Temperature and convictions: evidence from India

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Online Appendix

A. Supplementary figures

(a) Champhai, Mizoram   (b) Vizianagaram, Andhra Pradesh

Figure A1. Example of Indian district courts.

Note: Photos of district court complexes in India were obtained from `https://districts.ecourts.gov.in/`
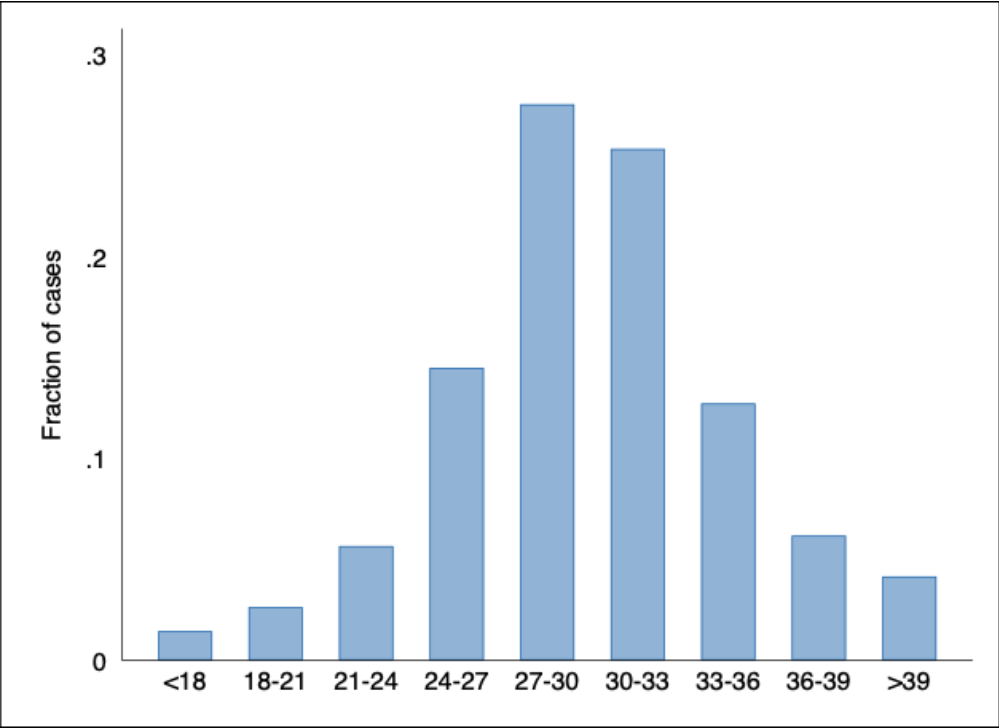
Figure A2. Distribution of daily maximum temperature for court cases.

Note: This figure plots the fraction of criminal court cases over maximum temperature bins in our sample.

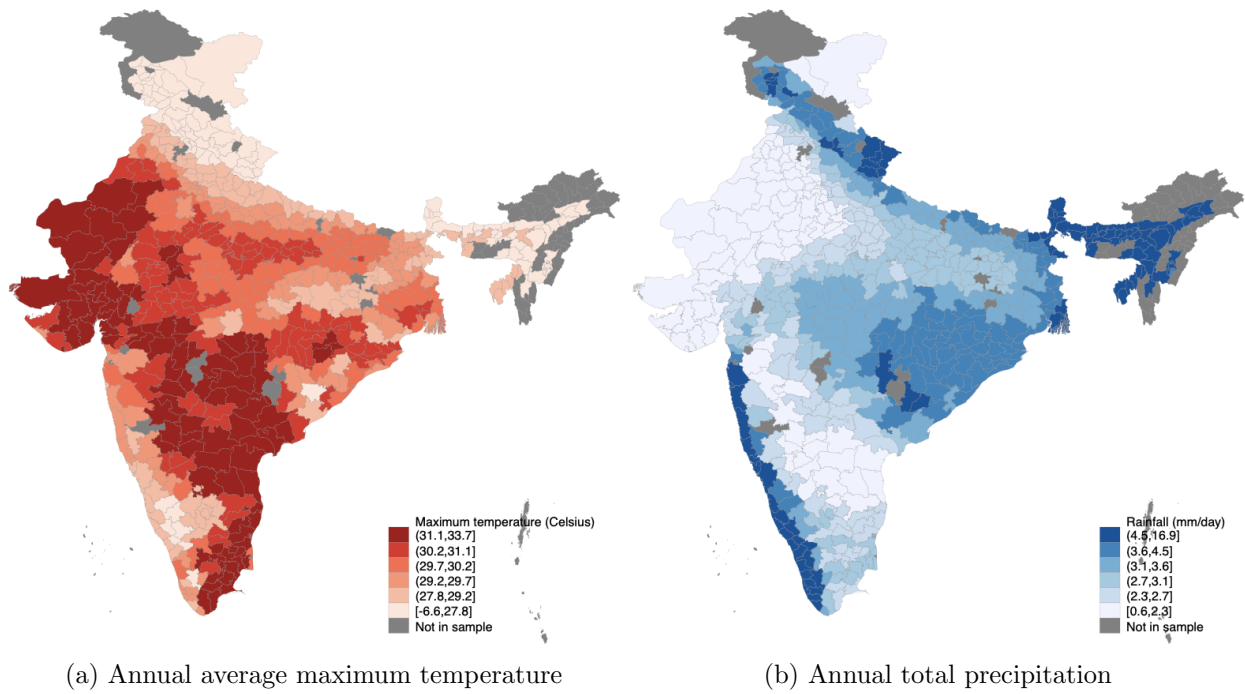(a) Annual average maximum temperature   (b) Annual total precipitation

Figure A3. Maps of maximum temperature and total precipitation.

