

Correction to “Temperature and Decisions: Evidence
from 207,000 Court Cases” (by Heyes and Saberian
AEJ: Applied Economics 11(2), 238-65, April 2019)
and Reply to Comment by Spamann
Appendix

Anthony Heyes	Soodeh Saberian
University of Ottawa	University of Manitoba
University of Exeter	

A Online Appendix

Table A.1: Summary Statistics

	Mean	Std. Dev.
Grant indicator	0.357	0.479
Temperature (°F)	66.865	16.232
Air pressure (pa)	29.735	0.800
Dew point (°F)	52.860	17.614
Precipitation (mm)	0.005	0.025
Wind speed (km/h)	7.514	3.611
Sky cover (percent)	57.135	0.268
Ozone (ppm)	0.025	0.014
CO (ppm)	0.937	0.509
PM _{2.5} (μ/m^3)	14.228	8.933

Table A.2: Fixed effect estimates: 6 AM - 4 PM average

	(1)	(2)	(3)	(4)
	Preferred	1-Day lag	1-Day lead	All
$Temperature_t/1000$	-0.974** [0.482]	-0.896 [0.547]	-1.355** [0.535]	-1.294** [0.596]
$Temperature_{t-1}/1000$	- -	-0.118 [0.405]	- -	-0.0870 [0.407]
$Temperature_{t+1}/1000$	- -	- -	0.607 [0.416]	0.602 [0.416]
Observations	82,872	82,872	82,872	82,872

Notes: The unit of analysis is an immigration case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature is the 6 AM to 4 PM average in the city in which the case is adjudicated, on the day of adjudication, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and PM_{25} , measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Time fixed effects include day of week and year dummies relating to the day of adjudication. Regressions also include city-month fixed effects, name of judge adjudicating case, type of application and nationality of applicant. Sample is all cases adjudicated at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.3: Alternative fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Temperature_t/1000$	-2.696***	-2.643***	-2.501***	-0.607	-0.999**	-0.781*	-0.662	-0.435	-0.974**
	[0.589]	[0.585]	[0.576]	[0.409]	[0.484]	[0.448]	[0.471]	[0.517]	[0.482]
Observations	82,872	82,872	82,872	82,872	82,872	82,872	82,872	82,872	82,872
Nationality FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Day of Week FEs	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Type of application FEs	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Judge FEs	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
City-month FEs	No	No	No	No	Yes	No	No	Yes	Yes
Judge-month FEs	No	No	No	No	No	No	Yes	No	No
City FEs	No	No	No	No	No	Yes	Yes	No	No
Year FEs	No	No	No	No	No	No	Yes	Yes	Yes
Year-month FEs	No	No	No	No	No	Yes	No	No	No
Date FEs	No	No	No	No	No	No	No	Yes	No

Notes: The unit of analysis is an immigration case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature is the 6 AM to 4 PM average in the city in which the case is adjudicated, on the day of adjudication, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather and pollution. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and PM_{25} , measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Each specification contains other controls as indicated. Column (10) coincides with column (1) from Table 2, our preferred specification. Sample is all cases adjudicated at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.4: Sensitivity analyses

	(1) Preferred spec.	(2) Calendar day	(3) Deviation from weekly avg.	(4) City \times Temp interactions	(5) Winter exclusion	(6) Rain \times temp interactions
$Temperature_t/1000$	-0.974** [0.482]	-0.474 [0.537]	-1.238** [0.495]	-0.695 [0.637]	-1.239** [0.530]	-1.005** [0.487]
$Temperature_t/1000 \times Rain_t$	- -	- -	- -	- -	- -	3.746 [9.240]
Observations	82,872	80,202	82,872	82,872	61,132	82,872
City*Temperature	N	N	N	Y	N	N
Temperature*Rain	N	N	N	N	N	Y

