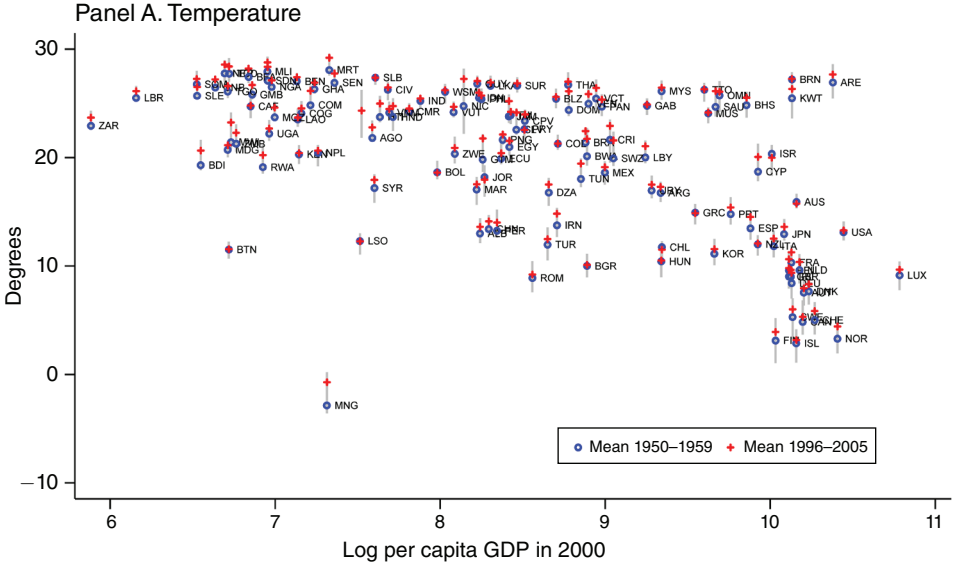

Panel A. Temperature
Degrees
30
20
10
0
−10
6
7
8
9
10
11
Log per capita GDP in 2000
Mean 1950–1959
Mean 1996–2005
ZAR
LBR
SLE
GIN
GNB
TGO
GMB
CAF
COG
MDG
UGA
RWA
BDI
MLI
BFA
NGA
BEN
GHA
SEN
MRT
CIV
COM
LAO
NPL
SLB
AGO
SYR
LSO
BTN
MNG
IND
WSM
VUT
NIC
SLV
GTM
HND
CMR
PNG
ZWE
BOL
JOR
MAR
DZA
TUN
IRN
TUR
ROM
BGR
HUN
CHL
KOR
MEX
COL
BRA
CRI
ECU
EGY
PRY
PAN
DOM
JAM
CPV
THA
BLZ
SUR
LCA
VCT
MYS
GAB
TTO
OMN
SAU
MUS
BHS
BRN
KWT
ARE
ISR
CYP
LBY
SWZ
BWA
AUS
GRC
PRT
ESP
JPN
NZL
ITA
USA
LUX
FRA
NLD
BEL
DNK
SWE
FIN
ISL
NOR
CHE
AUT
DEU
GBR
IRL
CAN