Note: Annual average maximum daily temperature and annual total precipitation for India (2010-2018).
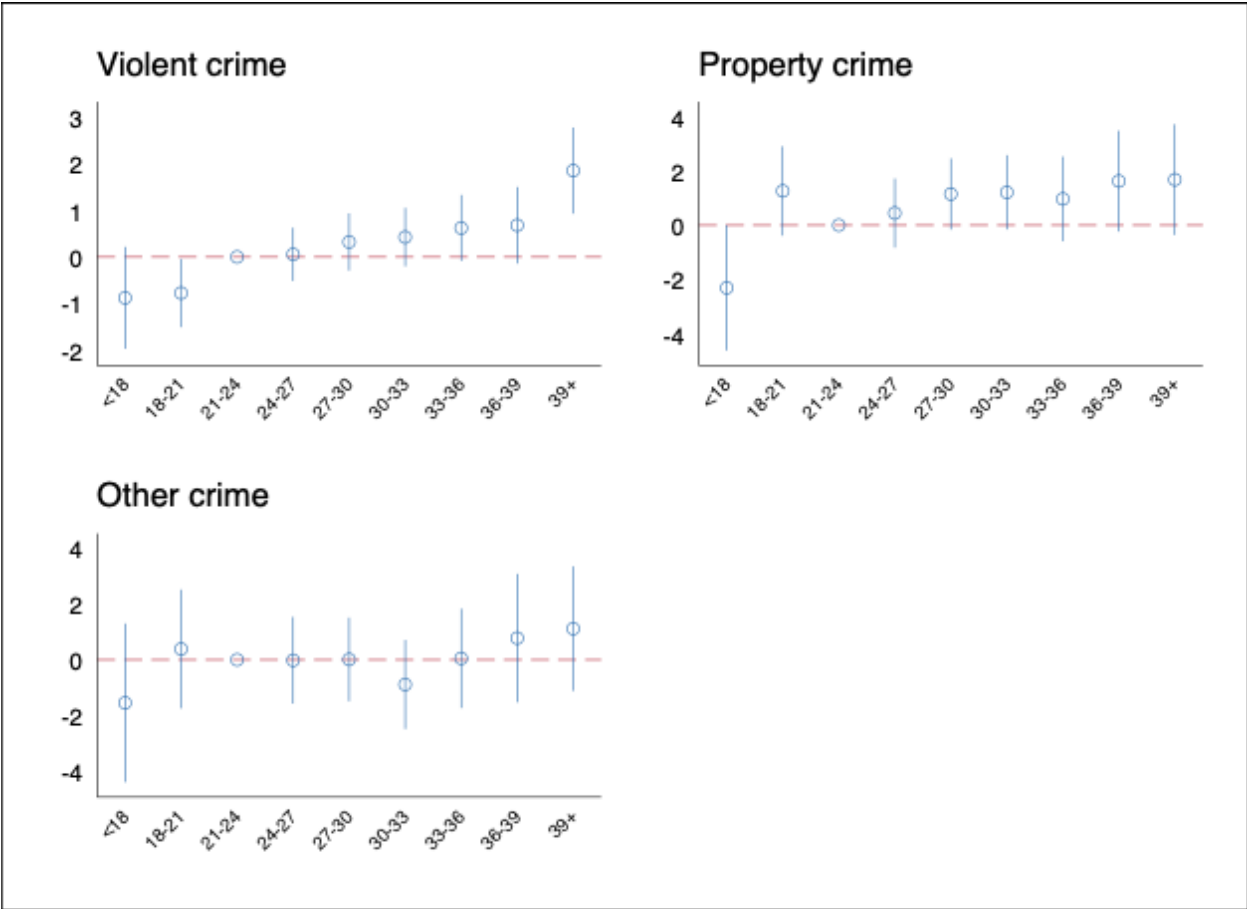
Figure A4. Nonlinear estimates by crime type.

Notes: This figure plots the coefficient estimates and their 95% confidence interval bands on the temperature indicator variables from estimation of the nonlinear specification by crime type. We also control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (defendant gender and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.

Figure A5. The effect of daily maximum temperature on conviction rate: nonlinear estimates robustness to clustering.