Notes: The unit of analysis is an immigration case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature is the 6 AM to 4 PM average in the city in which the case is adjudicated, on the day of adjudication, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and PM_{25} , measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Time fixed effects include day of week and year dummies relating to the day of adjudication. Regressions also include city-month fixed effects, name of judge adjudicating case, type of application and nationality of applicant. Sample is all cases adjudicated at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Column (1) repeats column (1) from Table 2, the preferred specification. In column (2) we re-estimate the preferred specification but with the temperature variable defined as calendar day average in Fahrenheit, divided by 1000. In column (3) we re-estimate the preferred specification replacing the temperature measure with deviation of 6 AM to 4 PM average temperature in city of adjudication on date of adjudication from what is average for that city for that week of the year. In column (4) we re-estimate the preferred specification but adding city times temperature interactions. In column (5) we re-estimate the preferred specification excluding cases adjudicated on dates in December, January and February. In column (6) we re-estimate the preferred specification including rain times temperature interactions. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.5: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Pollution exclusion	CA exclusion	Clear sky days	Zero precipitation	Zero precipitation including lag	HI	HI (>75)	Quartiles exclusion	Deciles exclusion
<i>Temperature_t/1000</i>	-1.169** [0.474]	-0.923* [0.548]	-3.229 [2.022]	-0.949 [0.661]	-0.567 [0.769]	- -	- -	-0.694 [0.784]	-0.993** [0.484]
<i>Heatindex_t/1000</i>	- -	- -	- -	- -	- -	-0.830** [0.326]	-1.479* [0.831]	- -	- -
Observations	82,872	64,612	4,638	47,964	35,826	82,796	32,114	40,864	81,788

Notes: The unit of analysis is an immigration case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature is the 6 AM to 4 PM average in the city in which the case is adjudicated, on the day of adjudication, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and $PM_{2.5}$, measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Time fixed effects include day of week and year dummies relating to the day of adjudication. Regressions also include city-month fixed effects, name of judge adjudicating case, type of application and nationality of applicant. Sample is all cases adjudicated at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Column (1) repeats column (1) from Table 2, the preferred specification. Column (2) excludes pollution covariates. Column (3) excludes all cases adjudicated in California. Column (4) is estimated only on cases when 6 AM to 4 PM cloud cover was below 10% in city of adjudication on day of adjudication. Column (5) is estimated only on cases where there was no precipitation in city of adjudication on day of adjudication. Column (6) is estimated only on cases where there was no precipitation in city of adjudication on day of adjudication or the day before. Column (7) repeats the preferred specification but replacing the temperature variable with heat index. Column (8) re-estimates specification in column (7) but only on cases adjudicated on days when heat index exceeded 75 °F. Columns (9) and (10) re-estimate the preferred specification but excluding cases adjudicated by judges in the top and bottom quartile, or top and bottom decile, by overall leniency. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.6: Placebos

	(1)	(2)	(3)	(4)
	Preferred	+100 days	-100 days	Furthest monitor
$Temperature_t/1000$	-0.974** [0.482]	0.122 [0.279]	0.102 [0.267]	0.537 [0.381]
Observations	82,872	82,872	82,872	80,155

Notes: All specifications coincide with column (1) in Table 2, our preferred specification. Column (2) re-estimates the preferred specification but replacing the temperature variable with the temperature in the city of adjudication 100 days after the case is adjudicated. Column (3) re-estimates the preferred specification but replacing the temperature variable with the temperature in the city of adjudication 100 days before the case is adjudicated. Column (4) re-estimates the preferred specification but replacing the temperature variable with the temperature on the date of adjudication at the courthouse location in mainland US furthest from the courthouse of adjudication. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.7: Parole: Calendar day

	(1)	(2)	(3)	(4)
	Preferred	1-Day lag	1-Day lead	All
$Temperature_t/1000$	-3.568*** [0.868]	-5.061*** [1.482]	-2.925** [1.367]	-4.611** [2.090]
$Temperature_{t-1}/1000$	- -	1.830 [1.505]	- -	1.745 [1.563]
$Temperature_{t+1}/1000$	- -	- -	-0.787 [1.465]	-0.466 [1.517]
Observations	9,426	9,426	9,426	9,426

Notes: The unit of analysis is a parole case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature is daily average at the monitoring station closest to the decision venue, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover daily averages. Pollutant covariates include controls for ozone, carbon monoxide and nitrogen dioxide, measured as daily averages at the air quality monitoring station closest to the venue of decision on the date of decision. Time fixed effects include day of week and year dummies relating to the day of decision. Regressions also include venue-month fixed effects, commissioners' name, type of application and name of inmate. Sample consists of data on all parole hearings conducted by the Board of Parole Hearing (BPH) between 3 January 2012 and 18 December 2015 is from the California Department of Corrections and Rehabilitation (CDCR). Standard errors are clustered on venue-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.8: Extended fixed effect estimates: 6 AM - 4 PM average