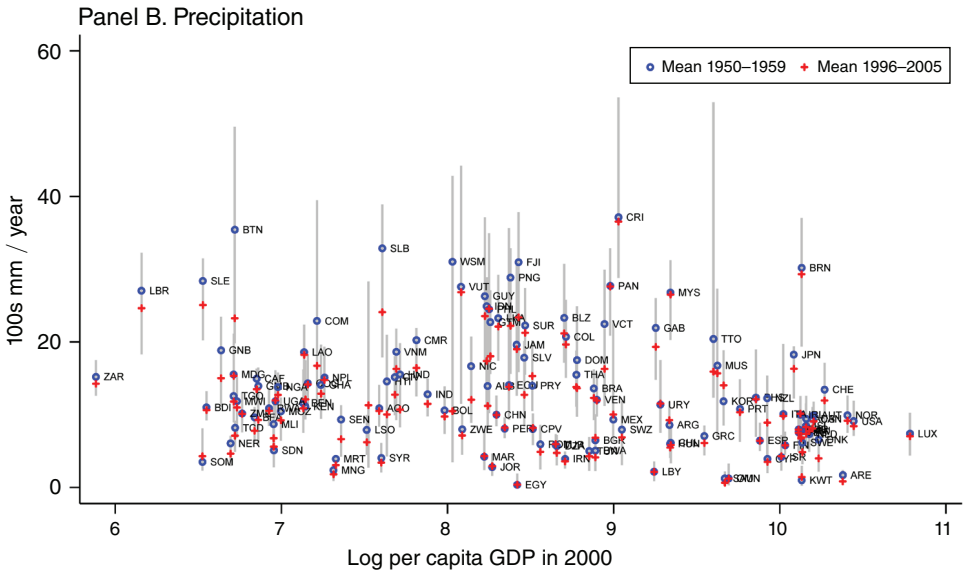


FIGURE 1. CHANGES AND VARIABILITY IN TEMPERATURE AND PRECIPITATION

TABLE 2—MAIN PANEL RESULTS

Dependent variable is the annual growth rate	(1)	(2)	(3)	(4)	(5)
Temperature	−0.325	0.261	0.262	0.172	0.561*
	(0.285)	(0.312)	(0.311)	(0.294)	(0.319)
Temperature interacted with…					
Poor country dummy		−1.655***	−1.610***	−1.645***	−1.806***
		(0.485)	(0.485)	(0.483)	(0.456)
Hot country dummy				0.237	
				(0.568)	
Agricultural country dummy					−0.371
					(0.409)
Precipitation			−0.083*	−0.228***	−0.105**
			(0.050)	(0.074)	(0.053)
Precipitation interacted with…					
Poor country dummy			0.153*	0.160**	0.145*
			(0.078)	(0.075)	(0.087)
Hot country dummy				0.185**	
				(0.078)	
Agricultural country dummy					0.010
					(0.085)
Observations	4,924	4,924	4,924	4,924	4,577
Within R^2	0.00	0.00	0.00	0.01	0.01
R^2	0.22	0.22	0.22	0.22	0.24
Temperature effect in poor countries		−1.394***	−1.347***	−1.473***	−1.245***
		(0.408)	(0.408)	(0.440)	(0.463)
Precipitation effect in poor countries			0.069	−0.0677	0.0401
			(0.058)	(0.073)	(0.089)

Notes: All specifications use WDI data and include country FE, region × year FE, and poor × year FE. Robust standard errors are 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 100 mm per year.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

TABLE 3—MODELS WITH LAGS

	No lags (1)	1 lag (2)	5 lags (3)	10 lags (4)	No lags (5)	1 lag (6)	5 lags (7)	10 lags (8)
Temperature × Poor	−1.394***	−1.610***	−1.555***	−1.597***	−1.347***	−1.559***	−1.514***	−1.580***
	(0.408)	(0.525)	(0.572)	(0.565)	(0.408)	(0.522)	(0.577)	(0.579)
L1: Temperature × Poor		0.514	0.614	0.572		0.576	0.666	0.627
		(0.439)	(0.489)	(0.498)		(0.433)	(0.479)	(0.481)
L2: Temperature × Poor			−0.334	−0.368			−0.338	−0.354
			(0.566)	(0.580)			(0.570)	(0.586)
L3: Temperature × Poor			−0.105	−0.175			−0.064	−0.152
			(0.480)	(0.489)			(0.489)	(0.506)
Temperature × Rich	0.261	0.206	0.227	0.219	0.262	0.215	0.235	0.234
	(0.312)	(0.323)	(0.330)	(0.348)	(0.311)	(0.322)	(0.338)	(0.356)
L1: Temperature × Rich		0.135	0.143	0.166		0.137	0.143	0.168
		(0.300)	(0.297)	(0.317)		(0.298)	(0.299)	(0.323)
L2: Temperature × Rich			0.165	0.158			0.181	0.172
			(0.257)	(0.263)			(0.262)	(0.273)
L3: Temperature × Rich			−0.100	−0.129			−0.110	−0.137
			(0.271)	(0.277)			(0.277)	(0.286)
Includes precipitation vars.	No	No	No	No	Yes	Yes	Yes	Yes
Observations	4,924	4,924	4,916	4,906	4,924	4,924	4,916	4,906
R^2	0.22	0.22	0.22	0.23	0.22	0.22	0.23	0.23
Within R^2	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01
Sum of all temp. coeff. in poor countries	−1.394***	−1.096***	−1.235**	−1.171*	−1.347***	−0.983**	−1.041**	−0.858
	(0.408)	(0.418)	(0.527)	(0.611)	(0.408)	(0.416)	(0.530)	(0.647)
Sum of all temp. coeff. in rich countries	0.261	0.341	−0.180	−0.152	0.262	0.352	−0.191	−0.189
	(0.312)	(0.400)	(0.566)	(0.786)	(0.311)	(0.396)	(0.546)	(0.758)