Notes: This figure plots the coefficient estimates and their 95% confidence interval bands on the temperature indicator variables from estimation of the nonlinear specification. We show the robustness of these estimates to different ways of clustering the standard errors. We also control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (defendant gender, crime type, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.
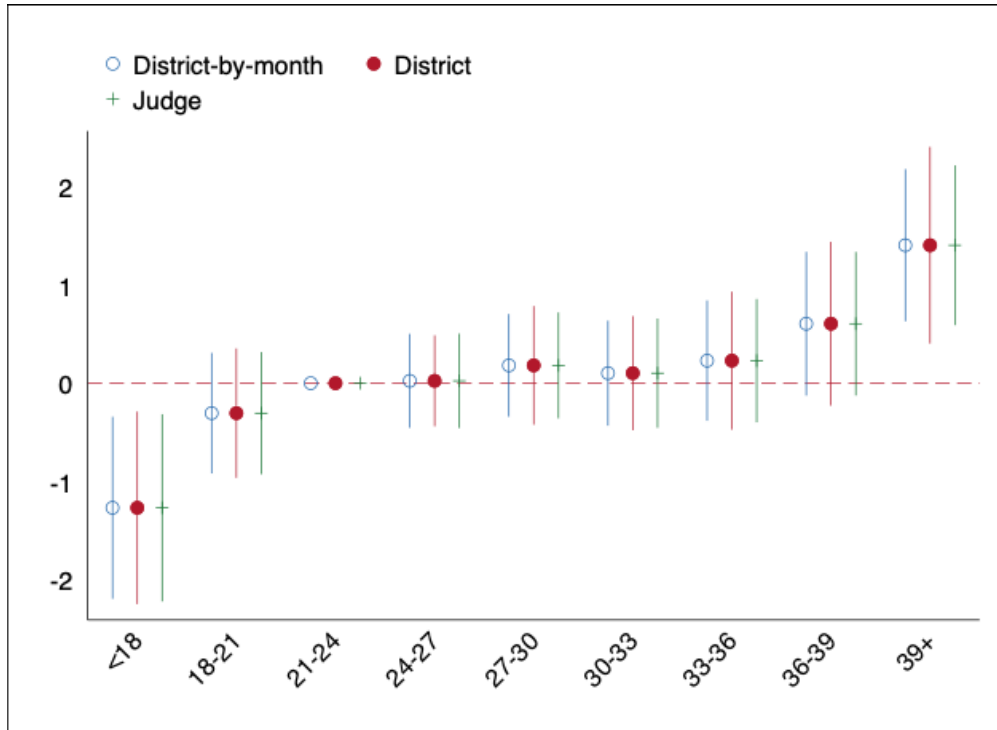
Figure A6. The effect of daily maximum WBGT on conviction rate: nonlinear estimates.

Notes: This figure plots the coefficient estimates and their 95% confidence interval bands on the temperature indicator variables from estimation of the nonlinear specification. The temperature is WBGT, which is constructed using the formula from Lemke and Kjellstrom (2012). Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals one if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We also control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (defendant gender, crime type, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.
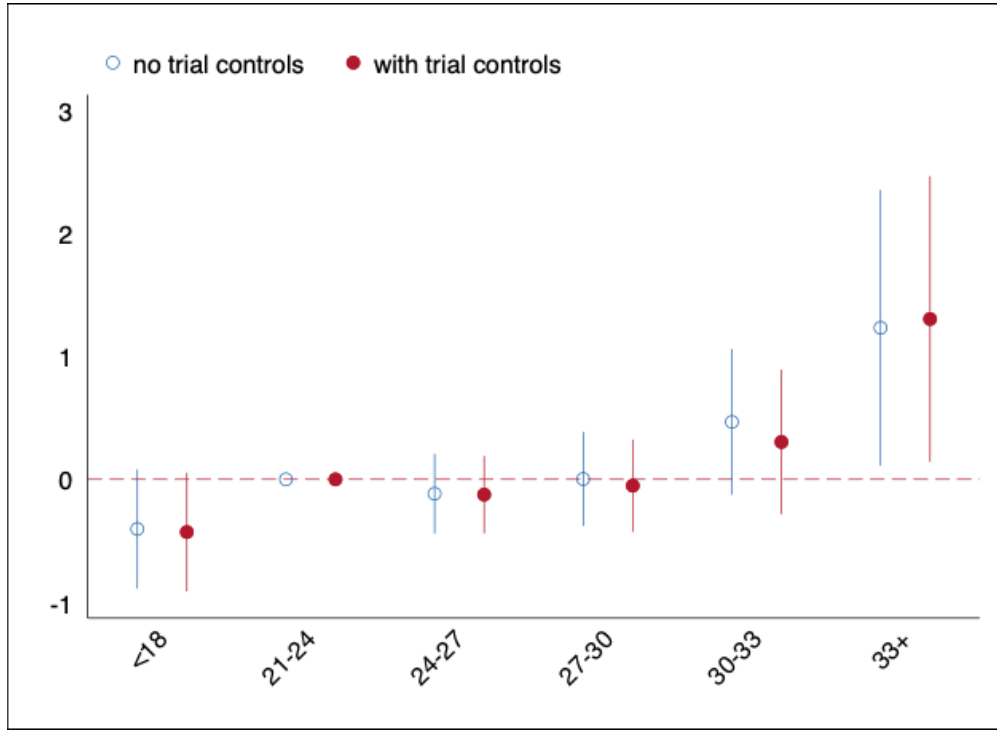
Figure A7. The effect of daily maximum WBGT on conviction rate: different thresholds.