	(1) Preferred	(2) 1-Day lag	(3) 1-Day lead	(4) All
$Temperature_t/1000$	-0.974** [0.482]	-0.896 [0.547]	-1.355** [0.535]	-1.294** [0.596]
$Temperature_{t-1}/1000$	- -	-0.118 [0.405]	- -	-0.0870 [0.407]
$Temperature_{t+1}/1000$	- -	- -	0.607 [0.416]	0.602 [0.416]
$Airpressure_t$	-0.000426 [0.0117]	-0.000424 [0.0117]	-0.00414 [0.0120]	-0.00411 [0.0120]
$Dewpoint_t$	0.000220 [0.000396]	0.000224 [0.000397]	0.000186 [0.000398]	0.000190 [0.000399]
$Precipitation_t$	0.0761 [0.0829]	0.0773 [0.0831]	0.0711 [0.0830]	0.0720 [0.0832]
$Windspeed_t$	0.000172 [0.000830]	0.000190 [0.000828]	0.000274 [0.000834]	0.000286 [0.000832]
$Skycover_t$	-0.0290*** [0.0107]	-0.0289*** [0.0107]	-0.0273** [0.0108]	-0.0272** [0.0108]
$Ozone_t$	-0.189 [0.246]	-0.192 [0.246]	-0.180 [0.245]	-0.182 [0.245]
CO_t	-0.0138** [0.00602]	-0.0138** [0.00601]	-0.0141** [0.00602]	-0.0141** [0.00602]
PM_{25t}	0.000288 [0.000286]	0.000285 [0.000285]	0.000287 [0.000286]	0.000285 [0.000285]
Observations	82,872	82,872	82,872	82,872

Notes: The unit of analysis is an immigration case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature is the 6 AM to 4 PM average in the city in which the case is adjudicated, on the day of adjudication, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and PM_{25} , measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Time fixed effects include day of week and year dummies relating to the day of adjudication. Regressions also include city-month fixed effects, name of judge adjudicating case, type of application and nationality of applicant. Sample is all cases adjudicated at all 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.9: Heterogeneity by gender of judge

	(1)	(2)	(3)
	Whole sample	Female	Male
$Temperature_t/1000$	-0.974** [0.482]	-1.477* [0.860]	-0.798 [0.562]
Observations	82,872	25,165	57,707
Hausman test	21.62***		
P-value	0.0000		

Notes: Column (1) re-states column (1) of Table 2, the preferred specification. Column (2) re-estimates this specification only on cases adjudicated by a female judge. Column (3) re-estimates this specification only on cases adjudicated by a male judge.

Table A.10: Non-linear estimates

	(1) Temperature	(2) Heat Index	(3) HI>65
X ≤ 20	0.0652* [0.0379]	0.0560 [0.0365]	- -
X ∈ [20-25)	0.0977** [0.0407]	0.0885** [0.0375]	- -
X ∈ [25-30)	0.00846 [0.0250]	0.000132 [0.0226]	- -
X ∈ [30-35)	-0.0142 [0.0188]	-0.0209 [0.0167]	- -
X ∈ [35-40)	-0.0191 [0.0140]	-0.0238* [0.0125]	- -
X ∈ [40-45)	-0.0135 [0.0134]	-0.0166 [0.0136]	- -
X ∈ [45-50)	-0.00113 [0.0116]	-0.00281 [0.0118]	- -
X ∈ [50-55)	- -	- -	- -
X ∈ [55-60)	-0.0218** [0.0108]	-0.0212** [0.0107]	- -
X ∈ [60-65)	-0.0154 [0.0135]	-0.0141 [0.0126]	- -
X ∈ [65-70)	-0.0128 [0.0150]	-0.0105 [0.0130]	- -
X ∈ [70-75)	-0.0217 [0.0147]	-0.0191 [0.0125]	-0.00850 [0.00867]
X ∈ [75-80)	-0.0273 [0.0167]	-0.0238* [0.0133]	-0.0129 [0.00928]
X ∈ [80-85)	-0.0200 [0.0187]	-0.0182 [0.0152]	-0.00623 [0.0113]
X ∈ [85-90)	-0.0388* [0.0204]	-0.0299* [0.0172]	-0.0184 [0.0133]
X ∈ [90-95)	- -	-0.0475** [0.0185]	-0.0322** [0.0162]
X ≥ 95	- -	-0.0501** [0.0194]	-0.0321* [0.0170]
Observations	82,872	82,796	49,843

Notes: The unit of analysis is an immigration case. Dependent variable is a dummy taking value one if decision is favourable to applicant, zero otherwise. Temperature bins are indicators for every 5 °F of 6 AM to 4 PM temperature in the city of which the case is adjudicated, on the day of adjudication, with the 50 - 55 °F bin as the reference category. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and $PM_{2.5}$, measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Time fixed effects include day of week and year dummies relating to the day of adjudication. Regressions also include city-month fixed effects, name of judge adjudicating case, type of application and nationality of applicant. Sample is all cases adjudicated at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Column (2) repeats the specification in column (1) replacing the temperature variable with heat index. Column (3) re-estimates specification in column (2) but only on cases adjudicated on days when heat index exceeded 65 °F. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Table A.12: Randomization test

