperature and precipitation produce similar point estimates, both in the baseline (Table A8) and in the robustness checks (Table A9). To compare the magnitudes of the temperature coefficients in the anomalies specification to the magnitudes of the temperature coefficients in the linear specification, multiply by 2, since the standard deviation of temperature within countries averages 0.5 degrees Celsius. To compare the magnitudes of the precipitation coefficients in the anomalies specification, multiply by 0.4, since the standard deviation of precipitation within countries averages 2.4.
2. The coefficients are more noisily estimated in the anomalies specification than in the linear specification (see Tables A8 through A10, as compared to Tables 2, 4, and 7). This suggests that absolute temperature is more economically meaningful than standard deviations from mean temperature.

Table A8: Anomalies Baseline

	(1)	(2)	(3)	(4)	(5)
Temperature	-0.092	0.148	0.145	0.070	0.090
	(0.139)	(0.130)	(0.131)	(0.123)	(0.145)
Temperature interacted with…					
Poor country dummy		-0.580**	-0.543*	-0.613**	-0.774**
		(0.281)	(0.289)	(0.283)	(0.326)
Hot country dummy				0.239	
				(0.214)	
Agricultural country dummy					0.144
					(0.244)
Precipitation			-0.039	-0.101	-0.091
			(0.097)	(0.097)	(0.109)
Precipitation interacted with…					
Poor country dummy			0.211	0.141	0.223
			(0.200)	(0.228)	(0.254)
Hot country dummy					0.066
					(0.254)
Agricultural country dummy				0.212	
				(0.216)	
Observations	6014	6014	6014	6014	5432
R-squared	0.14	0.14	0.14	0.14	0.15
Temperature effect in poor countries		-0.432*	-0.397	-0.543**	-0.684**
		(0.260)	(0.270)	(0.251)	(0.323)
Precipitation effect in poor countries			0.172	0.0406	0.132
			(0.173)	(0.233)	(0.263)

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table A9: Anomalies Robustness

	(1) Baseline	(2) Country FE and Region×Yr FE only	(3) Country FE and Year FE only	(4) All FE and country specific trends	(5) Balanced sample: 1971 - 2003	(6) Add countries with < 20 years of data	(7) GDP data from World Devel. Indicators	(8) Area-weighted climate data	(9) Sub-Saharan Africa Only	(10) Sub-Saharan Africa Excluded
Panel A: No lags										
Temp. immediate– Poor	-0.397	-0.263	-0.309*	-0.464*	-0.871**	-0.363	-0.655***	-0.594	-0.691	-0.144
	(0.270)	(0.213)	(0.162)	(0.247)	(0.355)	(0.223)	(0.204)	(0.707)	(0.491)	(0.216)
Temp. immediate– Rich	0.145	0.019	-0.015	0.212	0.171	0.364**	0.123	0.883***	0.236	0.166
	(0.131)	(0.127)	(0.107)	(0.143)	(0.201)	(0.147)	(0.131)	(0.296)	(0.734)	(0.132)
Precip. immediate– Poor	0.172	0.116	0.221	0.167	0.262	0.141	0.326**	1.493*	0.3	-0.037
	(0.173)	(0.182)	(0.165)	(0.180)	(0.210)	(0.159)	(0.132)	(0.865)	(0.272)	(0.233)
Precip. immediate– Rich	-0.039	-0.017	0.036	-0.14	-0.09	-0.02	-0.149	0.215	0.667	-0.088
	(0.097)	(0.101)	(0.098)	(0.095)	(0.122)	(0.109)	(0.098)	(0.551)	(0.579)	(0.095)
Observations	6014	6014	6014	6014	3192	6347	4927	5937	1809	4205
Panel B: 5 lags										
Temp. cumulative– Poor	-0.418	-0.209	-0.054	-0.334	-1.253*	-0.426	-0.607*	-0.668	-0.564	-0.193
	(0.384)	(0.307)	(0.307)	(0.450)	(0.694)	(0.314)	(0.347)	(0.772)	(0.647)	(0.509)
Temp. cumulative– Rich	0.223	0.012	-0.047	0.305	0.092	0.452	0.146	0.962***	1.963	0.047
	(0.284)	(0.268)	(0.252)	(0.372)	(0.366)	(0.318)	(0.242)	(0.341)	(1.269)	(0.275)
Precip. cumulative– Poor	0.53	0.376	0.415	0.701	0.537	0.214	1.023**	1.670*	1.127	-0.057
	(0.415)	(0.419)	(0.416)	(0.441)	(0.514)	(0.358)	(0.449)	(0.890)	(0.783)	(0.434)
Precip. cumulative– Rich	0.016	0.12	0.227	-0.405	-0.561*	0.186	-0.158	0.171	2.08	-0.118
	(0.245)	(0.246)	(0.219)	(0.289)	(0.319)	(0.265)	(0.246)	(0.592)	(1.618)	(0.225)
Observations	5785	5785	5785	5785	3192	6029	4919	5712	1785	4000
Panel C: 10 lags										
Temp. cumulative– Poor	-0.701	-0.633	-0.49	-0.677	-1.497	-0.783*	-0.375	-0.951	-0.801	-0.538
	(0.492)	(0.428)	(0.377)	(0.588)	(0.934)	(0.414)	(0.428)	(0.831)	(0.782)	(0.663)
Temp. cumulative– Rich	0.188	0.174	-0.058	0.214	0.033	0.53	0.29	1.058**	3.131*	-0.097
	(0.425)	(0.412)	(0.397)	(0.735)	(0.507)	(0.505)	(0.322)	(0.499)	(1.696)	(0.394)
Precip. cumulative– Poor	-0.008	-0.213	-0.121	0.083	-0.235	-0.331	1.160**	1.296	0.17	-0.179
	(0.515)	(0.511)	(0.508)	(0.618)	(0.696)	(0.452)	(0.545)	(0.945)	(0.893)	(0.642)
Precip. cumulative– Rich	0.022	0.107	0.231	-0.789	-0.469	0.184	0.068	0.29	1.082	-0.001
	(0.366)	(0.375)	(0.345)	(0.497)	(0.442)	(0.438)	(0.313)	(0.624)	(1.607)	(0.339)
Observations	5449	5449	5449	5449	3190	5563	4909	5383	1737	3712

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Except where noted in the text, panel A follows the same specification as column (5) of Table 2, panel B follows the same specification as column (9) of Table 3, and panel C follows the same specification as column (10) of Table 3. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A10: Anomalies, Changes in growth and climate in the medium-run

	Dependent variable: change in mean growth rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline Sample	Alternative comparison years					Africa Only	Excluding Africa	WDI data
Change in Temperature	1.080*	1.168*	0.461	-0.033	0.818	0.243	-1.045	1.317*	0.815
	(0.627)	(0.638)	(0.498)	(0.442)	(0.638)	(0.511)	(1.164)	(0.674)	(0.609)
Change in Temperature X Poor Country	-1.716	-2.043*	-1.281	-1.114	-0.980	-0.485	0.007	-1.461	-1.756
	(1.178)	(1.132)	(1.021)	(0.957)	(1.239)	(1.118)	(2.017)	(1.316)	(1.061)
Change in Precipitation	0.932	0.981	0.744	0.139	0.944	0.609	2.846	0.933	-0.125
	(0.670)	(0.686)	(0.592)	(0.546)	(0.685)	(0.651)	(2.984)	(0.710)	(0.561)
Change in Precipitation X Poor Country	-0.344	-0.719	-0.399	0.641	-0.143	-0.373	-0.916	-1.347	0.248
	(1.213)	(1.082)	(0.831)	(1.272)	(1.053)	(0.914)	(3.516)	(1.185)	(0.887)
Region FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Early Period	1970-1985	1970-1985	1970-1987	1961-1970	1971-1980	1981-1990	1970-1985	1970-1985	1970-1985
Late Period	1986-2000	1986-2000	1988-2003	1991-2000	1991-2000	1991-2000	1986-2000	1986-2000	1986-2000
Observations	134	134	134	93	134	134	41	93	121
R-squared	0.05	0.14	0.10	0.12	0.10	0.13	0.09	0.22	0.11
Temperature effect on poor Countries	-0.636	-0.875	-0.820	-1.147	-0.162	-0.242	-1.038	-0.144	-0.941
	(0.997)	(0.960)	(0.893)	(0.861)	(1.096)	(0.998)	(1.647)	(1.187)	(0.877)
Precipitation effect on poor Countries	0.589	0.262	0.345	0.780	0.801	0.235	1.929	-0.414	0.123
	(1.011)	(0.829)	(0.579)	(1.093)	(0.809)	(0.642)	(1.860)	(0.940)	(0.654)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the mean anomaly value in the Late Period and the mean anomaly value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Section 3: Daily Temperature Bins

The following graphs examine daily temperature data. Using daily climate data available on a 1.0 x 1.0 degree grid (NCC, 2005), we calculated the number of days that each grid cell spent in each of fifteen temperature bins during the course of each year, where the temperature bins are five degrees Celsius in width. We then aggregated the binned grid-level data to the national level, weighing by the population of each grid cell, to obtain the number of population-weighted days spent in each temperature bin over the course of the year, for all countries in our sample. Finally, we repeated our standard panel analysis (e.g., equation (4) with no lags) allowing the climate effects to vary arbitrarily for the different temperature bins. Figure A1.1 plots the coefficients from this regression for rich and poor countries, respectively. Figure A2 shows the percentage of country-year observations with a positive number of person-weighted days in each bin, for rich and poor countries respectively.

In addition, we also estimate the marginal effect of an additional day at a given temperature on annual growth using a third degree linear spline with knots at -5 C, 10 C and 25 C. These effects are plotted in Figure A1.2.

The data used for these calculations are model-based data – that is, ground station measurements were combined with climate models to derive a more complete data product (NCC, 2005). Model-based products provide the only daily data available on a global scale for our time period. Because the underlying ground station measurements of daily weather are relatively limited for some regions of the world – particularly less developed regions – the results should be interpreted cautiously.