Notes: This figure plots the coefficient estimates of different threshold specifications and their 95% confidence interval bands. Each threshold is an indicator that equals 1 if daily maximum WBGT exceeds the temperature specified on the x-axis. WBGT is constructed using the formula from Lemke and Kjellstrom (2012). Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We also control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (defendant gender, crime type, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.
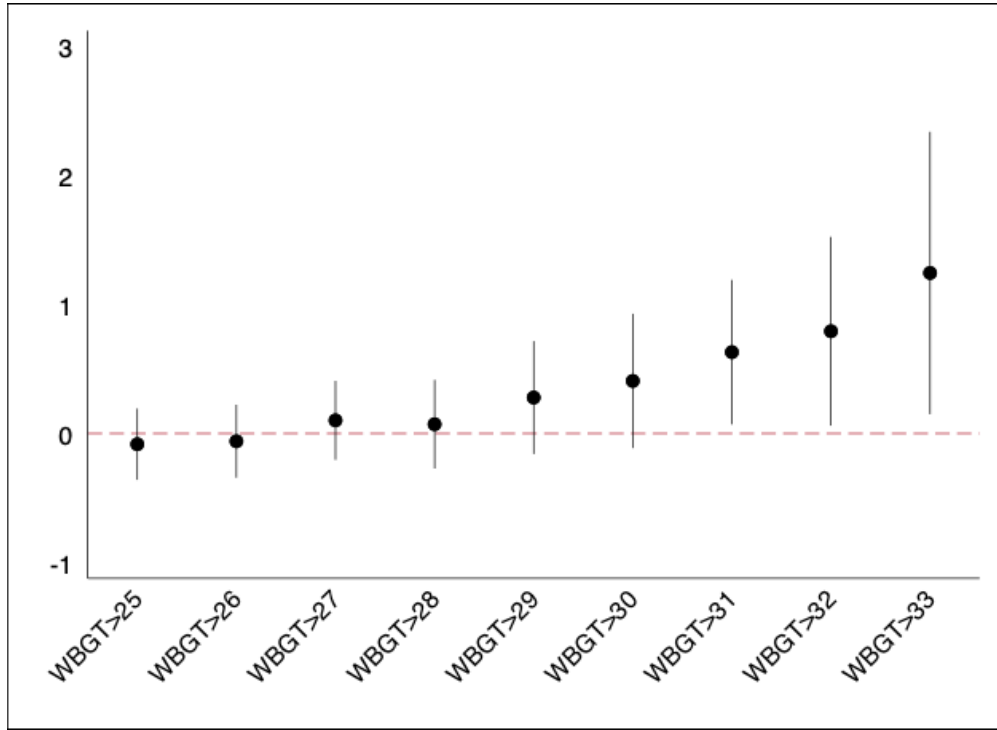
Figure A8. The effect of daily maximum temperature on conviction rate: different thresholds by region.

Notes: This figure plots the coefficient estimates of different threshold specifications and their 95% confidence interval bands by region. Each threshold is an indicator that equals 1 if daily maximum temperature exceeds the temperature specified on the *x*-axis. Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals one if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We also control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (defendant gender, crime type, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.
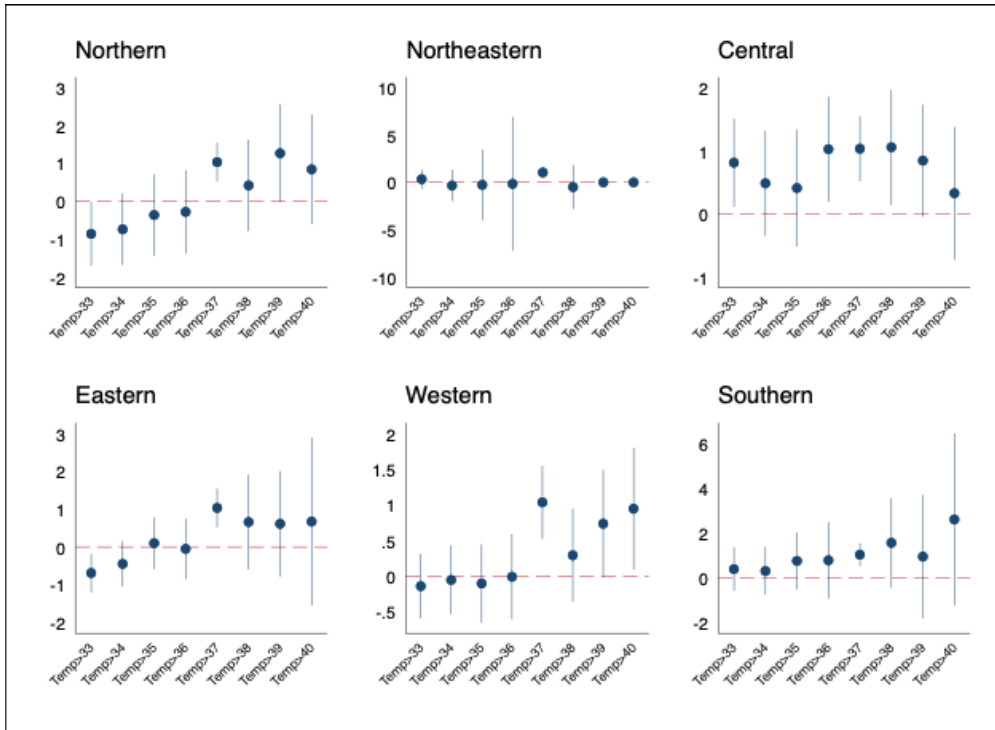
Figure A9: Distribution of daily maximum temperature for court cases by region.