	Immigration				Parole		
	(1) Type of app.	(2) Middle East applicant	(3) Female judge	(4) Number of cases	(5) Type of app.	(6) Female judge	(7) Number of cases
<i>Temperature_{it}/1000</i>	0.813** [0.409]	0.203 [0.315]	0.225 [0.483]	-1.421 [1.144]	-0.456 [0.848]	-0.159 [1.909]	-1.017 [2.297]
Judge FE	Y	Y	N	Y	Y	N	Y
Nationality FE	Y	N	Y	N	N	N	N
Type of application FE	N	Y	Y	N	N	Y	N
Observations	82,872	82,872	82,872	48,744	9,426	9,426	5,065

Notes: The unit of analysis is an immigration case. Dependent variable in columns (1) and (5) is a dummy for type of application, in column (2) is a dummy taking value one if an applicant is Middle Eastern origin, zero otherwise, in columns (3) and (6) is a dummy that takes value one if case is adjudicated by a female judge, zero otherwise and in columns (4) and (7) is total number of cases heard by each judge in each day. Temperature is the 6 AM to 4 PM average in the city in which the case is adjudicated, on the day of adjudication, in Fahrenheit. The temperature measure is divided by 1000 to reduce decimal places. All regressions control for weather, pollution and time fixed effects. Weather covariates include dew point, air pressure, wind speed, precipitation and cloud cover measured as 6 AM to 4 PM averages in the city in which the case is adjudicated, on the day of adjudication. Pollutant covariates include controls for ozone, carbon monoxide and PM_{25} , measured as calendar daily averages at the air quality monitoring station closest to the courthouse of adjudication, on the day of adjudication. Time fixed effects include day of week and year dummies relating to the day of adjudication. Regressions also include city-month fixed effects. Each specification contains other controls as indicated. Sample is all cases adjudicated at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004. Standard errors are clustered on city-month in brackets. * significant at 10% ** significant at 5% *** significant at 1%.

Figures

Figure A.1: Location of immigration courts (excluding Honolulu)