Figure A1.1: Regression coefficients for each temperature bin

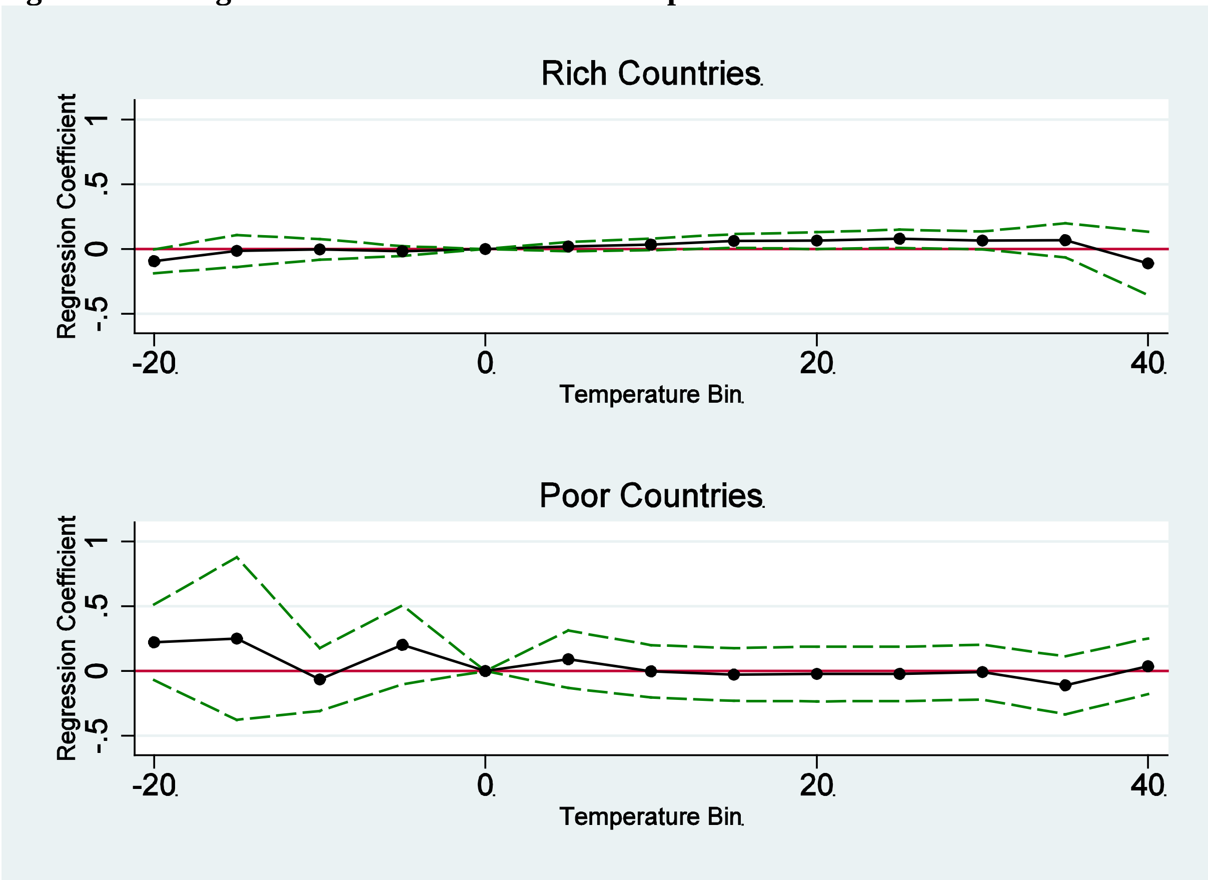
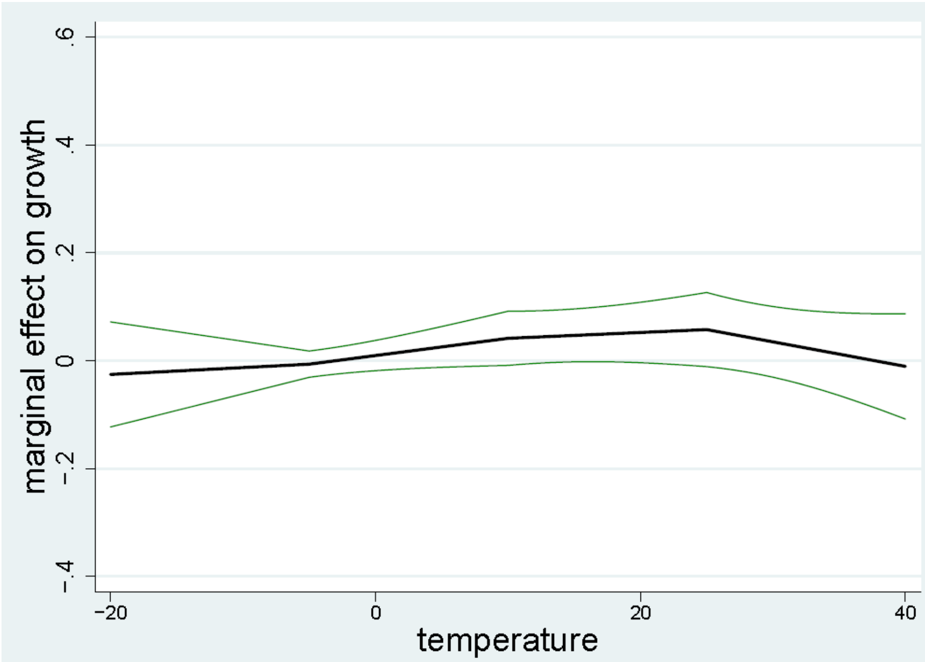


Figure A1.2: 3rd degree linear splines estimating the marginal effect of an additional day at a given temperature on annual growth

Panel A: Rich Countries



Panel B: Poor Countries

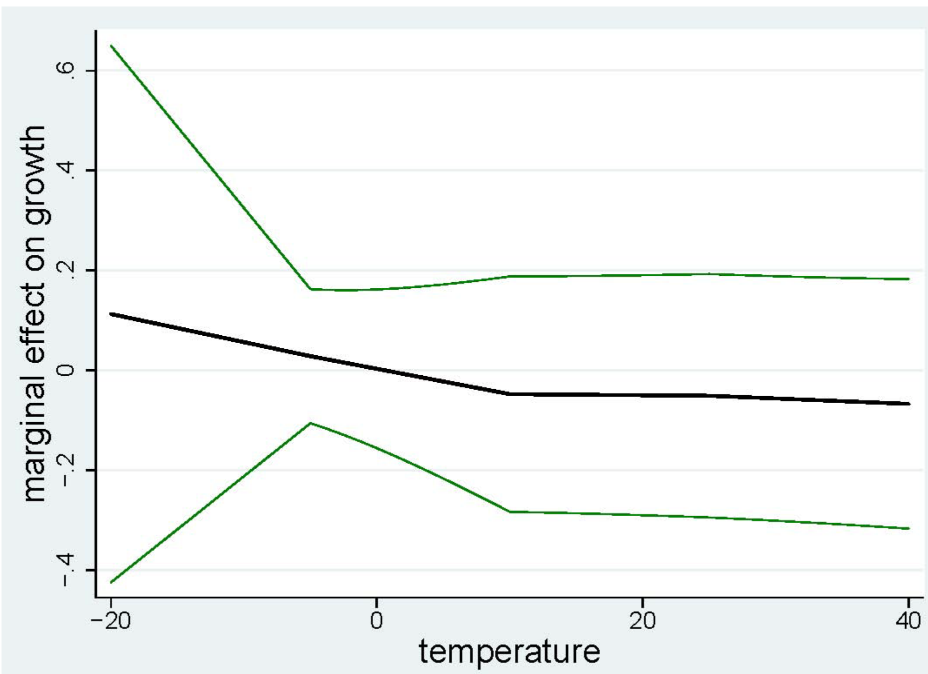
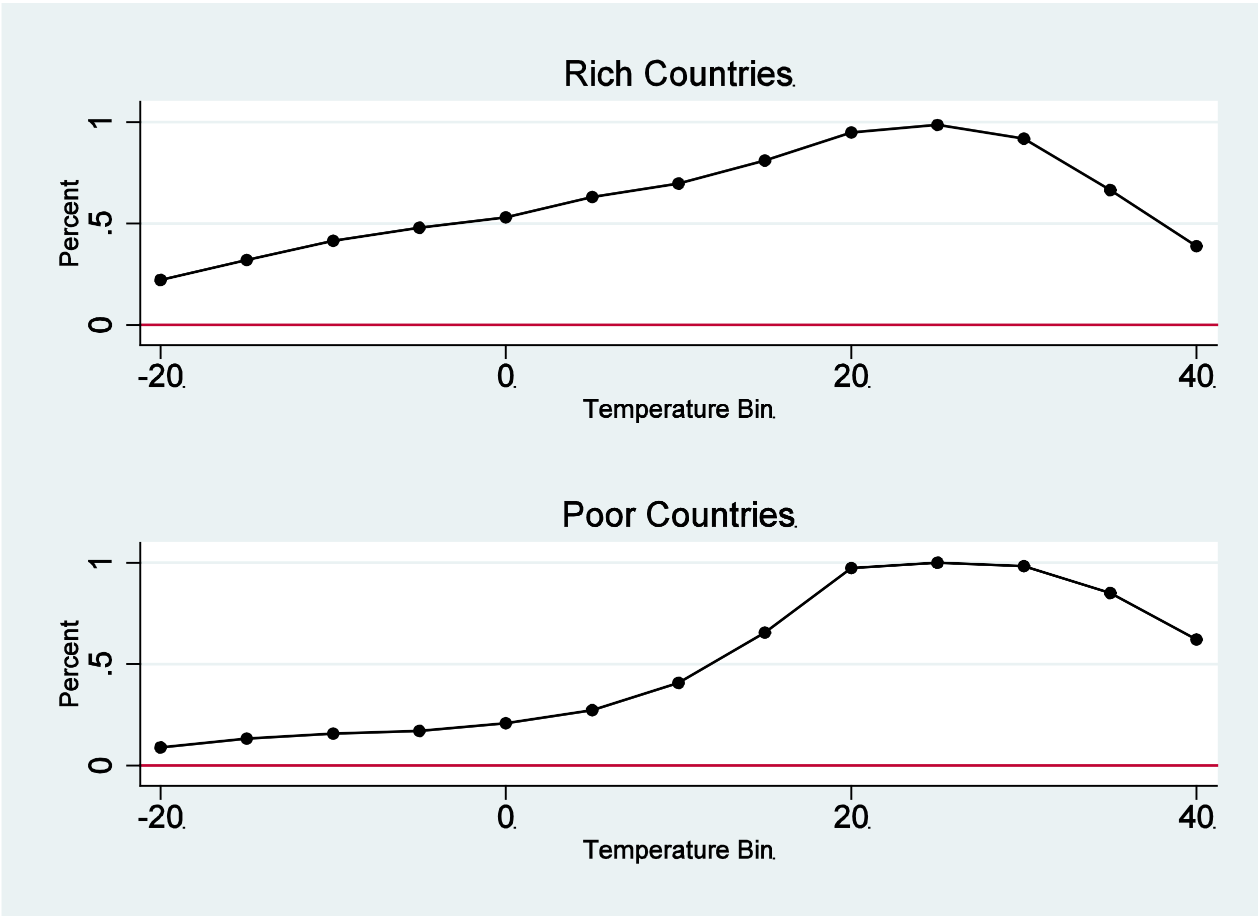


Figure A2: Percentage of country-years with at least one observation in the temperature bin