Note: This figure plots the fraction of criminal court cases over maximum temperature bins by region.

B. Supplementary tables

Table A1. The effect of daily maximum temperature on conviction rate by crime type

	Linear			Threshold			Binned		
	Violent	Property	Other	Violent	Property	Other	Violent	Property	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Daily max temperature in C (Temp)	0.0788	0.0899	0.0514						
	(0.0206)	(0.0455)	(0.0465)						
Temp ≥ 37.7C				1.1984	0.2464	1.5591			
				(0.2803)	(0.6261)	(0.6646)			
<18							-0.8743	-2.3088	-1.5475
							(0.5561)	(1.1783)	(1.4525)
18-21							-0.7725	1.2612	0.3859
							(0.3721)	(0.8400)	(1.0875)
24-27							0.0553	0.4455	-0.0186
							(0.2906)	(0.6495)	(0.7940)
27-30							0.3207	1.1481	0.0111
							(0.3128)	(0.6693)	(0.7662)
30-33							0.4240	1.2103	-0.8877
							(0.3194)	(0.6983)	(0.8158)
33-36							0.6189	0.9674	0.0511
							(0.3604)	(0.7965)	(0.9099)
36-39							0.6776	1.6242	0.7780
							(0.4172)	(0.9478)	(1.1759)
39+							1.8467	1.6791	1.1167
							(0.4697)	(1.0410)	(1.1413)
Observations	496486	113689	117585	496486	113689	117585	496486	113689	117585
R^2	0.226	0.354	0.542	0.226	0.354	0.542	0.227	0.354	0.542

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear, nonlinear, and threshold specifications by crime type. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (defendant gender and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.
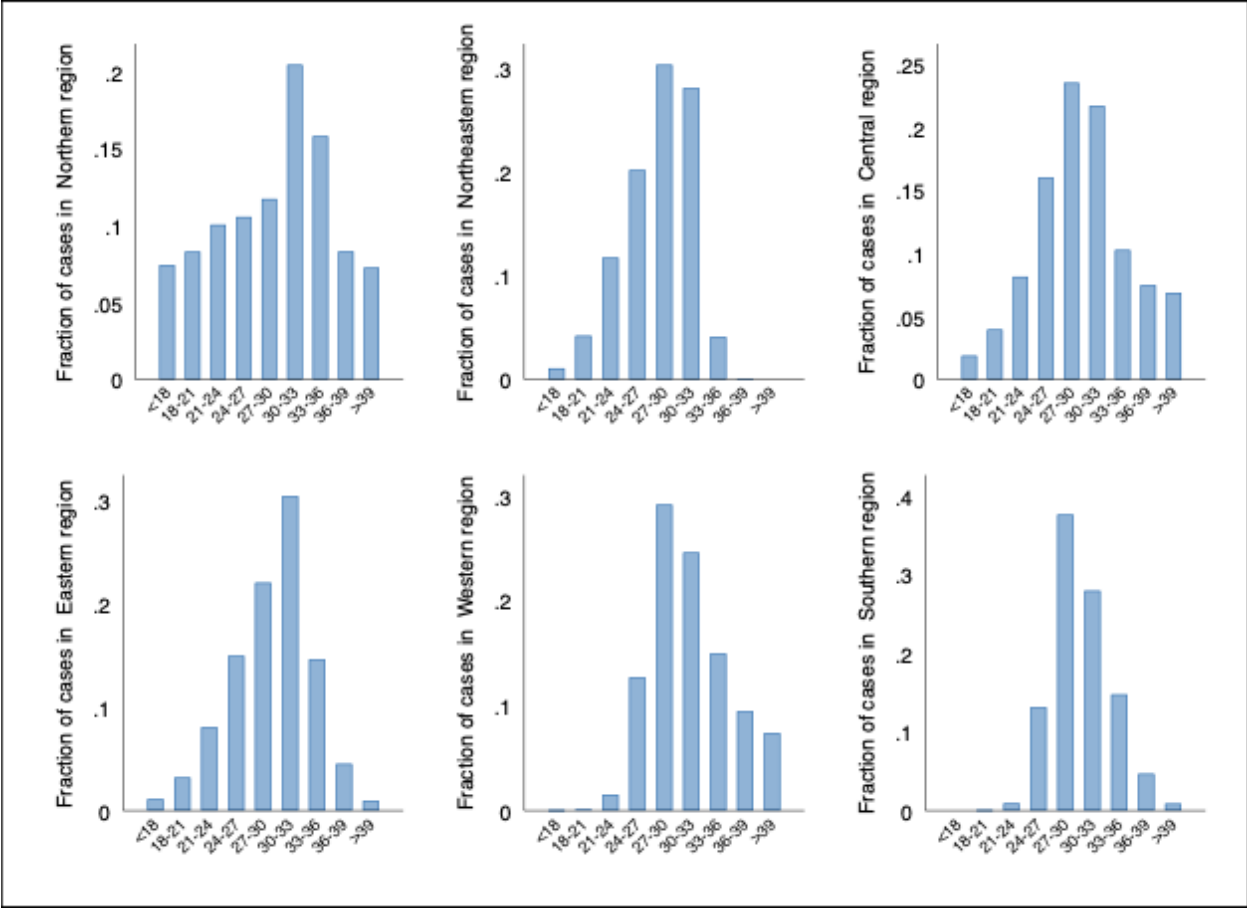
Table A2. The effect of daily maximum temperature on conviction rate by judge gender