Notes: All specifications use WDI data and include country FE, region × year FE, and poor × year FE. Robust standard errors are 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. Columns 5–8 also include Precipitation × Poor and Precipitation × Rich, with the same number of lags as the temperature variables shown in the table. Columns 3 and 7 also include the fourth and fifth lags of Temperature × Poor, Temperature × Rich, Precipitation × Poor and Precipitation × Rich. Similarly columns 4 and 8 also include the fourth through tenth lags of Temperature × Poor, Temperature × Rich, Precipitation × Poor and Precipitation × Rich; those coefficients are suppressed in the table to save space. Sum of all temperature coefficients in poor countries shows the sum (and calculated standard error) of Temperature × Poor and all of the lags of Temperature × Poor included in the regression; sum of all temperature coefficients in rich countries is calculated analogously.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

TABLE 4—ALTERNATIVE SPECIFICATIONS OF PANEL RESULTS

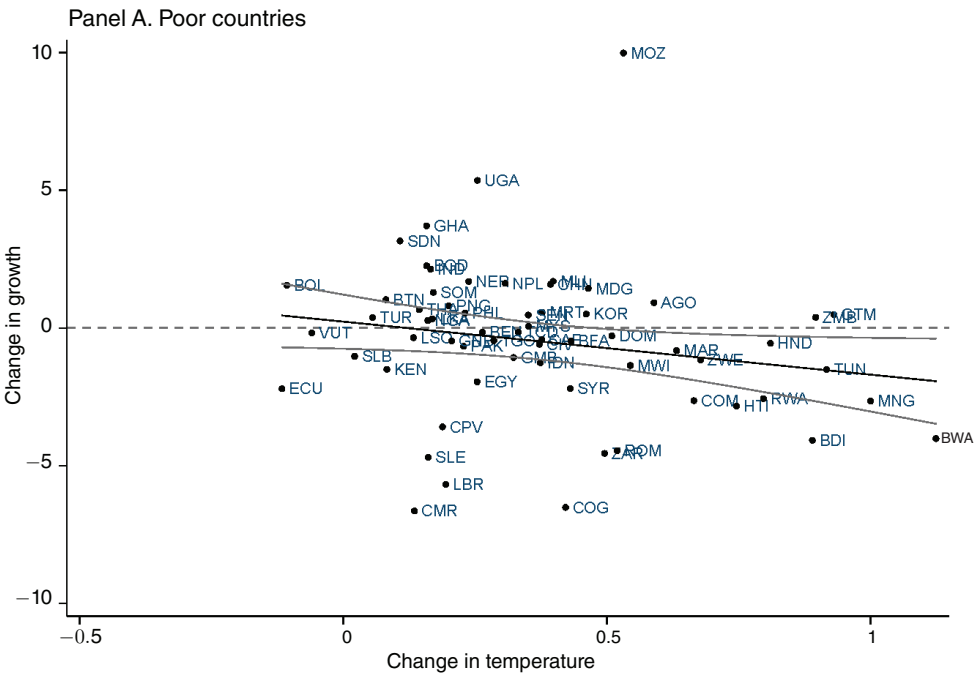
	Baseline (1)	All FE and country specific trends (2)	Balanced sample: 1971–2003 (3)	Add countries with < 20 years of data (4)	GDP data from PWT (5)	Area-weighted climate data (6)	Sub-Saharan Africa only (7)	Sub-Saharan Africa excluded (8)
Panel A. Models with no lags								
Temp. immediate effect—poor	−1.347***	−1.723***	−1.377***	−1.158***	−0.860***	−0.891**	−1.881***	−0.904*
	(0.408)	(0.603)	(0.484)	(0.424)	(0.299)	(0.347)	(0.631)	(0.531)
Temp. immediate effect—rich	0.262	0.417	0.387	0.595	0.343	0.480**		0.295
	(0.311)	(0.473)	(0.323)	(0.381)	(0.228)	(0.220)		(0.323)
Precip. immediate effect—poor	0.070	0.026	0.040	0.029	0.050	0.074	0.131	0.032
	(0.058)	(0.137)	(0.084)	(0.051)	(0.069)	(0.063)	(0.111)	(0.071)
Precip. immediate effect—rich	−0.083*	−0.066	−0.101*	−0.022	−0.074	−0.087		−0.087*
	(0.050)	(0.089)	(0.058)	(0.061)	(0.060)	(0.056)		(0.053)