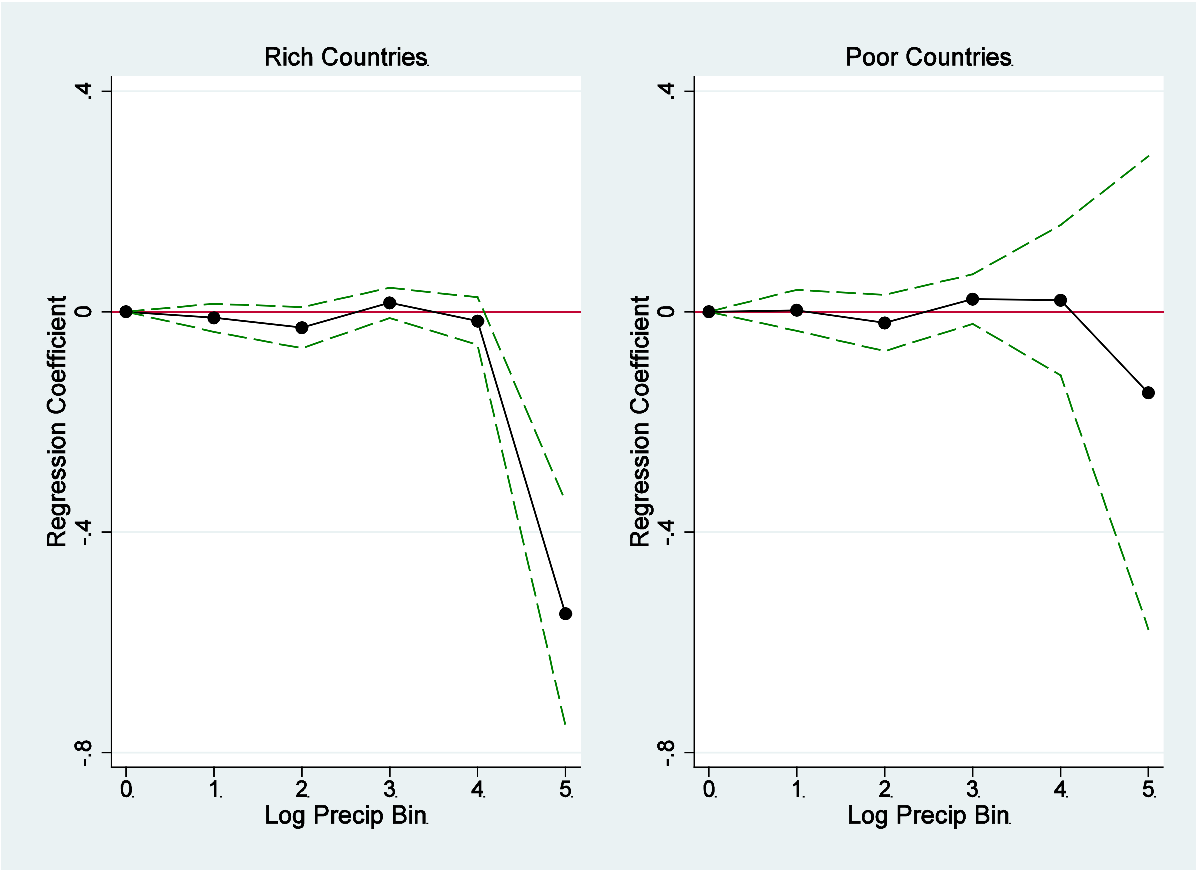
Section 4: Daily Precipitation Bins

The following results are from analysis of daily precipitation data. Using daily climate data available on a 1.0 x 1.0 degree grid (NCC, 2005), we calculated the number of days that each grid cell spent in each of five precipitation bins during the course of each year, as in the temperature bins discussed in Section 3 above. Given the large dispersion in precipitation amounts, we define precipitation bins on a log scale. The definition of the bins, plotted in the graphs below, is as follows:

0 precip is the omitted category,
1 => log (precip)<2
2 => log (precip)>=2 & log (precip)<3
3 => log (precip)>=3 & log (precip)<4
4 => log (precip)>=4 & log (precip)<5
5=> log (precip)>=5

We aggregated the binned grid-level data to the national level, weighing by the population of each grid cell, to obtain the number of population-weighted days spent in each precipitation bin over the course of a year, for all countries in our sample. Then, we repeated our standard panel analysis above (e.g., equation (4) with no lags) allowing the climate effects to vary arbitrarily for the different precipitation bins. The two figures below plot the coefficients from this regression for rich and poor countries, respectively. This data confirms the negative effect of precipitation on rich countries and shows that it is driven exclusively by extremely large precipitation events. The poor country results show no significant effects. As with the daily temperature results reported in the section above, these data are model-based and hence should be interpreted cautiously.

Figure A3: Regression coefficients for each precipitation bin



Section 5: Comparison of Our Precipitation Data to Other African Precipitation Data Sets

Here, we compare our Africa precipitation data to three other commonly used data sets on African precipitation, all explored by Miguel, Satyanath, and Sergenti (2004).

Global Precipitation Climatology Project (GPCP) Data

The Global Precipitation Climatology Project (GPCP) database of rainfall estimates stretches back to 1979. The GPCP data rely on a combination of actual weather station rainfall gauge measures and satellite information on the density of cold cloud cover, which is closely related to actual precipitation. Estimates are made at 2.5 latitude and longitude degree intervals. The units of measurement are in millimeters of rainfall per day and are the average per month. To construct the data, Miguel et al. multiplied each monthly average by the number of days in a given month. They then added up all of the total monthly estimates in a given year to generate an estimate of total yearly rainfall for each 2.5 latitude / longitude degree node. Next, each yearly rainfall estimate per 2.5 latitude / longitude degree node was averaged over all nodes in a given country to produce an estimate of total yearly rainfall per country. This corresponds to something akin to an area-weighted average, rather than the population-weighted averages we use in our main specifications. No degree grid node fell within the national boundaries for five countries – Burundi, Djibouti, Gambia, Guinea-Bissau, and Rwanda. In these cases, they assigned the rainfall measures from the nearest node(s) to their borders.

B. National Centers for Environment Prediction (NCEP) Data

This data set is essentially similar to the GPCP data set. It differs in that it uses the Xie and Arkin (1997) method of data selection and merging.

C. U.N. Food and Agricultural Organization Climatic (FAOCLIM2) Data

The FAOCLIM2 data set relies solely on gauge measures. Data are available starting in the early 1800's for some countries. Rain gauge coverage becomes increasingly limited after 1990, and especially after 1996, leading to missing observations. The units of measurement are in millimeters of rainfall per month per gauge station. Miguel et al. first calculated the average rainfall per month for the entire country by taking the average of the rainfall per month measurements across gauge stations. They then added up all of the country monthly averages in a given year to generate a measure of total yearly rainfall per country. It is often the case that data are not available for many gauge stations. That is, the total number of gauge stations used to calculate the average rainfall per month is not constant.

The correlations between our population weighted precipitation measure (wpre) and these measures are:

Corr(wpre, GPCP)= 0.9193
Corr(wpre, NCEP)= 0.9142
Corr(wpre, FAO)= 0.9339

Table A11 reports our baseline specification using these datasets. Column (1) presents results using our data and our sample for Sub-Saharan Africa (SSAF). Column (2) uses our data and the more limited GPCP/NCEP sample for SSAF. Column (3) reports estimates using the GPCP data and column (4) using the NCEP data for SSAF. Column (5) uses our data and the even more limited FAO sample. Finally, column (6) reports estimates using the FAO data. We report results using zero, one, and five lags of the climate variables. Due to the shorter time period covered by the GPCP, NCEP, and FAO data sets, the ten lag specification leads to very few observations and very noisy results, and hence is not reported here.

The alternative datasets typically show similar coefficients as the baseline data but with wider standard errors, as expected given the substantial drop in sample size. The rich country temperature estimates are also similar across samples and specifications, though they tend to be economically larger when using the FAO data (column 6) or our data with the FAO sample (column 5), and are statistically significant when lags are not included. Finally, the precipitation effects for both rich and poor countries are also similar across most samples and data sets. Both the rich and poor country precipitation effects tend to be larger when we use our data with the more limited samples (columns 2 and 5) or when we use the alternative datasets, as compared to when we use our data in the full sample (column 1). In addition, the rich country precipitation effect in the FAO data (column 6) has the opposite sign and differs statistically from the rich country precipitation estimates using the other datasets.

Table A11: Alternate African Precipitation Data

	(1) Baseline Data and Sample, SSAF	(2) Baseline Data: GPCP/NCEP Sample	(3) GPCP Data	(4) NCEP Data	(5) Baseline Data: FAO Sample	(6) FAO Data
Panel A: No lags						
Temp. immediate– Poor	-1.928**	-2.476*	-2.541	-2.579	-1.517	-1.499
	(0.813)	(1.442)	(1.550)	(1.590)	(1.461)	(1.454)
Temp. immediate– Rich	0.719	-0.723	-0.82	-0.938	-1.722*	-2.176**
	(2.170)	(0.772)	(0.734)	(0.749)	(0.974)	(1.061)
Precip. immediate– Poor	0.18	0.607**	0.399	0.385	0.482	0.520
	(0.112)	(0.290)	(0.287)	(0.322)	(0.392)	(0.324)
Precip. immediate– Rich	0.152	0.482**	0.491**	0.462*	0.387	-0.272
	(0.138)	(0.215)	(0.214)	(0.232)	(0.310)	(0.280)
Observations	1855	672	672	672	561	561
Panel B: 1 lag						
Temp. cumulative– Poor	-1.609*	-1.967	-2.246	-1.808	-1.117	-0.672
	(0.838)	(1.584)	(1.793)	(1.549)	(1.415)	(1.752)
Temp. cumulative– Rich	1.378	-1.325	-1.731	-1.797	-3.241	-3.765*
	(3.102)	(1.624)	(1.664)	(1.697)	(1.990)	(1.954)
Precip. cumulative– Poor	0.277	0.510	0.077	0.299	0.119	0.302
	(0.184)	(0.485)	(0.359)	(0.216)	(0.463)	(0.511)
Precip. cumulative– Rich	0.169	0.474	0.294	0.299	0.377	-0.331
	(0.158)	(0.299)	(0.381)	(0.478)	(0.427)	(0.507)
Observations	1855	672	672	672	554	554
Panel C: 5 lags						
Temp. cumulative– Poor	-1.631	-4.812	-4.960*	-4.948	-4.256***	-4.021**
	(1.044)	(3.101)	(2.816)	(3.418)	(1.259)	(1.549)
Temp. cumulative– Rich	2.396	1.308	-1.375	-1.234	-1.082	-3.845
	(4.699)	(4.257)	(4.174)	(4.148)	(3.919)	(4.976)
Precip. cumulative– Poor	0.662	0.273	-0.207	-0.084	-0.062	0.046
	(0.404)	(1.329)	(0.622)	(0.494)	(1.083)	(0.589)
Precip. cumulative– Rich	0.722	1.113	1.041*	0.556	1.427	-0.652
	(0.555)	(0.764)	(0.610)	(0.666)	(1.559)	(1.251)
Observations	1815	508	508	508	389	389

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at the parent-country level. * significant at 10%; ** significant at 5%; *** significant at 1%

Section 6: Reconciling Our Results with Miguel, Satyanath, and Sergenti (2004)

Tables A12 and A13 reconcile our results with those in Miguel, Satyanath, and Sergenti (2004). Table A12 examines the Miguel et al. first stage, which relates precipitation to economic growth. Column (1) presents our baseline result, which uses our sample, our data, and our specification (without a precipitation x poor interaction). Column (2) reports estimates using our data and specification with the Miguel et al. sample (to the greatest extent possible in our data), which consists of Sub-Saharan Africa (SSAF) for 1981 to 1999. Next, column (3) uses our specification on the Miguel et al. data and sample. Column (4) reports a specification that – like the Miguel et al. specification – includes rainfall growth and lagged rainfall growth on the right hand side. It also includes year fixed effects, in contrast to the country-specific time trends used by Miguel et al. This column uses the Miguel et al. data and sample. Finally, column (5) uses the Miguel et al. data, sample, and specification: GDP growth on rainfall growth, lagged rainfall growth, and a country-specific time trend.

The results in Table A12 show that the main difference in the importance of rainfall appears when comparing columns (1) and (2) (i.e., moving to their restricted sample), as the rainfall coefficients are small and insignificant when we look at the global sample for the 1950-2003 period but become statistically and economically significant when we limit the sample to SSAF for the 1981 to 1999 period. In short, differences in first stage are largely due to sample.

Table A13 then examines the Miguel et al. reduced form, which relates precipitation to civil wars. Columns (1) and (2) present our baseline results - which use our sample, our data, and our specification (without a precipitation x poor interaction) – for conflicts with more than 25 deaths and more than 1,000 deaths, respectively. Columns (3) and (4) report estimates using our data and specification with the Miguel et al. sample, again for conflicts with more than 25 deaths and more than 1,000 deaths, respectively. Next, columns (5) and (6) use our specification on the Miguel et al. data and sample. Columns (7) and (8) report a specification that – like the Miguel et al. specification – includes rainfall growth and lagged rainfall growth on the right hand side. It also includes year fixed effects, in contrast to the country-specific time trends used by Miguel et al. These columns use the Miguel et al. data and sample. Finally, columns (9) and (10) use the Miguel et al. data, sample, and specification (GDP growth on rainfall growth, lagged rainfall growth, and a country-specific time trend). The main difference for the conflict results appears to come from a combination of their more limited sample and specification.