	Linear		Threshold		Binned	
	Male	Female	Male	Female	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
Daily max temperature in C (Temp)	0.0608	0.0717				
	(0.0213)	(0.0296)				
Temp $\geq$ 37.7C			0.9365	1.7843		
			(0.2937)	(0.4077)		
<18					-1.1870	-1.4186
					(0.5882)	(0.8199)
18-21					-0.6919	0.6091
					(0.3750)	(0.5601)
24-27					0.1013	-0.0671
					(0.3008)	(0.4090)
27-30					0.1816	0.2429
					(0.3180)	(0.4642)
30-33					0.0490	0.2277
					(0.3315)	(0.4626)
33-36					0.3768	-0.0404
					(0.3811)	(0.5290)
36-39					0.3582	1.1949
					(0.4475)	(0.6376)
39+					1.2998	1.7633
					(0.4872)	(0.6829)
Outcome mean	18.74	17.50	18.74	17.50	18.74	17.50
Outcome SD	39.02	38.00	39.02	38.00	39.02	38.00
R-squared	0.26	0.28	0.26	0.28	0.26	0.28
N	595614	282639	595614	282639	595614	282639

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear, nonlinear, and threshold specifications by defendant gender. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (crime type, defendant gender, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.

Table A3. The effect of daily maximum temperature on conviction rate by defendant gender

	Linear		Threshold		Binned	
	Male	Female	Male	Female	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
Daily max temperature in C (Temp)	0.0635	0.0709				
	(0.0176)	(0.0532)				
Temp $\geq$ 37.7C			1.1159	1.2093		
			(0.2367)	(0.7466)		
<18					-1.1779	-3.8955
					(0.4816)	(1.6991)
18-21					-0.2679	-0.4870
					(0.3274)	(1.1327)
24-27					0.0282	-0.0655
					(0.2495)	(0.7255)
27-30					0.1387	0.4321
					(0.2707)	(0.7332)
30-33					0.1300	-0.4153
					(0.2771)	(0.7904)
33-36					0.1870	0.7680
					(0.3175)	(0.8997)
36-39					0.5671	0.8785
					(0.3808)	(1.0643)
39+					1.4337	0.8846
					(0.4026)	(1.2516)
Outcome mean	17.93	18.37	17.93	18.37	17.93	18.37
Outcome SD	38.36	38.73	38.36	38.73	38.36	38.73
R-squared	0.27	0.33	0.27	0.33	0.27	0.33
N	813282	92855	813282	92855	813282	92855

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear, nonlinear, and threshold specifications by defendant gender. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (crime type and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.

Table A4. Fixed effects sensitivity analysis: linear and threshold specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Linear Specification						
Daily max temperature in C (Temp)	0.0053	0.0991	0.1041	0.0474	0.0533	0.0533	0.0633
	(0.0122)	(0.0281)	(0.0244)	(0.0242)	(0.0279)	(0.0218)	(0.0173)
Outcome mean	17.96	17.97	17.97	17.97	17.96	17.97	17.96
Outcome SD	38.39	38.39	38.39	38.39	38.39	38.39	38.39
R-squared	0.27	0.16	0.15	0.38	0.29	0.28	0.27
N	910318	910612	910691	882489	910068	910231	910318
	Threshold specification						
Temp $\geq$ 37.7C	0.7490	0.7715	1.1876	0.8877	0.9848	0.7787	1.1070
	(0.2002)	(0.3998)	(0.3730)	(0.3007)	(0.2958)	(0.2694)	(0.2326)
Outcome mean	17.96	17.97	17.97	17.97	17.96	17.97	17.96
Outcome SD	38.39	38.39	38.39	38.39	38.39	38.39	38.39
R-squared	0.27	0.16	0.15	0.38	0.29	0.28	0.27
N	910318	910612	910691	882489	910068	910231	910318
Trial controls	X	X	X	X	X	X	X
Day of week FE	X	X	X	X		X	
Judge FE	X	X	X		X	X	X
District-month FE		X			X	X	
Judge-month FE				X			
District FE			X	X			
Year FE				X	X	X	X
Year-month FE			X				
Date FE					X		
Month FE					X		X

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear and threshold specifications. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day. Trial controls include crime type, defendant gender, and trial duration. Each specification contains various other fixed effects as indicated. Note that column (9) is our main specification in table 2. Standard errors are clustered at the district-month level.