Figure A.2: Location of parole hearing venues

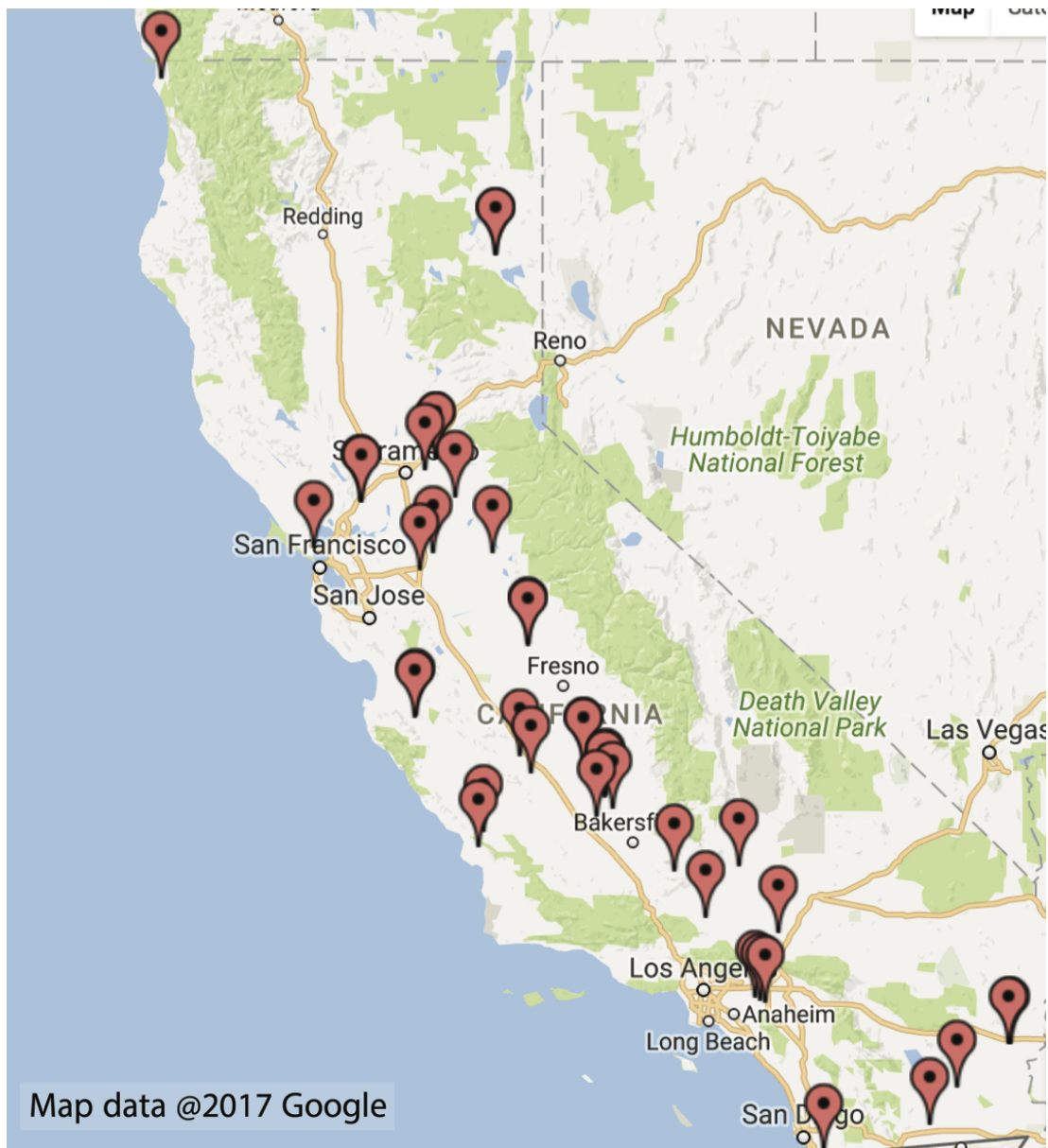
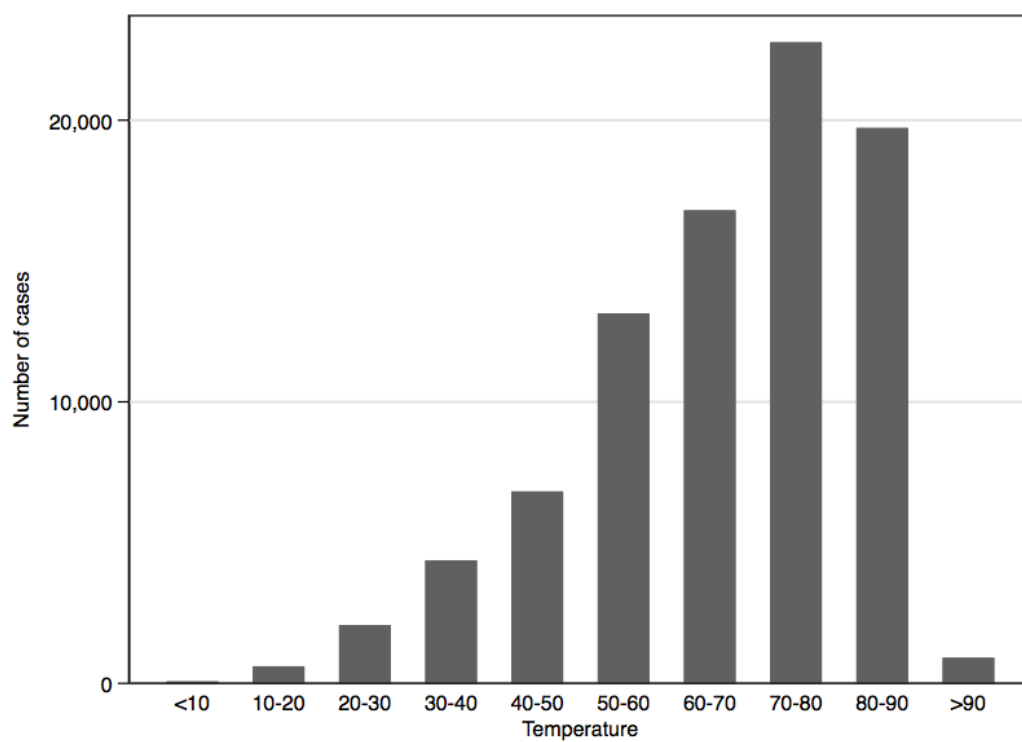
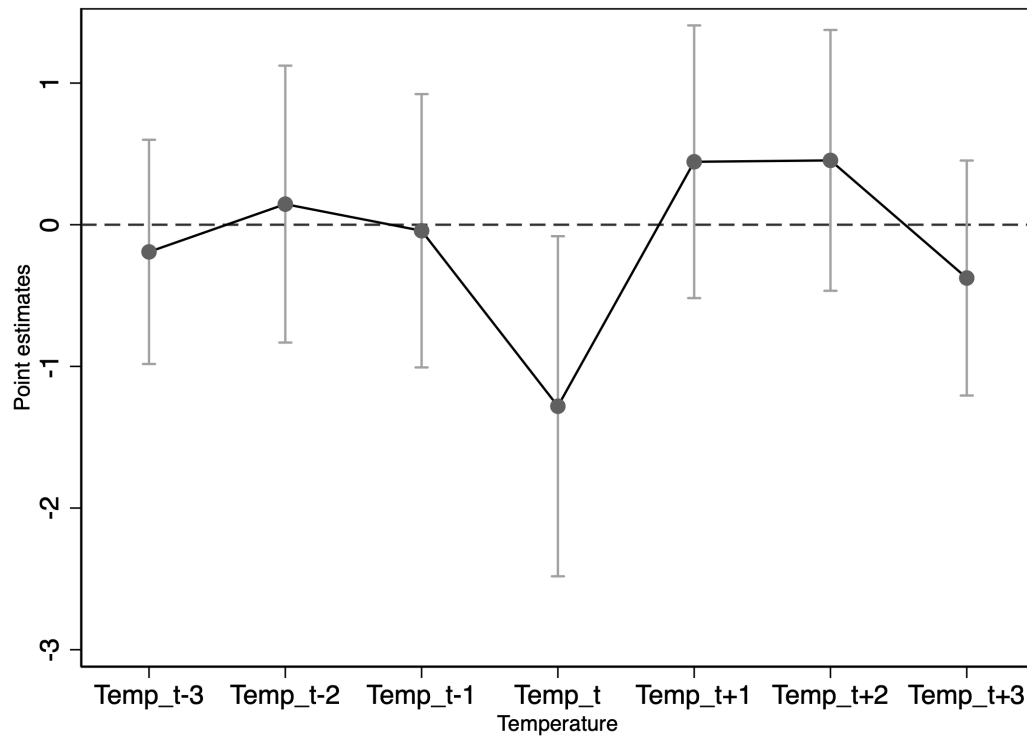