Table A12: Miguel et al First Stage

	(1)	(2)	(3)	(4)	(5)
	Our data, our sample, our spec	Our data, their sample, our spec	Their data, their sample, our spec	Their data, their sample, their spec with year FE	Their data, their sample, their spec
Dependent variable is:	growth (PWT)	growth (PWT)	growth (Fearon-Laitin)	growth (Fearon-Laitin)	growth (Fearon-Laitin)
rainfall (Delaware) in decimeters	-0.019	0.620***			
	(0.040)	(0.180)			
rainfall (GPCP) in decimeters			0.513***		
			(0.179)		
growth in rainfall, t (GPCP)				4.598**	4.858***
				(1.810)	(1.702)
growth in rainfall, t-1 (GPCP)				2.483	2.800*
				(1.754)	(1.419)
country FE	Yes	Yes	Yes	Yes	Yes
region*year FE	Yes	Yes	Yes	Yes	No
poor*year FE	Yes	Yes	Yes	No	No
country specific time trend	No	No	No	No	Yes
Number of observations	6014	722	743	743	743
R-squared	0.14	0.15	0.12	0.12	0.13

Notes: Robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%. Columns (2) through (5) include only one region, and thus region x year fixed effects are equivalent to year fixed effects.

Table A13: Miguel et al. Reduced Form

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Our sample, our data, our spec (no poor interaction)		Their sample, our data, our spec (no poor interaction		Their sample, their data, our spec		Their sample, their data, their spec with year FE		Their sample, their data, their spec	
Dependent variable is:	>25 deaths	>1000 deaths	>25 deaths	>1000 deaths	>25 deaths	>1000 deaths	>25 deaths	>1000 deaths	>25 deaths	>1000 deaths
rainfall (Delaware)	0.001	0.000	-0.002	0.006						
	(0.001)	(0.001)	(0.002)	(0.006)						
rainfall (GPCP)					-0.011	-0.018*				
					(0.010)	(0.010)				
growth in rainfall, t (GPCP)							0.024	-0.061	-0.024	-0.062**
							(0.060)	(0.047)	(0.043)	(0.030)
growth in rainfall, t-1 (GPCP)							-0.087*	-0.059	-0.122**	-0.069**
							(0.049)	(0.048)	(0.052)	(0.032)
country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
region*year FE	yes	yes	yes	yes	yes	yes	yes	yes	no	no
poor*year FE	yes	yes	yes	yes	yes	yes	no	no	no	no
country specific time trend	no	no	no	no	no	no	no	no	yes	yes
Number of observations	7277	7277	743	743	743	743	743	743	743	743
R-squared	0.46	0.28	0.62	0.6	0.56	0.56	0.56	0.56	0.71	0.7

Notes: Robust standard errors in parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%. Columns (3) through (10) include only one region, and thus region x year fixed effects are equivalent to year fixed effects**.**

Section 7: First Differencing

First differencing and fixed effects specifications provide similar estimates for the zero lag model, whereas the estimates for the five and ten lag models become substantially larger in absolute value (i.e., more negative) and noisily estimated.

Table A14: Fixed Effects v. First Difference

	(1) Baseline specification (fixed effects)	(2) First Differences
Panel A: Models with no lags		
Temp. immediate effect – Poor	-1.074**	-1.210**
	(0.446)	(0.558)
Temp. immediate effect – Rich	0.208	0.003
	(0.212)	(0.005)
Precip. immediate effect – Poor	0.030	-0.013
	(0.065)	(0.081)
Precip. immediate effect – Rich	-0.072*	-0.004
	(0.042)	(0.007)
Observations	6014	5878
Panel B: Models with 5 lags		
Temp. cumulative effect – Poor	-1.662**	-2.931
	(0.737)	(2.521)
Temp. cumulative effect – Rich	0.155	0.001
	(0.460)	(0.004)
Precip. cumulative effect – Poor	0.128	0.022
	(0.146)	(0.311)
Precip. cumulative effect – Rich	-0.127	-0.005
	(0.085)	(0.005)
Observations	5785	5649
Panel C: Models with 10 lags		
Temp. cumulative effect – Poor	-1.946**	-5.789
	(0.881)	(6.116)
Temp. cumulative effect – Rich	-0.147	-0.166
	(0.654)	(0.221)
Precip. cumulative effect – Poor	0.107	-0.16
	(0.171)	(0.427)
Precip. cumulative effect – Rich	-0.112	-0.023
	(0.109)	(0.050)
Observations	5449	5313

Column (1) includes country FE, region × year FE, and poor x year FE. Column (2) first differences the specification in column (1). Robust standard errors are in parentheses, adjusted for clustering at the parent-country level. Panel A follows the same specification as column (5) of Table 2, panel B follows the same specification as column (9) of Table 3, and panel C follows the same specification as column (10) of Table 3. * significant at 10%; ** significant at 5%; *** significant at 1%

Section 8: Testing for Endogeneity in the Climate Data

Now we examine the determinants of missing values in the Global Historical Climatology Network (GHCN) dataset, which is the underlying source for our gridded climate data. Table A15 reports the following regression:

$$in_{ct} = \beta_0 + \beta_1 outcome_{ct} + \beta_2 outcome_{ct} * poor_{ct} + \alpha_t + \gamma_c + \epsilon_{ct}$$

where in_{ct} is the percentage of all stations in the 1950-2003 panel assigned to country *c* that appear in the GHCN in year *t*. Poor is defined as usual, and the regression includes both region x year and country fixed effects. This specification thus tests for a relationship between the number of stations reporting data and economic variables of interest. We repeat this specification for all the main outcome variables in the paper. Of the 12 variables we examine (gdp growth, agricultural gdp growth, industrial gdp growth, polity interregnum, regular leader transition, and irregular leader transition, all interacted with poor), we find only one significant relationship with the presence of GHCN stations (industrial GDP growth in rich countries), suggesting that endogenous changes in the GHCN data is unlikely to be driving the results.

Table A15: Missing Values in the GHCN

	(1)	(2)	(3)	(4)	(5)	(6)
GDP growth	0.033					
	(0.072)					
GDP growth x poor	0.008					
	(0.085)					
Agricultural GDP growth		0.037				
		(0.035)				
Ag. GDP growth x poor		-0.037				
		(0.048)				
Industrial GDP growth			-0.182**			
			(0.077)			
Ind. GDP growth x poor			0.183**			
			(0.091)			
Polity Interrengum				-0.008		
				(0.033)		
Polity Interrengum x poor				-0.001		
				(0.043)		
Regular Leader Transition					-0.002	
					(0.005)	
Regular Transition x poor					0.020	
					(0.014)	
Irregular Leader Transition						-0.009
						(0.016)
Irregular Transition x poor						0.012
						(0.023)
Observations	5306	3288	3288	4975	6229	6229
R^2	0.67	0.69	0.69	0.66	0.63	0.63
Effect for poor countries	0.041	0.000	0.002	-0.010	0.017	0.003
Standard error	(0.049)	(0.030)	(0.057)	(0.028)	(0.013)	(0.016)

Robust standard errors in parentheses, adjusted for clustering at parent-country level. * significant at 10%; ** significant at 5%; *** significant at 1%

Section 9: Urban Population and Rural Population Weighted Results

Tables A16 through A18 repeat Tables 2, 4, and 7 in the main text, with the weather variables calculated by weighting by rural population only. Tables A19 through A21 perform a similar exercise, weighting by urban population only. Rural-weighted results are very similar to the results in the paper calculated weighting by overall population.

Table A16: Baseline Results with Rural-Weighted Weather

	(1)	(2)	(3)	(4)	(5)
Temperature	-0.335	-0.133	-0.141	-0.266	-0.140
	(0.233)	(0.315)	(0.311)	(0.281)	(0.325)
Temperature interacted with…					
Poor country dummy		-0.969*	-0.951*	-0.949*	-0.981*
		(0.538)	(0.542)	(0.529)	(0.539)
Hot country dummy				0.477	
				(0.411)	
Agricultural country dummy					0.005
					(0.411)
Precipitation			-0.012**	-0.020***	-0.017***
			(0.005)	(0.007)	(0.005)
Precipitation interacted with…					
Poor country dummy			0.014	0.016	0.003
			(0.010)	(0.011)	(0.012)
Hot country dummy				0.013	
				(0.009)	
Agricultural country dummy					0.027***
					(0.010)
Observations	6011	6011	6011	5948	5726
R-squared	0.14	0.15	0.15	0.15	0.15
Temperature effect in poor countries		-1.101**	-1.092**	-1.215***	-1.121**
		(0.456)	(0.463)	(0.447)	(0.500)
Precipitation effect in poor countries			0.003	-0.004	-0.014
			(0.009)	(0.009)	(0.013)

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table A17: Robustness Results with Rural-Weighted Weather

	(1) Baseline	(2) Country FE and Region×Yr FE only	(3) Country FE and Year FE only	(4) All FE and country specific trends	(5) Balanced sample: 1971 - 2003	(6) Add countries with < 20 years of data	(7) GDP data from World Devel. Indicators	(8) Sub-Saharan Africa Only	(9) Sub-Saharan Africa Excluded
Panel A: No lags									
Temp. immediate– Poor	-1.092**	-0.771**	-1.009***	-1.093**	-1.738***	-0.916**	-1.332***	-1.887**	-0.382
	(0.463)	(0.383)	(0.313)	(0.458)	(0.664)	(0.397)	(0.418)	(0.926)	(0.373)
Temp. immediate– Rich	-0.141	-0.255	-0.289	-0.101	-0.122	0.06	0.071	1.549	-0.146
	(0.311)	(0.255)	(0.266)	(0.351)	(0.471)	(0.370)	(0.409)	(2.077)	(0.315)
Precip. immediate– Poor	0.003	0.001	0.002	0.004	0.006	-0.003	0.013*	0.028	-0.007
	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)	(0.007)	(0.008)	(0.021)	(0.009)
Precip. immediate– Rich	-0.012**	-0.010**	-0.007	-0.015***	-0.017***	-0.009	-0.012***	0.015	-0.013***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)	(0.005)	(0.020)	(0.005)
Observations	6011	6011	6011	6011	3168	6344	4944	1766	4245
Panel B: 5 lags									
Temp. cumulative– Poor	-1.316*	-0.992	-0.985	-0.938	-2.476*	-1.247**	-1.036*	-1.355	-0.942
	(0.745)	(0.640)	(0.610)	(1.094)	(1.436)	(0.601)	(0.596)	(1.173)	(1.135)
Temp. cumulative– Rich	-0.475	-0.612	-0.721	-0.634	-0.483	-0.428	-0.428	3.142	-0.567
	(0.542)	(0.455)	(0.492)	(0.627)	(0.865)	(0.591)	(0.481)	(4.942)	(0.521)
Precip. cumulative– Poor	0.012	0.005	0.003	0.022	0.015	-0.006	0.042	0.110*	-0.011
	(0.018)	(0.018)	(0.018)	(0.025)	(0.023)	(0.012)	(0.026)	(0.065)	(0.015)
Precip. cumulative– Rich	-0.016*	-0.014	-0.009	-0.032**	-0.030***	0.001	-0.016*	0.058	-0.016*
	(0.009)	(0.010)	(0.008)	(0.013)	(0.009)	(0.017)	(0.008)	(0.064)	(0.008)
Observations	5778	5778	5778	5778	3168	6022	4932	1742	4036
Panel C: 10 lags									
Temp. cumulative– Poor	-1.577	-1.507*	-1.384*	-1.021	-2.282	-1.487*	-0.742	-1.675	-1.143
	(0.969)	(0.882)	(0.784)	(1.480)	(1.811)	(0.784)	(0.773)	(1.414)	(1.425)
Temp. cumulative– Rich	-0.698	-0.705	-0.905**	-1.106	-0.643	-0.691	-0.559	6.916	-0.846*
	(0.517)	(0.500)	(0.447)	(0.767)	(0.774)	(0.611)	(0.600)	(5.723)	(0.480)
Precip. cumulative– Poor	0.005	-0.002	-0.004	0.021	0.002	-0.013	0.065**	0.083	-0.007
	(0.021)	(0.021)	(0.020)	(0.031)	(0.022)	(0.016)	(0.027)	(0.067)	(0.022)
Precip. cumulative– Rich	-0.015	-0.01	-0.008	-0.049**	-0.018	0.002	-0.015	0.041	-0.008
	(0.014)	(0.015)	(0.013)	(0.022)	(0.016)	(0.027)	(0.015)	(0.093)	(0.013)
Observations	5437	5437	5437	5437	3166	5551	4917	1694	3743