Table A5. Fixed effects sensitivity analysis: binned specification

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<18	-1.4240	-0.5326	-1.3293	-0.6026	-0.5142	-0.9113	-1.2659
	(0.4623)	(0.5836)	(0.5604)	(0.6087)	(0.5494)	(0.5350)	(0.4717)
18-21	-0.2508	-0.1884	-0.5016	0.0480	-0.0321	-0.1210	-0.3044
	(0.3095)	(0.3501)	(0.3659)	(0.3574)	(0.3368)	(0.3216)	(0.3124)
24-27	-0.2863	-0.1065	0.1861	-0.3743	-0.1654	-0.2688	0.0238
	(0.2272)	(0.3128)	(0.3025)	(0.2742)	(0.2545)	(0.2514)	(0.2436)
27-30	-0.2992	0.2188	0.5067	-0.0984	0.0008	-0.0607	0.1807
	(0.2267)	(0.3361)	(0.3554)	(0.3039)	(0.2890)	(0.2769)	(0.2659)
30-33	-0.5600	0.4858	0.5281	0.0168	0.2066	0.0765	0.1020
	(0.2260)	(0.3589)	(0.3642)	(0.3255)	(0.3196)	(0.2942)	(0.2721)
33-36	-0.6045	0.5448	0.6204	-0.0181	0.0849	0.0968	0.2290
	(0.2593)	(0.4259)	(0.4265)	(0.3724)	(0.3747)	(0.3397)	(0.3120)
36-39	-0.3436	0.9351	1.3570	0.1031	0.2692	0.2220	0.6041
	(0.3249)	(0.4759)	(0.4884)	(0.4380)	(0.4564)	(0.3958)	(0.3725)
39+	0.3759	1.6245	2.0811	0.9416	0.9986	0.8758	1.4013
	(0.3028)	(0.5984)	(0.5815)	(0.5195)	(0.5337)	(0.4637)	(0.3944)
Outcome mean	17.96	17.97	17.97	17.97	17.96	17.97	17.96
Outcome SD	38.39	38.39	38.39	38.39	38.39	38.39	38.39
R-squared	0.27	0.16	0.15	0.38	0.29	0.28	0.27
N	910318	910612	910691	882489	910068	910231	910318

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Trial controls	X	X	X	X	X	X	X
Day of week FE	X	X	X	X	X	X	X
Judge FE	X	X	X		X	X	X
District-month FE		X	X		X	X	
Judge-month FE				X			
District FE			X	X			
Year FE				X	X	X	X
Year-month FE			X				
Date FE					X		
Month FE					X		X

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear and threshold specifications. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day. Trial controls include crime type, defendant gender, and trial duration. Each specification contains various other fixed effects as indicated. Note that column (9) is our main specification in table 2. Standard errors are clustered at the district-month level.

Table A6. The effect of daily maximum temperature on conviction rate: robustness to clustering

	Linear			Threshold		
	(1)	(2)	(3)	(4)	(5)	(6)
Temp	0.0633	0.0633	0.0633			
	(0.0173)	(0.0238)	(0.0189)			
Temp $\geq$ 37.7C				1.1070	1.1070	1.1070
				(0.2326)	(0.2917)	(0.2442)
Outcome mean	17.96	17.96	17.96	17.96	17.96	17.96
Outcome SD	38.39	38.39	38.39	38.39	38.39	38.39
R-squared	0.27	0.27	0.27	0.27	0.27	0.27
N	910318	910318	910318	910318	910318	910318
Level of clustering:						
District by month	X			X		
District only		X			X	
Judge only			X			X

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear, nonlinear, and threshold specifications and test their robustness to different ways of clustering the standard errors. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (crime type, defendant gender, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.

Table A7. The effect of daily maximum temperature on conviction rate: alternative outcome definition

	Linear		Threshold		Binned	
	(1)	(2)	(3)	(4)	(5)	(6)
Temp	0.0300	0.0304				
	(0.0110)	(0.0110)				
Temp $\geq$ 37.7C			0.5482	0.5624		
			(0.1948)	(0.1949)		
<18					-0.0987	-0.0760
					(0.2048)	(0.2048)
18-21					0.2528	0.2809
					(0.1793)	(0.1799)
24-27					0.1787	0.1877
					(0.1449)	(0.1451)
27-30					0.1010	0.1045
					(0.1711)	(0.1711)
30-33					0.1665	0.1780
					(0.1647)	(0.1648)
33-36					0.1673	0.1761
					(0.1887)	(0.1888)
36-39					0.6223	0.6374
					(0.2382)	(0.2384)
39+					0.8855	0.9090
					(0.2964)	(0.2966)
Outcome mean	7.45	7.45	7.45	7.45	7.45	7.45
Outcome SD	26.25	26.25	26.25	26.25	26.25	26.25
R-squared	0.24	0.24	0.24	0.24	0.24	0.24
N	2222518	2222518	2222518	2222518	2222518	2222518
Trial controls		X		X		X

Notes: Sample is restricted to cases with dispositions of conviction, prison, fine, reject, acquitted, appeal, accepted, decided, disposed, judgment, probation, stayed, transferred, 258 crpc (acquittal), and referred to Lok Adalat. This selection of dispositions closely follows Ash et al (2022), but we exclude dispositions for which the judge might not be the primary decision-maker (e.g., plead guilty, withdrawn, and other). The dependent variable is a binary measure that equals 1 if the defendant case's disposition is conviction or prison, and 0 otherwise. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than a fraction. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day. Trial controls include defendant gender, crime type, and trial duration. The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.