Figure A.3: Distribution of cases over 6 AM - 4 PM temperature bins



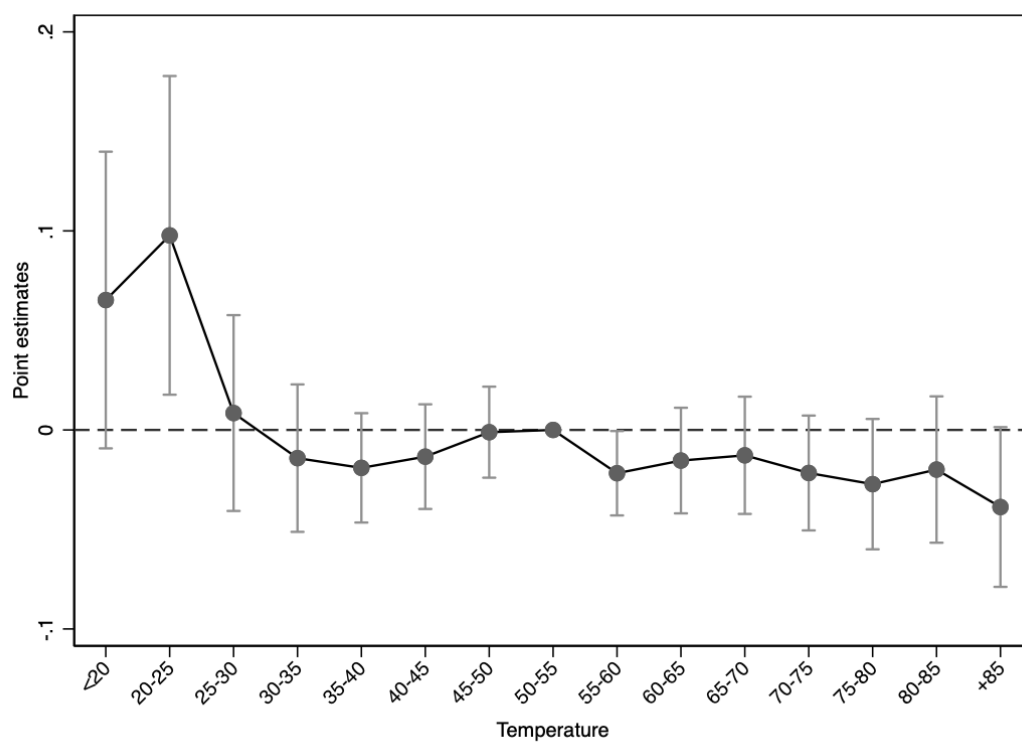
Notes: This figure plots number of cases adjudicated over 6 AM to 4 PM temperature bins at 36 mainland US federal immigration courthouse locations from 1 January 2000 to 31 August 2004.