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Except where noted in the text, panel A follows the same specification as column (5) of Table 2, panel B follows the same specification as column (9) of Table 3, and panel C follows the same specification as column (10) of Table 3. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A18: Medium-run Results with Rural-Weighted Weather

	Dependent variable: change in mean growth rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline Sample	Alternative comparison years					Africa Only	Excluding Africa	WDI data
Change in Temperature	0.991	0.974	0.270	-0.256	1.681	-0.753	-6.131***	1.003	1.330*
	(1.046)	(0.996)	(0.965)	(0.789)	(1.234)	(0.869)	(2.235)	(1.014)	(0.783)
Change in Temperature X Poor Country	-4.048***	-4.135**	-3.524**	-1.560	-4.083**	-0.448	3.911	-4.146**	-3.538**
	(1.539)	(1.589)	(1.619)	(1.885)	(1.995)	(1.705)	(2.949)	(2.002)	(1.365)
Change in Precipitation	0.016	0.021	0.008	0.007	0.004	-0.000	0.242***	0.021	-0.005
	(0.016)	(0.019)	(0.014)	(0.033)	(0.015)	(0.018)	(0.081)	(0.019)	(0.012)
Change in Precipitation X Poor Country	-0.030	-0.046	-0.027	-0.006	-0.001	0.005	-0.105	-0.059*	0.002
	(0.031)	(0.030)	(0.027)	(0.059)	(0.030)	(0.033)	(0.170)	(0.031)	(0.025)
Region FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Early Period	1970-1985	1970-1985	1970-1987	1961-1970	1971-1980	1981-1990	1970-1985	1970-1985	1970-1985
Late Period	1986-2000	1986-2000	1988-2003	1991-2000	1991-2000	1991-2000	1986-2000	1986-2000	1986-2000
Observations	134	134	134	93	134	134	40	94	121
R-squared	0.06	0.15	0.12	0.10	0.11	0.13	0.10	0.22	0.14
Tem effect poor countries	-3.058***	-3.161**	-3.254**	-1.816	-2.402	-1.201	-2.220	-3.143*	-2.209**
SE1	(1.129)	(1.248)	(1.325)	(1.666)	(1.597)	(1.486)	(1.924)	(1.744)	(1.123)
Pre effect poor countries	-0.013	-0.025	-0.018	0.001	0.003	0.005	0.138	-0.038	-0.003
SE2	(0.026)	(0.024)	(0.022)	(0.047)	(0.026)	(0.028)	(0.149)	(0.02)	(0.021)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the mean value in the Late Period and the mean value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A19: Baseline Results with Urban-Weighted Weather

	(1)	(2)	(3)	(4)	(5)
Temperature	-0.280	0.110	0.089	0.037	0.014
	(0.217)	(0.221)	(0.227)	(0.219)	(0.252)
Temperature interacted with…					
Poor country dummy		-1.124**	-1.083**	-1.114**	-1.383***
		(0.442)	(0.451)	(0.446)	(0.490)
Hot country dummy				0.173	
				(0.444)	
Agricultural country dummy					-0.022
					(0.357)
Precipitation			-0.079	-0.181***	-0.107*
			(0.051)	(0.065)	(0.062)
Precipitation interacted with…					
Poor country dummy			0.111	0.087	0.084
			(0.098)	(0.092)	(0.122)
Hot country dummy				0.175**	
				(0.084)	
Agricultural country dummy					0.095
					(0.115)
Observations	5743	5743	5743	5743	5227
R-squared	0.15	0.15	0.15	0.15	0.16
Temperature effect in poor countries		-1.014**	-0.995**	-1.077***	-1.370**
		(0.405)	(0.413)	(0.386)	(0.491)
Precipitation effect in poor countries			0.032	-0.094	-0.022
			(0.084)	(0.095)	(0.128)

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.
* significant at 10%; ** significant at 5%; *** significant at 1%**.**

Table A20: Robustness Results with Urban-Weighted Weather

	(1) Baseline	(2) Country FE and Region×Yr FE only	(3) Country FE and Year FE only	(4) All FE and country specific trends	(5) Balanced sample: 1971 - 2003	(6) Add countries with < 20 years of data	(7) GDP data from World Devel. Indicators	(8) Sub-Saharan Africa Only	(9) Sub-Saharan Africa Excluded
Panel A: No lags									
Temp. immediate– Poor	-0.995**	-0.687**	-0.887***	-0.912**	-1.313**	-0.396*	-1.733***	-1.730**	-0.296
	(0.413)	(0.341)	(0.275)	(0.412)	(0.619)	(0.203)	(0.373)	(0.742)	(0.371)
Temp. immediate– Rich	0.089	-0.137	-0.215	0.255	-0.121	0.345**	0.014	-0.314	0.138
	(0.227)	(0.210)	(0.168)	(0.268)	(0.380)	(0.165)	(0.232)	(1.953)	(0.214)
Precip. immediate– Poor	0.032	0.011	0.025	0.061	0.076	0.063	0.089	0.112	-0.037
	(0.084)	(0.084)	(0.077)	(0.081)	(0.119)	(0.167)	(0.065)	(0.140)	(0.111)
Precip. immediate– Rich	-0.079	-0.077	-0.045	-0.112**	-0.107	-0.009	-0.112**	0.206	-0.103*
	(0.051)	(0.054)	(0.058)	(0.055)	(0.066)	(0.131)	(0.047)	(0.250)	(0.054)
Observations	5743	5743	5743	5743	3024	6055	4693	1809	3934
Panel B: 5 lags									
Temp. cumulative– Poor	-1.545**	-0.96	-0.867	-1.079	-2.209	-0.333	-1.479***	-2.048*	-0.736
	(0.780)	(0.677)	(0.640)	(0.993)	(1.475)	(0.319)	(0.565)	(1.057)	(1.333)
Temp. cumulative– Rich	0.4	-0.021	-0.305	0.938	0.56	0.656**	0.075	1.426	0.26
	(0.387)	(0.360)	(0.330)	(0.613)	(0.649)	(0.322)	(0.376)	(3.081)	(0.357)
Precip. cumulative– Poor	0.223	0.154	0.113	0.378*	0.33	0.314	0.497*	0.701	-0.069
	(0.198)	(0.200)	(0.202)	(0.219)	(0.263)	(0.341)	(0.263)	(0.436)	(0.178)
Precip. cumulative– Rich	-0.064	-0.048	-0.039	-0.217	-0.202	0.087	-0.132	0.598	-0.113
	(0.135)	(0.137)	(0.139)	(0.165)	(0.214)	(0.275)	(0.137)	(0.698)	(0.137)
Observations	5522	5522	5522	5522	3024	5753	4685	1785	3737
Panel C: 10 lags									
Temp. cumulative– Poor	-2.160**	-1.787**	-1.691**	-2.075	-3.317**	-0.813**	-1.529**	-2.433*	-1.309
	(0.841)	(0.781)	(0.702)	(1.282)	(1.634)	(0.391)	(0.721)	(1.227)	(1.135)
Temp. cumulative– Rich	0.332	0.148	-0.422	1.055	0.461	0.821*	0.281	3.221	0.112
	(0.467)	(0.479)	(0.441)	(1.086)	(0.817)	(0.461)	(0.458)	(4.295)	(0.396)
Precip. cumulative– Poor	0.072	-0.007	-0.046	0.265	0.004	-0.291	0.593*	0.512	-0.143
	(0.249)	(0.249)	(0.245)	(0.295)	(0.316)	(0.428)	(0.331)	(0.523)	(0.276)
Precip. cumulative– Rich	-0.051	-0.026	-0.024	-0.337	-0.114	0.128	-0.073	0.318	-0.054
	(0.187)	(0.199)	(0.200)	(0.299)	(0.327)	(0.451)	(0.165)	(0.935)	(0.177)
Observations	5196	5196	5196	5196	3022	5307	4675	1737	3459

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Except where noted in the text, panel A follows the same specification as column (5) of Table 2, panel B follows the same specification as column (9) of Table 3, and panel C follows the same specification as column (10) of Table 3. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A21: Medium-run Results with Urban-Weighted Weather

	Dependent variable: change in mean growth rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline Sample	Alternative comparison years					Africa Only	Excluding Africa	WDI data
Change in Temperature	1.335	1.685*	1.000	-0.487	1.165	0.214	-2.809	1.837*	1.404*
	(0.856)	(0.934)	(0.789)	(0.674)	(0.928)	(1.076)	(2.449)	(0.984)	(0.803)
Change in Temperature	-3.623*	-4.388***	-4.063**	-2.015	-3.257*	0.393	-0.350	-3.071	-4.101***
X Poor Country	(2.031)	(1.659)	(1.647)	(1.673)	(1.831)	(2.435)	(3.209)	(2.534)	(1.471)
Change in Precipitation	0.172	0.237	0.190	-0.060	0.019	0.363	2.237*	0.198	-0.189
	(0.383)	(0.417)	(0.342)	(0.319)	(0.341)	(0.410)	(1.157)	(0.423)	(0.258)
Change in Precipitation	-0.212	-0.364	-0.462	0.181	-0.082	0.002	-1.651	-0.669	0.248
X Poor Country	(0.544)	(0.551)	(0.486)	(0.696)	(0.485)	(0.499)	(1.402)	(0.592)	(0.389)
Region FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Early Period	1970-1985	1970-1985	1970-1987	1961-1970	1971-1980	1981-1990	1970-1985	1970-1985	1970-1985
Late Period	1986-2000	1986-2000	1988-2003	1991-2000	1991-2000	1991-2000	1986-2000	1986-2000	1986-2000
Observations	127	127	127	91	127	127	41	86	114
R-squared	0.05	0.16	0.13	0.13	0.11	0.13	0.11	0.24	0.15
Tem effect poor countries	-2.287	-2.703*	-3.064**	-2.502*	-2.092	0.607	-3.159	-1.233	-2.698
SE1	(1.842)	(1.494)	(1.530)	(1.506)	(1.688)	(2.229)	(2.074)	(2.471)	(1.243)
Pre effect poor countries	-0.040	-0.127	-0.272	0.122	-0.062	0.365	0.586	-0.471	0.059
SE2	(0.386)	(0.352)	(0.340)	(0.605)	(0.340)	(0.283)	(0.791)	(0.405)	(0.282)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the mean value in the Late Period and the mean value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Section 10: Different Definitions of Interaction Variables

Tables A22 through A24 examine different definitions of poor, hot, and agricultural, respectively.

Column (2) of Table A22 interacts temperature with quintiles of initial income, and column (3) includes an interaction with the continuous initial income variable. When using a more detailed definition of poor, the temperature effects appear strongest in the bottom quintile of income. Results using the continuous income variable (column 3) are also consistent with the baseline results.