Table A8. The effect of the number of trial days with temperature above 37.7C on conviction

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Num. of trial days w/ temp. $\geq$ 37.7C	0.0755	0.0690	0.0695	0.0768	0.0746	0.0775	0.0774
	(0.0021)	(0.0020)	(0.0020)	(0.0023)	(0.0020)	(0.0021)	(0.0022)
Outcome mean	17.96	17.97	17.97	17.97	17.96	17.97	17.96
Outcome SD	38.39	38.39	38.39	38.39	38.39	38.39	38.39
R-squared	0.28	0.17	0.15	0.38	0.29	0.29	0.27
N	910318	910612	910691	882489	910068	910231	910318
Trial controls	X	X	X	X	X	X	X
Day of week FE	X	X	X	X		X	
Judge FE	X	X	X		X	X	X
District-month FE		X			X	X	
Judge-month FE				X			
District FE			X	X			
Year FE				X	X	X	X
Year-month FE			X				
Date FE					X		
Month FE					X		X

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear and threshold specifications. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day. Trial controls include crime type, defendant gender, and trial duration. Each specification contains various other fixed effects as indicated. Note that column (9) is our main specification in table 2. Standard errors are clustered at the district-month level.

Table A9. The effect of daily maximum WBGT on conviction

	Linear		Threshold		Binned	
	(1)	(2)	(3)	(4)	(5)	(6)
WBGT	0.0480	0.0419				
	(0.0243)	(0.0238)				
WBGT ≥ 32C			0.7702	0.7925		
			(0.3759)	(0.3734)		
<18					-0.4212	-0.3720
					(0.2469)	(0.2423)
21-24					0.1890	0.1424
					(0.2150)	(0.2090)
24-27					0.0398	-0.0044
					(0.2460)	(0.2400)
27-30					0.1420	0.0705
					(0.2657)	(0.2595)
30-33					0.5110	0.4245
					(0.3601)	(0.3514)
33+					1.4020	1.4237
					(0.6255)	(0.6202)
Outcome mean	17.96	17.96	17.96	17.96	17.96	17.96
Outcome SD	38.39	38.39	38.39	38.39	38.39	38.39
R-squared	0.26	0.27	0.26	0.27	0.26	0.27
N	910318	910318	910318	910318	910318	910318
Trial controls		X		X		X

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. WBGT is constructed using the formula from table 2. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day. Trial controls include defendant gender, crime type, and trial duration. The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.

Table A10. The effect of daily maximum temperature on conviction rate: heterogeneous effects by pollution

	Linear		Threshold		Binned	
	high	low	high	low	high	low
	(1)	(2)	(3)	(4)	(5)	(6)
Temp	0.0809	0.1083				
	(0.0240)	(0.0272)				
Temp $\geq$ 37.7C			0.9639	1.3821		
			(0.3138)	(0.3358)		
<18					-1.0675	-4.6607
					(0.4991)	(1.8262)
18-21					-0.3128	-0.5142
					(0.3264)	(1.0190)
24-27					0.3022	-0.6842
					(0.2672)	(0.5257)
27-30					0.5506	-0.4841
					(0.3051)	(0.5306)
30-33					0.3498	-0.3141
					(0.3363)	(0.5404)
33-36					0.1999	0.3803
					(0.3767)	(0.5976)
36-39					0.6155	0.7083
					(0.4715)	(0.6400)
39+					1.5190	1.3603
					(0.5165)	(0.6702)
Outcome mean	16.59	19.35	16.59	19.35	16.59	19.35
Outcome SD	37.20	39.50	37.20	39.50	37.20	39.50
R-squared	0.27	0.29	0.27	0.29	0.27	0.29
N	453853	453373	453853	453373	453853	453373

Notes: Sample is restricted to cases with dispositions of conviction or acquittal. The dependent variable is a binary measure that equals 1 if the defendant is convicted and 0 if the defendant is acquitted. We scaled this measure by 100 so that the conviction rate can be expressed as a percentage rather than as a fraction. We present results from estimation of the linear, nonlinear, and threshold specifications by pollution and different relative humidity measures. We split the sample to court decisions with pollution above (high) or below (low) the median in our sample. In all specifications, we control for precipitation and pollution (PM2.5), measured as calendar daily average on the decision day, and trial controls (crime type, defendant gender, and trial duration). The regressions include year, month, district, and judge fixed effects as well. Standard errors are clustered at the district-month level.