Observations	4,924	4,924	2,592	5,396	5,494	4,924	1,366	3,430
Panel B. Models with 5 lags								
Temp. cumulative effect—poor	−1.041**	−2.025**	−0.931	−1.067**	−0.738***	−0.874*	−0.705	−1.318*
	(0.530)	(0.907)	(0.943)	(0.494)	(0.269)	(0.522)	(0.840)	(0.684)
Temp. cumulative effect—rich	−0.191	0.245	0.276	−0.073	−0.022	−0.053		−0.377
	(0.546)	(0.961)	(0.654)	(0.582)	(0.517)	(0.504)		(0.562)
Precip. cumulative effect—poor	0.238	0.211	0.221	0.084	0.193	0.241	0.868	−0.003
	(0.194)	(0.290)	(0.215)	(0.139)	(0.169)	(0.191)	(0.611)	(0.141)
Precip. cumulative effect—rich	−0.127	−0.084	−0.161	−0.039	−0.134	−0.129		−0.121
	(0.088)	(0.208)	(0.196)	(0.142)	(0.094)	(0.089)		(0.089)
Observations	4,916	4,916	2,592	5,285	5,272	4,916	1,366	3,422
Panel C. Models with 10 lags								
Temp. cumulative effect—poor	−0.858	−1.964	−0.951	−0.791	−0.768**	−0.683	−0.803	−0.969
	(0.647)	(1.211)	(1.242)	(0.641)	(0.337)	(0.635)	(0.994)	(0.843)
Temp. cumulative effect—rich	−0.189	0.582	0.198	−0.059	−0.443	−0.064		−0.469
	(0.758)	(1.414)	(0.913)	(0.827)	(0.822)	(0.738)		(0.783)
Precip. cumulative effect—poor	0.429*	0.573	0.455*	0.236	0.254	0.435**	0.922	0.234
	(0.227)	(0.413)	(0.244)	(0.180)	(0.182)	(0.221)	(0.770)	(0.153)
Precip. cumulative effect—rich	−0.195	−0.142	−0.141	−0.183	−0.070	−0.196		−0.180
	(0.137)	(0.370)	(0.394)	(0.178)	(0.134)	(0.138)		(0.143)
Observations	4,906	4,906	2,590	5,146	4,946	4,906	1,366	3,412

Notes: All specifications use WDI data and include country FE, region × year FE, and poor × year FE unless otherwise noted. Robust standard errors adjusted for two-way clustering at the parent-country and year-region levels are in parentheses. Except where noted, panel A follows the same specification as column 5 of Table 2, panel B follows the same specification as column 7 of Table 3, and panel C follows the same specification as column 8 of Table 3. In column 7, the sub-Saharan Africa sample incorporates three rich countries—South Africa, Gabon, and Mauritius.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.