Next, Table A23 does not find evidence for differential effects of temperature shocks in hot countries. This is the case regardless of whether the definition of hot used is initial (average for the 1950s) temperature above global median temperature (column 1), above the 75th percentile of global temperature (column 2), above the 90th percentile of global temperature (column 3), or the continuous initial temperature variable (column 4).

Finally, Table A24 examines whether there are differential effects of temperature shocks in agricultural countries, as compared to non-agricultural countries. Column (1) defines agricultural as above median global GDP share in agriculture in 1995, column (2) uses the 1980 data instead, and column (3) uses the 1990 data. Column (4) interacts temperature with the continuous 1995 agricultural share variable. In no case is the agricultural share interaction significant.

Table A22: Examining Definition of Poor

	(1) Baseline	(2) Quintile	(3) Linear
Temperature	-0.158		-5.526***
	(0.214)		(1.503)
Temperature x IncomeQuintile1		-1.672**	
		(0.843)	
Temperature x IncomeQuintile2		-0.663	
		(0.422)	
Temperature x IncomeQuintile3		-0.311	
		(0.394)	
Temperature x IncomeQuintile4		0.410	
		(0.374)	
Temperature x IncomeQuintile5		0.341	
		(0.235)	
Temperature x Initial Income			0.658***
			(0.174)
Observations	6014	6014	6014
R-squared	0.14	0.14	0.14

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level.

Table A23: Exploring Different Definitions of Hot

	(1) Hot is above median	(2) Hot is above 75th percentile	(3) Hot is above 90th percentile	(4) Linear measure for hot
Temperature	-0.232	-0.200	-0.151	0.046
	(0.190)	(0.199)	(0.206)	(0.355)
Temperature x hot	0.250	0.407	-0.138	-0.013
	(0.406)	(0.624)	(0.852)	(0.025)
Observations	6014	6014	6014	6014
R-squared	0.14	0.14	0.14	0.14

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level.

Table A24: Exploring Different Definitions of Agricultural

	(1) 1995 Ag Share	(2) 1980 Ag Share	(3) 1990 Ag Share	(4) Linear control
Temperature	-0.032	-0.102	-0.064	-0.205
	(0.242)	(0.219)	(0.238)	(0.274)
Temperature x agricultural	-0.572	-0.031	-0.371	-0.001
	(0.394)	(0.381)	(0.402)	(0.002)
Observations	5432	4757	5341	5432
R-squared	0.14	0.15	0.14	0.16

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level.

Section 11: Services

Table A25 examines the impact of temperature and precipitation shocks on growth in value added in the services sector. There is some evidence, significant at the 10% level, that hot years lower immediate growth in the services sector.

Table A25: Immediate and Growth Effects in Services

Panel A: Models with no lags

	(1)
	Growth in Service Value Added
Temperature	
Immediate– Poor	-2.050*
	(1.150)
Immediate– Rich	-0.001
	(0.282)
Precipitation	-0.009
Immediate– Poor	(0.121)
	-0.044
Immediate– Rich	(0.046)
Observations	3812

Panel B: Models with lags

	Dependent variable is:		
	(1)	(2)	(3)
	Growth in Service Value Added		
Temperature	1 Lag	5 Lags	10 Lags
Cumulative– Poor	-1.91	-2.009	-0.644
	(1.515)	(1.495)	(1.409)
Cumulative– Rich	0.177	0.247	0.064
	(0.398)	(0.513)	(0.585)
Immediate– Poor	-2.105*	-2.069*	-2.281*
	(1.101)	(1.141)	(1.213)
Immediate– Rich	-0.081	-0.081	-0.066
	(0.262)	(0.262)	(0.264)
Precipitation			
Cumulative– Poor	0.366*	0.41	0.609
	(0.212)	(0.279)	(0.438)
Cumulative– Rich	0.008	0.051	0.047
	(0.070)	(0.087)	(0.111)
Immediate– Poor	-0.033	-0.064	-0.06
	(0.127)	(0.137)	(0.144)
Immediate– Rich	-0.066	-0.066	-0.07
	(0.045)	(0.044)	(0.044)
Observations	3812	3808	3804

Notes: Growth in services is from the World Development Indicators. All specifications include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of PWT growth observations.

Section 12: Median Regression

With so few observations in the medium-run results, one might be concerned that a few outliers drive the medium-run results. However, we find similar (and in fact stronger) results using median regressions, which give much less weight to outliers.

Table A26: Median Regression (WDI), Changes in growth and climate in the medium-run

	Dependent variable: change in mean growth rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline Sample	Alternative comparison years					Africa Only	Excluding Africa	PWT data
Change in Temperature	0.004	0.440	0.205	-0.562	0.154	-0.406	-3.006	0.413	0.885
	(0.584)	(0.747)	(0.631)	(1.006)	(1.578)	(1.334)	(2.332)	(1.092)	(0.637)
Change in Temperature	-2.261**	-2.540**	-1.918*	-0.178	-1.957	-0.935		-2.556	-4.906***
X Poor Country	(0.932)	(1.177)	(1.016)	(1.550)	(2.513)	(2.089)		(2.007)	(0.950)
Change in Precipitation	0.028	0.038	-0.188	-0.475	-0.035	-0.014	0.284	0.055	-0.103
	(0.113)	(0.111)	(0.136)	(0.290)	(0.363)	(0.123)	(0.430)	(0.162)	(0.092)
Change in Precipitation	0.120	0.315	0.337*	0.611*	0.331	0.139		0.219	0.323**
X Poor Country	(0.182)	(0.208)	(0.201)	(0.362)	(0.499)	(0.214)		(0.355)	(0.161)
Region FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Early Period	1970-1985	1970-1985	1970-1987	1961-1970	1971-1980	1981-1990	1970-1985	1970-1985	1970-1985
Late Period	1986-2000	1986-2000	1988-2003	1991-2000	1991-2000	1991-2000	1986-2000	1986-2000	1986-2000
Observations	125	125	125	101	112	124	38	87	120
Tem effect poor countries	-2.257***	-2.100**	-1.713**	-0.740	-1.803	-1.341		-2.144	-4.021***
SE1	(0.726)	(0.919)	(0.817)	(1.193)	(1.996)	(1.604)		(1.710)	(0.719)
Pre effect poor countries	0.148	0.354**	0.149	0.136	0.296	0.126		0.273	0.220
SE2	(0.143)	(0.175)	(0.151)	(0.223)	(0.350)	(0.178)		(0.311)	(0.133)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the mean value in the Late Period and the mean value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. For Africa only, we do not split out by poor/rich since we have so few rich country observations in Sub-Saharan Africa.

Table A27: Median Regression (PWT), Changes in growth and climate in the medium-run

	Dependent variable: change in mean growth rate								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Baseline Sample	Alternative comparison years					Africa Only	Excluding Africa	WDI data
Change in Temperature	0.406	-0.139	-0.252	-0.990	0.661	-0.633	-4.032**	0.774	0.415
	(0.757)	(0.495)	(0.597)	(1.116)	(0.889)	(0.677)	(1.660)	(1.131)	(0.724)
Change in Temperature	-4.556***	-3.967***	-2.290**	-1.111	-2.799*	-2.512**	1.565**	-4.601*	-3.867***
X Poor Country	(1.205)	(0.785)	(1.082)	(1.661)	(1.503)	(1.151)	(0.617)	(2.393)	(1.243)
Change in Precipitation	0.062	-0.067	-0.196	-0.200	0.032	-0.252***	-0.342	-0.032	-0.052
	(0.104)	(0.074)	(0.135)	(0.292)	(0.118)	(0.064)	(2.085)	(0.167)	(0.111)
Change in Precipitation	-0.075	0.255*	0.428**	0.349	0.045	0.247**	-1.174*	-0.119	0.290
X Poor Country	(0.182)	(0.133)	(0.202)	(0.481)	(0.216)	(0.125)	(0.672)	(0.281)	(0.211)
Region FE	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Early Period	1970-1985	1970-1985	1970-1987	1961-1970	1971-1980	1981-1990	1970-1985	1970-1985	1970-1985
Late Period	1986-2000	1986-2000	1988-2003	1991-2000	1991-2000	1991-2000	1986-2000	1986-2000	1986-2000
Observations	134	134	134	93	134	134	40	94	121
Tem effect poor countries	-4.150***	-4.106***	-2.542***	-2.101	-2.138*	-3.145***	-4.374***	-3.827*	-3.452***
SE1	(0.937)	(0.618)	(0.915)	(1.306)	(1.239)	(0.916)	(1.262)	(2.119)	(1.031)
Pre effect poor countries	-0.0130	0.188	0.232	0.148	0.0776	-0.00513	0.391	-0.152	0.238
SE2	(0.149)	(0.115)	(0.157)	(0.371)	(0.187)	(0.110)	(0.267)	(0.237)	(0.182)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the mean value in the Late Period and the mean value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. For Africa only, we do not split out by poor/rich since we have so few rich country observations in Sub-Saharan Africa.

Section 13: Satellite Data

Satellite data is available for a shorter time period and at lower spatial resolution. The satellite climate data series begins in 1980, which cuts sample sizes by 35%. Further, the underlying satellite data is coarser, available at 2.5 by 2.5 degree resolution, as compared to the 0.5 by 0.5 degree resolution of our main data set, which is thus built from approximately 25 times as many climate observations over a given area. Using satellite data, the coefficients on temperature x poor are generally similar in magnitude to those estimated using the ground-based temperature data, but tend to be noisier.

Table A28: Main panel results with satellite temperature data

	Dependent variable is the annual growth rate				
	(1)	(2)	(3)	(4)	(5)
Temperature	-0.634*	-0.346	-0.396	-0.514	-0.348
	(0.382)	(0.353)	(0.353)	(0.344)	(0.350)
Temperature interacted with…					
Poor country dummy		-0.786	-0.658	-0.693	-0.197
		(0.672)	(0.681)	(0.692)	(1.129)
Hot country dummy				0.555	
				(0.815)	
Agricultural country dummy					-0.159
					(1.151)
Precipitation			-0.110**	-0.163*	-0.117*
			(0.051)	(0.092)	(0.068)
Precipitation interacted with…					
Poor country dummy			0.183*	0.199*	0.254**
			(0.097)	(0.103)	(0.109)
Hot country dummy				0.065	
				(0.102)	
Agricultural country dummy					0.006
					(0.089)
Observations	3213	3213	3213	3213	2877
R-squared	0.16	0.16	0.16	0.16	0.16
Temperature effect in poor countries		-1.132*	-1.054	-1.207*	-0.545
		(0.674)	(0.684)	(0.708)	(1.174)
Precipitation effect in poor countries			0.073	0.036	0.137
			(0.083)	(0.089)	(0.122)

Notes: All specifications use PWT data and include country FE, region year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A29: Models with lags using satellite temperature data

	(1) No lags	(2) 1 lag	(3) 3 lags	(4) 5 lags
Temperature × Poor	-1.132*	-1.117*	-1.054*	-0.434
	(0.674)	(0.672)	(0.628)	(0.703)
L1: Temperature × Poor		-0.144	-0.684	-0.489
		(0.613)	(0.648)	(0.579)
L2: Temperature × Poor			0.932	1.044
			(1.138)	(1.254)
L3: Temperature × Poor			-2.223***	-2.196***
			(0.743)	(0.817)
Temperature × Rich	-0.346	-0.353	-0.401	-0.38
	(0.353)	(0.354)	(0.392)	(0.429)
L1: Temperature × Rich		0.293	0.452	0.315
		(0.344)	(0.323)	(0.336)
L2: Temperature × Rich			-0.545	-0.666*
			(0.343)	(0.371)
L3: Temperature × Rich			0.407	0.141
			(0.276)	(0.322)
Includes precipitation vars.	NO	NO	NO	NO
Observations	3213	3213	2945	2677
R-squared	0.16	0.16	0.17	0.17
Sum of all temp. coeff.	-1.132 *	-1.261	-3.029*	-3.447
in poor countries	(0.674)	(0.917)	(1.808)	(2.952)