Figure A.4: Timing of exposure: 6 AM - 4 PM



Notes: This figure plots the coefficients that result from running the specification in column (1) of Table (2) but including three lags and three leads of the temperature variable. Grey lines show the 95 percent confidence intervals based on standard errors clustered on city-month.

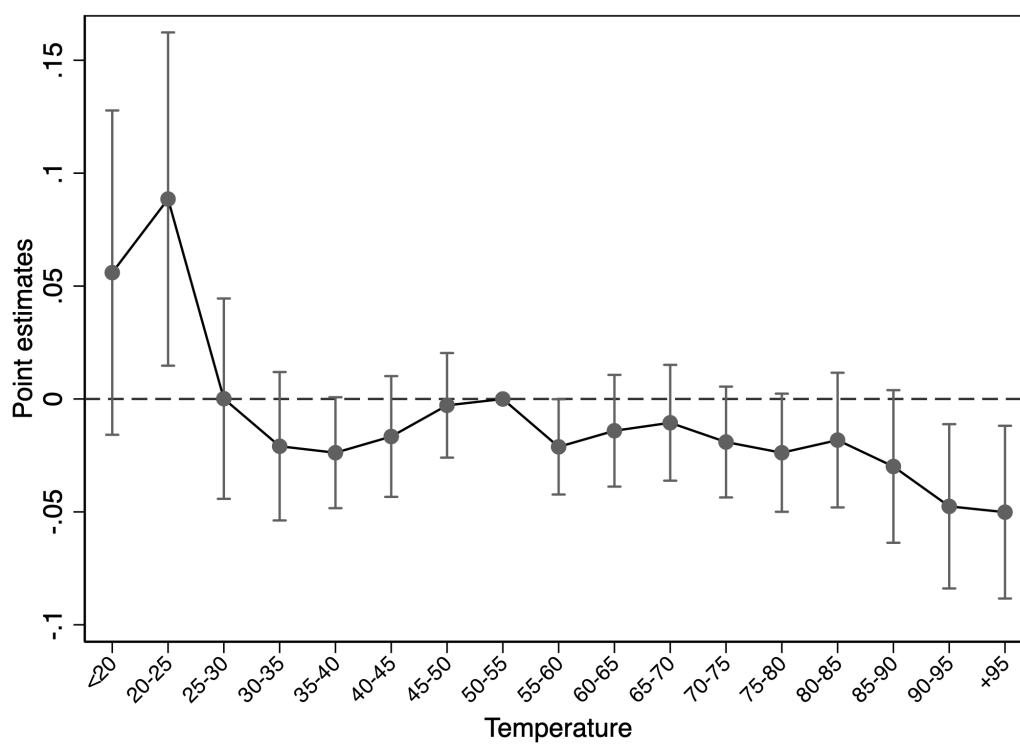
Figure A.5: Non-linear estimates: Temperature, 6 AM - 4 PM



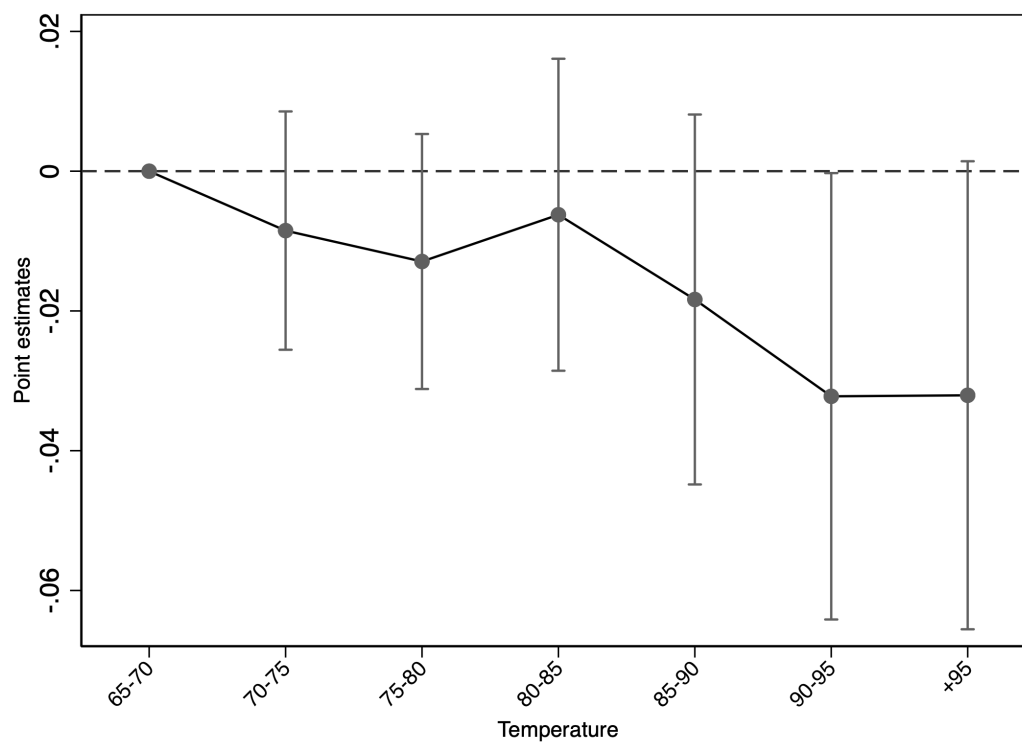
Notes: This figure plots the coefficients on the temperature indicator variables from estimation of the non-linear specification reported in column (1) from Table A.3. Grey lines show the 95 percent confidence intervals based on standard errors clustered on city-month.