Panel A. Poor countries
Change in growth
Change in temperature
10
5
0
−5
−10
−0.5
0
0.5
1
MOZ
UGA
GHA
SDN
BOL
NER
NPL
MLI
MDG
SOM
BTN
AGO
TUR
KOR
ZMB
VUT
DOM
HND
SLB
KEN
MAR
ZWE
TUN
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CPV
BDI
BWA
SLE
ZAR
LBR
CMR
COG

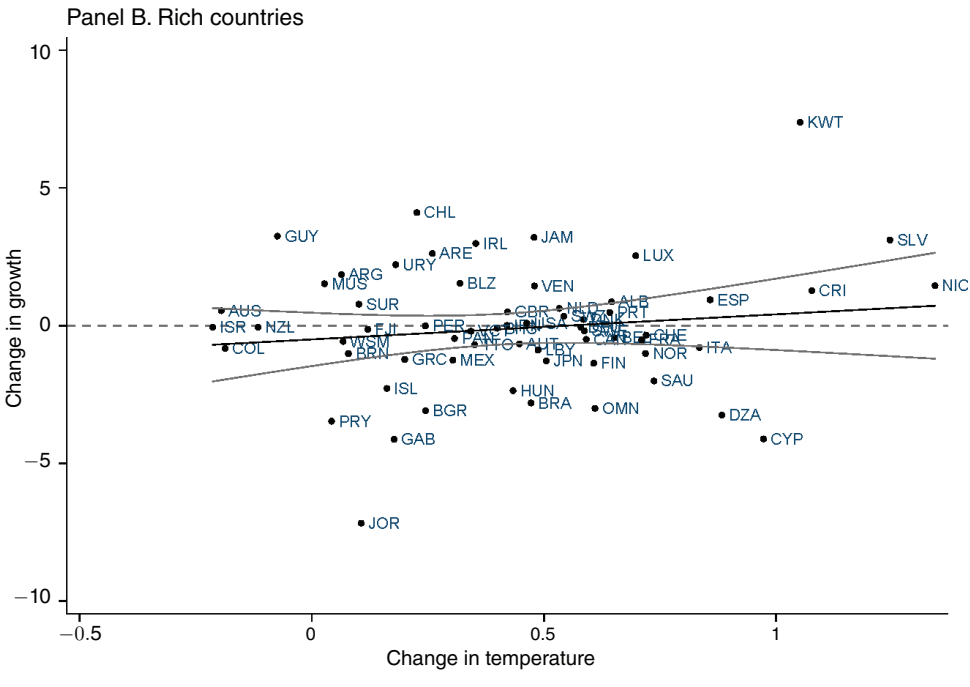

FIGURE 2. CHANGES IN GROWTH AND TEMPERATURE IN THE MEDIUM RUN

TABLE 7—CHANGES IN GROWTH AND TEMPERATURE IN THE MEDIUM RUN

	Dependent variable: change in mean growth rate						
	Baseline sample				Africa only	Excluding Africa	PWT data
	OLS		Median regression				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change in temperature	0.952	1.325	0.004	0.440	−1.654	1.318	1.576
	(1.021)	(0.980)	(0.584)	(0.747)	(2.250)	(1.004)	(1.135)
Change in temp. × poor country	−2.886**	−3.010**	−2.261**	−2.540**		−2.980**	−3.917**
	(1.420)	(1.456)	(0.932)	(1.177)		(1.435)	(1.532)
Change in precipitation	−0.070	−0.047	0.028	0.038	0.034	−0.020	0.025
	(0.097)	(0.123)	(0.113)	(0.111)	(0.565)	(0.121)	(0.111)
Change in precip. × poor country	0.060	0.050	0.120	0.315		0.009	0.010
	(0.191)	(0.214)	(0.182)	(0.208)		(0.212)	(0.238)
Region FE	No	Yes	No	Yes	No	Yes	Yes
Poor country dummy	Yes	Yes	Yes	Yes	No	Yes	Yes
Early period	1970–1985	1970–1985	1970–1985	1970–1985	1970–1985	1970–1985	1970–1985
Late period	1986–2000	1986–2000	1986–2000	1986–2000	1986–2000	1986–2000	1986–2000
Observations	125	125	125	125	35	87	120
R^2	0.04	0.11			0.06	0.19	0.12
Within R^2	0.03	0.04			0.04	0.04	0.06
Temp. effect on poor countries	−1.934*	−1.684	−2.257***	−2.100**	−1.654	−1.661	−2.341**
	(0.986)	(1.088)	(0.726)	(0.919)	(2.250)	(1.047)	(1.029)
Precip. effect on poor countries	−0.010	0.003	0.148	0.354**	0.034	−0.012	0.035
	(0.164)	(0.167)	(0.143)	(0.175)	(0.565)	(0.153)	(0.211)

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. For Africa only, we do not split out by poor/rich since we have so few rich country observations in sub-Saharan Africa.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

TABLE 5—COMPONENTS OF OUTPUT GROWTH

Panel A. Models with no lags

	Dependent variable is		