Notes: All specifications use PWT data and include country FE, region year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5%, and ***1%

Table A30: Alternative specifications of panel results using satellite temperature data

	(1) Baseline	(2) All FE and country specific trends	(3) Country FE and Region×Yr FE only	(4) Country FE and Year FE only	(5) Balanced sample: 1971 - 2003	(6) GDP data from WDI	(7) Sub-Saharan Africa Only	(8) Sub-Saharan Africa Excluded
Panel A: Models with no lags								
Temp. immediate effect – Poor	-1.054	-0.645	-1.439**	-0.832	-1.077	-0.355	0.284	-1.388*
	(0.684)	(0.624)	(0.601)	(0.699)	(0.685)	(0.470)	(1.428)	(0.813)
Temp. immediate effect – Rich	-0.396	-0.229	-0.591**	-0.328	-0.39	-0.051	-0.468	-0.497
	(0.353)	(0.311)	(0.284)	(0.363)	(0.350)	(0.222)	(1.076)	(0.368)
Precip. immediate effect – Poor	0.073	0.089	0.097	0.085	0.074	0.081	0.374**	-0.074
	(0.083)	(0.083)	(0.079)	(0.095)	(0.083)	(0.063)	(0.148)	(0.081)
Precip. immediate effect – Rich	-0.110**	-0.124***	-0.069	-0.089	-0.108**	-0.104***	0.346**	-0.120**
	(0.051)	(0.045)	(0.050)	(0.073)	(0.050)	(0.036)	(0.169)	(0.047)
Observations	3213	3213	3213	3213	3192	2977	984	2229
Panel B: Models with 5 lags								
Temp. cumulative effect – Poor	-2.691	-0.353	-2.736*	-2.569	-2.681	-3.689*	-14.712	1.274
	(2.871)	(1.457)	(1.489)	(3.663)	(2.884)	(2.150)	(9.307)	(3.476)
Temp. cumulative effect – Rich	-2.233**	-1.376	-2.850***	-2.148	-2.225**	-1.848**	2.455	-2.174**
	(1.052)	(1.119)	(0.961)	(1.402)	(1.049)	(0.923)	(6.852)	(1.059)
Precip. cumulative effect – Poor	0.360*	0.350*	0.396*	0.542*	0.362*	0.363	1.003*	0.087
	(0.190)	(0.186)	(0.204)	(0.316)	(0.192)	(0.222)	(0.559)	(0.127)
Precip. cumulative effect – Rich	-0.315***	-0.339***	-0.229***	-0.367***	-0.312***	-0.233***	0.859	-0.320***
	(0.067)	(0.072)	(0.066)	(0.114)	(0.068)	(0.067)	(0.605)	(0.068)
Observations	2677	2677	2677	2677	2660	2512	820	1857

Notes: Specifications use PWT data and include country FE, region year FE, and poor x year FE unless otherwise noted. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5%, and ***1%

Section 14: Different Time Periods

The following tables report the baseline results splitting the sample into two periods: 1961 to 1979 and 1980 to 2003. The estimated temperature x poor effect tends to be larger in the earlier period, but the negative effect of temperature increases in poor countries appears in both periods and the difference in estimates between the periods is not statistically significant

Table A31: Early Period (1961-1979)

	(1)	(2)	(3)	(4)	(5)
Temperature	-0.764	0.211	0.199	0.615	0.301
	(0.604)	(0.625)	(0.629)	(0.504)	(0.688)
Temperature interacted with…					
Poor country dummy		-2.635**	-2.689**	-2.457*	-1.755
		(1.268)	(1.304)	(1.297)	(1.212)
Hot country dummy				-1.930*	
				(1.104)	
Agricultural country dummy					-1.482
					(1.008)
Precipitation			-0.073	-0.255*	-0.056
			(0.122)	(0.133)	(0.128)
Precipitation interacted with…					
Poor country dummy			-0.012	0.005	0.012
			(0.167)	(0.164)	(0.209)
Hot country dummy				0.277**	
				(0.126)	
Agricultural country dummy					-0.067
					(0.209)
Observations	1672	1672	1672	1672	1615
R-squared	0.26	0.26	0.26	0.27	0.27
Temperature effect in poor countries		-2.424**	-2.491**	-1.842*	-1.454
		(1.036)	(1.081)	(1.110)	(1.012)
Precipitation effect in poor countries			-0.0846	-0.251	-0.0435
			(0.122)	(0.157)	(0.197)

Notes: All specifications use WDI data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A32: Later Period (1980-2003)

	(1)	(2)	(3)	(4)	(5)
Temperature	-0.203	0.355	0.332	0.290	0.319
	(0.318)	(0.338)	(0.337)	(0.327)	(0.366)
Temperature interacted with…					
Poor country dummy		-1.709***	-1.670***	-1.694***	-1.961***
		(0.550)	(0.547)	(0.547)	(0.695)
Hot country dummy				0.189	
				(0.635)	
Agricultural country dummy					0.477
					(0.652)
Precipitation			-0.118**	-0.173*	-0.121**
			(0.057)	(0.090)	(0.058)
Precipitation interacted with…					
Poor country dummy			0.134	0.133	0.087
			(0.114)	(0.110)	(0.137)
Hot country dummy				0.087	
				(0.102)	
Agricultural country dummy					0.070
					(0.132)
Observations	2112	2112	2112	2112	2040
R-squared	0.26	0.27	0.27	0.27	0.27
Temperature effect in poor countries		-1.354***	-1.339***	-1.404***	-1.642**
		(0.466)	(0.459)	(0.458)	(0.710)
Precipitation effect in poor countries			0.0159	-0.0402	-0.0336
			(0.103)	(0.110)	(0.127)

Notes: All specifications use WDI data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.
* significant at 10%; ** significant at 5%; *** significant at 1%

Section 15: Miscellaneous Further Information and Results

Table A33: Country List

Country	Code	Temperature
Poor - Eastern Europe and Central Asia		
Romania	ROM	9.06
Poor - Latin America		
Bolivia	BOL	18.80
Dominican Republic	DOM	25.27
Ecuador	ECU	20.41
Guatemala	GTM	20.98
Haiti	HTI	24.22
Honduras	HND	24.03
Poor - Middle East and North Africa		
Egypt	EGY	21.15
Morocco	MAR	16.94
Syria	SYR	17.31
Tunisia	TUN	18.49
Turkey	TUR	12.13
Poor - South and East Asia		
Bangladesh	BGD	25.59
Bhutan	BTN	11.41
China	CHN	13.66
India	IND	25.21
Indonesia	IDN	25.56
Korea, Republic of	KOR	11.25
Malaysia	MYS	26.03
Mongolia	MNG	-1.03
Nepal	NPL	20.20
Pakistan	PAK	22.54
Papua New Guinea	PNG	21.93
Philippines	PHL	25.51
Solomon Islands	SLB	27.24
Sri Lanka	LKA	26.80
Thailand	THA	26.83
Vanuatu	VUT	24.61

Poor - Sub Saharan Africa		
Angola	AGO	22.51
Benin	BEN	27.02
Botswana	BWA	20.88
Burkina Faso	BFA	27.69
Burundi	BDI	20.15
Cameroon	CMR	24.24
Cape Verde	CPV	23.51
Central African Republic	CAF	24.32
Chad	TCD	27.81
Comoros	COM	25.79
Congo, Dem. Rep.	ZAR	23.20
Congo, Republic of	COG	24.10
Cote d`Ivoire	CIV	26.13
Gambia, The	GMB	26.17
Ghana	GHA	26.56
Guinea-Bissau	GNB	26.73
Kenya	KEN	20.03
Lesotho	LSO	12.22
Liberia	LBR	25.79
Madagascar	MDG	20.73
Malawi	MWI	22.72
Mali	MLI	28.30
Mauritania	MRT	28.56
Mozambique	MOZ	24.34
Niger	NER	28.14
Nigeria	NGA	26.73
Rwanda	RWA	19.76
Senegal	SEN	27.21
Sierra Leone	SLE	26.07
Somalia	SOM	26.73
Sudan	SDN	27.71
Togo	TGO	26.18
Uganda	UGA	22.37
Zambia	ZMB	21.49
Zimbabwe	ZWE	20.62
Rich - Eastern Europe and Central Asia		
Albania	ALB	13.30
Bulgaria	BGR	10.01
Cyprus	CYP	19.61
Hungary	HUN	10.29

Rich - Latin American Countries		
Argentina	ARG	17.15
Bahamas	BHS	25.07
Belize	BLZ	25.51
Brazil	BRA	21.91
Chile	CHL	11.34
Colombia	COL	21.41
Costa Rica	CRI	22.31
El Salvador	SLV	23.30
Guyana	GUY	26.82
Jamaica	JAM	24.72
Mexico	MEX	18.63
Nicaragua	NIC	25.59
Panama	PAN	24.86
Paraguay	PRY	22.20
Peru	PER	13.78
St.Vincent & Grenadines	VCT	26.05
Suriname	SUR	26.70
Trinidad &Tobago	TTO	25.81
Uruguay	URY	17.21
Venezuela	VEN	25.34
Rich - Middle East and North Africa		
Algeria	DZA	16.79
Iran	IRN	14.15
Israel	ISR	19.91
Jordan	JOR	17.62
Kuwait	KWT	25.39
Libya	LBY	20.27
Oman	OMN	25.26
Saudi Arabia	SAU	25.21
United Arab Emirates	ARE	26.82
Rich - South and East Asia		
Brunei	BRN	26.96
Fiji	FJI	23.87
Japan	JPN	13.15
Samoa	WSM	26.03
Rich - Sub Saharan Africa		
Gabon	GAB	24.61
Mauritius	MUS	24.11
South Africa	ZAF	17.50

Swaziland	SWZ	20.69
Rich - Western Europe and Offshoots		
Australia	AUS	15.96
Austria	AUT	7.61
Belgium	BEL	9.98
Canada	CAN	4.95
Denmark	DNK	7.87
Finland	FIN	3.28
France	FRA	10.66
Germany	DEU	8.90
Greece	GRC	14.63
Iceland	ISL	2.53
Ireland	IRL	9.17
Italy	ITA	11.84
Luxembourg	LUX	9.09
Netherlands	NLD	9.91
New Zealand	NZL	11.98
Norway	NOR	3.62
Portugal	PRT	15.06
Spain	ESP	13.91
Sweden	SWE	5.45
Switzerland	CHE	5.31
United Kingdom	GBR	9.19
United States	USA	12.96

Note: Temperature is the mean population-weighted temperature for the country over the sample period.