	Growth in agriculture value added	Growth in industrial value added	Growth in investment
	(1)	(2)	(3)
Temperature	No lags	No lags	No lags
Immediate effect—poor	−2.666***	−2.036**	−0.895
	(0.948)	(0.878)	(1.269)
Immediate effect—rich	−0.222	0.514	0.182
	(0.650)	(0.452)	(0.870)
Precipitation			
Immediate effect—poor	0.182	0.238	−0.019
	(0.135)	(0.146)	(0.223)
Immediate effect—rich	0.16	−0.007	−0.419*
	(0.119)	(0.100)	(0.217)
Observations	3,835	3,835	4,419

TABLE 6—POLITICAL ECONOMY EFFECTS

	Any change in POLITY score (1)	Leader transition (2)	Regular leader transition (3)	Irregular leader transition (4)	Start of conflicts (conditional on conflict = 0 in $t-1$) (5)	End of conflicts (conditional on conflict > 0 in $t-1$) (6)
Temperature	−0.013	−0.002	0.004	−0.005	−0.006	0.005
	(0.009)	(0.015)	(0.015)	(0.004)	(0.006)	(0.060)
Temperature × Poor	0.040**	0.033	−0.017	0.050***	0.012	0.003
	(0.016)	(0.023)	(0.017)	(0.013)	(0.013)	(0.068)
Precipitation	0.001	0.003	0.003	0.000	0.000	0.023
	(0.003)	(0.002)	(0.003)	(0.001)	(0.001)	(0.019)
Precipitation × Poor	0.008	−0.008*	−0.008**	0.000	0.000	−0.031
	(0.005)	(0.004)	(0.004)	(0.002)	(0.002)	(0.020)
Observations	5,388	6,624	6,624	6,624	5,702	852
R^2	0.14	0.18	0.2	0.11	0.09	0.43
Within R^2	0.003	0.001	0.001	0.004	0.000	0.004
Temperature effect in poor countries	0.027*	0.031*	−0.013	0.044***	0.007	0.008
	(0.015)	(0.017)	(0.010)	(0.013)	(0.011)	(0.037)
Precipitation effect in poor countries	−0.009**	−0.005	−0.005*	0.000	0.000	−0.009
	(0.004)	(0.004)	(0.003)	(0.002)	(0.002)	(0.007)

Notes: Column 1 uses data from the POLITY IV dataset; columns 2–4 use data from the Archigos dataset; and columns 5–6 use data from the PRIO dataset. Columns 1–4 include country FE, region × year FE, and poor × year FE; columns 5–6 include country FE and year FE. Robust standard errors are in parentheses, adjusted for two-way clustering at parent-country and year-region levels. Sample includes all countries with at least 20 years of WDI growth observations (i.e., the same set of countries considered in the previous tables).

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.