Table A34: Full Set of Lags Reported for 10 Lag model

Temp * Poor	-1.580***	Temp * Rich	0.234
	(0.579)		(0.356)
L1: Temp * Poor	0.627	L1: Temp * Rich	0.168
	(0.481)		(0.323)
L2: Temp * Poor	-0.354	L2: Temp * Rich	0.172
	(0.586)		(0.273)
L3: Temp * Poor	-0.152	L3: Temp * Rich	-0.137
	(0.506)		(0.286)
L4: Temp * Poor	0.3	L4: Temp * Rich	-0.144
	(0.505)		(0.270)
L5: Temp * Poor	-0.339	L5: Temp * Rich	-0.479*
	(0.492)		(0.290)
L6: Temp * Poor	0.615	L6: Temp * Rich	0.100
	(0.586)		(0.282)
L7: Temp * Poor	0.659	L7: Temp * Rich	-0.318
	(0.581)		(0.354)
L8: Temp * Poor	-0.35	L8: Temp * Rich	0.031
	(0.612)		(0.317)
L9: Temp * Poor	-0.377	L9: Temp * Rich	-0.063
	(0.515)		(0.332)
L10: Temp * Poor	0.092	L10: Temp * Rich	0.248
	(0.560)		(0.297)

Notes: The specification uses WDI data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for two-way clustering at parent-country and year-region levels. Sample includes all countries with at least 20 years of growth observations. The specification also includes Precipitation × Poor and Precipitation × Rich, with the same number of lags as the temperature variables shown in the table. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A35: Heterogeneity by Initial Precipitation

	(1)	(2)
Temperature	0.262	0.262
	(0.311)	(0.368)
Temperature interacted with…		
Poor country dummy	-1.610***	-1.603***
	(0.485)	(0.476)
Rainy country dummy		0.006
		(0.383)
Precipitation	-0.083*	-0.058
	(0.050)	(0.098)
Precipitation interacted with…		
Poor country dummy	0.153*	0.155**
	(0.078)	(0.079)
Rainy country dummy		-0.029
		(0.112)
Observations	4924	4924
R-squared	0.22	0.22
Temperature effect in poor countries	-1.347***	-1.341***
	(0.408)	(0.442)
Precipitation effect in poor countries	0.0698	0.0970
	(0.058)	(0.114)

Notes: All specifications use WDI data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above median average temperature in the 1950s. Agricultural is defined as a dummy for a country having above median share of GDP in agriculture in 1995. Temperature is in degrees Celsius and precipitation is in units of 100mm per year.

* significant at 10%; ** significant at 5%; *** significant at 1%

Table A36: Political economy effects

	(1)	(2)	(3)	(4)
	Any change in POLITY score	Improvement in Polity	Deterioration in Polity	POLITY interregnum period
Temperature	-0.013	-0.009	0.001	-0.016**
	(0.009)	(0.007)	(0.005)	(0.007)
Temperature X Poor	0.040**	0.005	0.015	0.029**
	(0.016)	(0.014)	(0.010)	(0.013)
Precipitation	-0.001	-0.001	0.000	0.001
	(0.003)	(0.002)	(0.002)	(0.001)
Precipitation X Poor	-0.008	-0.007*	0.002	-0.005*
	(0.005)	(0.004)	(0.003)	(0.003)
Obs.	5388	5388	5388	5388
Temperature effect in poor countries	0.027*	-0.003	0.016*	0.013
	(0.015)	(0.013)	(0.009)	(0.012)
Precipitation effect in poor countries	-0.009**	-0.008**	0.001	-0.004
	(0.004)	(0.003)	(0.002)	(0.003)

Notes: All columns use data from the POLITY IV dataset and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for two-way clustering at parent-country and year-region levels.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A37: Models with leads (WDI)

	(1) No leads	(2) 1 lead	(3) 1 lead	(4) 5 leads	(5) 10 leads	(6) 1 lead	(7) 5 leads	(8) 10 leads
Tem x Poor	-1.394***		-1.644***	-1.842***	-1.833***	-1.784***	-1.906***	-2.012***
	(0.369)		(0.469)	(0.500)	(0.519)	(0.482)	(0.555)	(0.570)
Lead1: Tem x Poor		-0.174	0.521	0.238	0.691	0.459	0.270	0.675
		(0.380)	(0.444)	(0.535)	(0.496)	(0.450)	(0.546)	(0.509)
Lead2: Tem x Poor				0.017	-0.229		-0.022	-0.212
				(0.490)	(0.477)		(0.486)	(0.503)
Lead3: Tem x Poor				-0.448	-0.238		-0.411	-0.092
				(0.462)	(0.492)		(0.467)	(0.494)
Tem x Rich	0.261		0.329	0.259	0.501	0.28	0.234	0.400
	(0.304)		(0.282)	(0.298)	(0.360)	(0.260)	(0.278)	(0.330)
Lead1: Tem x Rich		-0.053	-0.16	-0.137	-0.146	-0.178	-0.115	-0.124
		(0.285)	(0.232)	(0.245)	(0.297)	(0.229)	(0.250)	(0.300)
Lead2: Tem x Rich				0.036	-0.082		0.059	-0.054
				(0.228)	(0.278)		(0.227)	(0.282)
Lead3: Tem x Rich				-0.158	-0.28		-0.119	-0.248
				(0.225)	(0.243)		(0.226)	(0.254)
Includes lags	NO	NO	NO	NO	NO	YES	YES	YES
Observations	4924	4800	4800	4301	3683	4800	4293	3665
R-squared	0.22	0.22	0.23	0.23	0.26	0.23	0.23	0.23
Sum of all temp leads			0.521	0.686	1.27	0.459	0.715	1.349
in poor countries			(0.444)	(0.697)	(0.953)	{0.450)	{0.737)	{0.972)
Sum of all temp leads			-0.160	-0.286	-1.013	-0.178	-0.171	-1.022
in rich countries			(0.232)	(0.472)	(0.665)	{0.229)	{0.477)	{0.642)

Notes: All specifications use WDI data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Columns (6) – (8) also include temperature lags interacted with poor and rich, with the number of lags equal to the number of leads given in the column headings. Columns (4) and (7) also include the 4th and 5th leads – and, in column (7), lags - of Tem x Poor and Tem x Rich. Similarly columns (5) and (8) also include the 4th through 10th leads – and, in column (8), lags - of Tem x Poor and Tem x Rich; those coefficients are suppressed in the table to save space.. Sum of all leads in poor countries shows the sum of all of the leads of Tem x Poor included in the regression; sum of all leads in rich countries is calculated analogously.* significant at 10%; ** significant at 5%; *** significant at 1%

Table A38: Models with leads (PWT)

	(1) No leads	(2) 1 lead	(3) 1 lead	(4) 5 leads	(5) 10 leads	(6) 1 lead	(7) 5 leads	(8) 10 leads
Tem x Poor	-1.087**		-1.231**	-1.042*	-1.265	-1.123**	-0.900*	-1.623**
	(0.442)		(0.513)	(0.534)	(0.850)	(0.468)	(0.518)	(0.779)
Lead1: Tem x Poor		-0.066	0.404	0.206	0.650	0.449	0.352	0.959
		(0.745)	(0.812)	(0.853)	(1.114)	(0.906)	(0.907)	(1.329)
Lead2: Tem x Poor				0.572	0.435		0.580	0.524
				(0.676)	(0.721)		(0.746)	(0.821)
Lead3: Tem x Poor				0.225	0.300		0.156	0.316
				(0.488)	(0.479)		(0.498)	(0.534)
Tem x Rich	0.219		0.266	0.225	0.456*	0.234	0.297	0.576**
	(0.210)		(0.213)	(0.216)	(0.254)	(0.232)	(0.227)	(0.282)
Lead1: Tem x Rich		0.003	-0.093	-0.193	-0.202	-0.107	-0.234	-0.209
		(0.248)	(0.252)	(0.268)	(0.299)	(0.252)	(0.275)	(0.331)
Lead2: Tem x Rich				-0.044	-0.038		0.112	0.017
				(0.313)	(0.354)		(0.293)	(0.367)
Lead3: Tem x Rich				0.412	0.511		0.479	0.654
				(0.409)	(0.467)		(0.452)	(0.549)
Includes lags	NO	NO	NO	NO	NO	YES	YES	YES
Observations	6014	5879	5879	5337	4657	5879	5108	4092
R-squared	0.14	0.15	0.15	0.15	0.18	0.15	0.16	0.18
Sum of all temp leads		-0.066	0.404	0.231	0.364	0.449	0.363	0.871
in poor countries		(0.745)	(0.812)	(1.021)	(1.191)	(0.906)	(1.206)	(1.430)
Sum of all temp leads		0.003	-0.093	0.420	0.457	-0.107	0.682	0.631
in rich countries		(0.248)	(0.252)	(0.596)	(0.891)	(0.252)	(0.690)	(1.140)

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Columns (6) – (8) also include temperature lags interacted with poor and rich, with the number of lags equal to the number of leads given in the column headings. Columns (4) and (7) also include the 4th and 5th leads – and, in column (7), lags - of Tem x Poor and Tem x Rich. Similarly columns (5) and (8) also include the 4th through 10th leads – and, in column (8), lags - of Tem x Poor and Tem x Rich; those coefficients are suppressed in the table to save space.. Sum of all leads in poor countries shows the sum of all of the leads of Tem x Poor included in the regression; sum of all leads in rich countries is calculated analogously.* significant at 10%; ** significant at 5%; *** significant at 1%

Table A39: Examining Non-Linearities in Temperature

	(1)	(2)
	Full Sample	
Tem x Above Country Mean	0.013	
	(0.272)	
Tem x Poor x Above Country Mean	-1.399**	
	(0.618)	
Tem x Below Country Mean	-0.008	
	(0.286)	
Tem x Poor x Below Country Mean	-1.398**	
	(0.637)	
Tem x Hot Country		0.488
		(0.463)
Tem x Poor x Hot Country		-1.550*
		(0.912)
Tem x Cold Country		0.123
		(0.204)
Tem x Poor x Cold Country		-1.217***
		(0.420)
Observations	6014	6014
R-squared	0.15	0.14
Tem effect: poor and temp above country mean	-1.386** (0.562)	
Tem effect: poor and temp below country mean	-1.406** (0.577)	
Tem effect: poor and hot		-1.062
		(0.811)
Tem effect: poor and cold		-1.095***
		(0.354)

Notes: All specifications use PWT data and include country FE, region × year FE, and poor x year FE. Robust standard errors in parentheses, adjusted for clustering at parent-country level. Sample includes all countries with at least 20 years of growth observations. Poor is defined as a dummy for a country having below median PPP gdp per capita in its first year in the data. Hot is defined as a dummy for a country having above global median average temperature in the 1950s, and cold is defined analogously. Above is a dummy equal to one if a country's temperature was above the country average in a given year, and equal to zero otherwise. Below is defined analogously. Temperature is in degrees Celsius.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A40

	(1)	(2)	(3)	(4)
	Alternative comparison years			
Change in Temperature	0.879	-1.365	1.080	0.190
	(0.706)	(0.942)	(0.944)	(0.891)
Change in Tem X Poor Country	-2.310*	0.490	-3.346**	-1.848
	(1.195)	(1.065)	(1.680)	(1.546)
Change in Precipitation	-0.045	-0.299	-0.058	-0.008
	(0.111)	(0.220)	(0.220)	(0.107)
Change in Pre X Poor Country	0.100	0.535	0.423	0.149
	(0.226)	(0.325)	(0.435)	(0.234)
Region FE	Yes	Yes	Yes	Yes
Poor Country Dummy	Yes	Yes	Yes	Yes
Early Period	1970-1987	1961-1970	1971-1980	1981-1990
Late Period	1988-2003	1991-2000	1991-2000	1991-2000
Observations	125	101	112	124
R-squared	0.09	0.26	0.18	0.17
Within R-squared	0.03	0.05	0.08	0.02
Tem effect on poor countries	-1.431	-0.875	-2.266	-1.658
	(0.982)	(0.688)	(1.399)	(1.279)
Pre effect on poor Countries	0.055	0.236	0.365	0.141
	(0.187)	(0.232)	(0.396)	(0.209)

Notes: All specifications have one observation per country. Change in temperature and precipitation are computed for each country as the difference between the mean value in the Late Period and the mean value in the Early Period (these periods are indicated in the table for each specification). The dependent variable is the change in mean growth rate comparing the indicated Late and Early Periods. Region fixed effects and a dummy for being an initially poor country are included as indicated for each specification. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.