Figure A.6: Non-linear estimates: Heat index, 6 AM - 4 PM

a) Whole sample

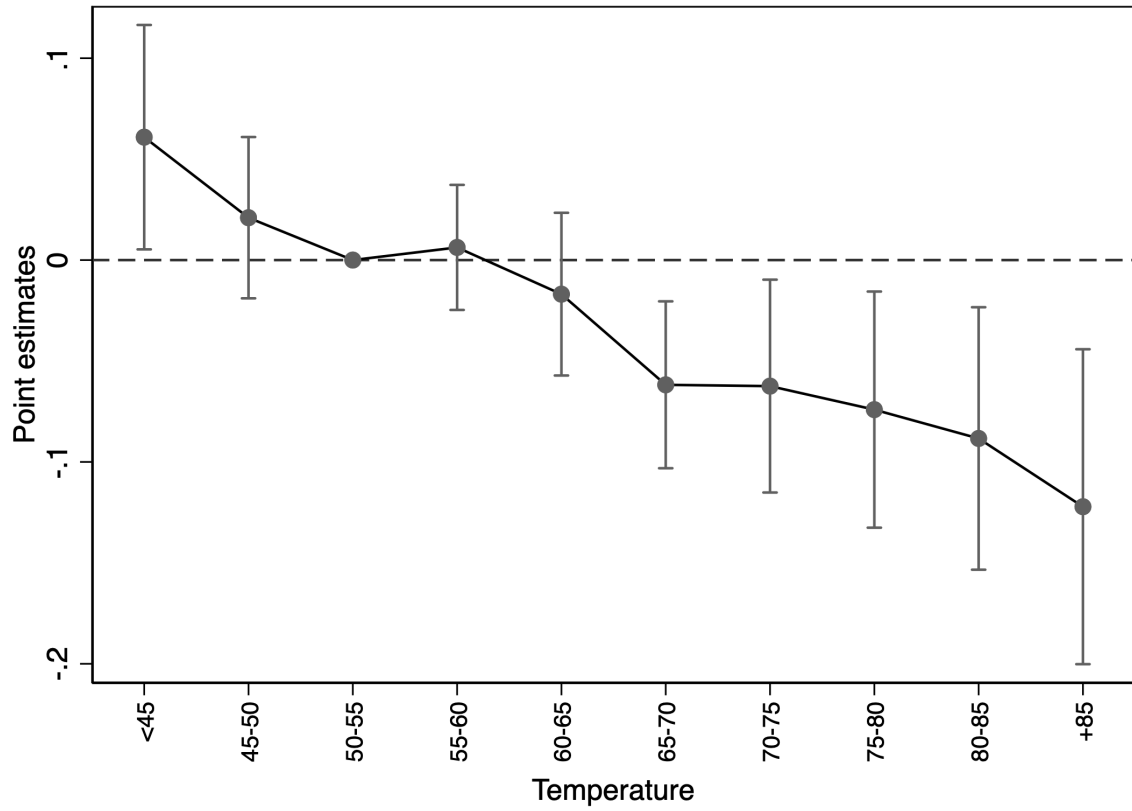


b) HI > 65



Notes: This figure plots the coefficients on the heat index indicator variables from estimation of the non-linear specifications reported in columns (2) and (3) from Table A.3. Grey lines show the 95 percent confidence intervals based on standard errors clustered on city-month.

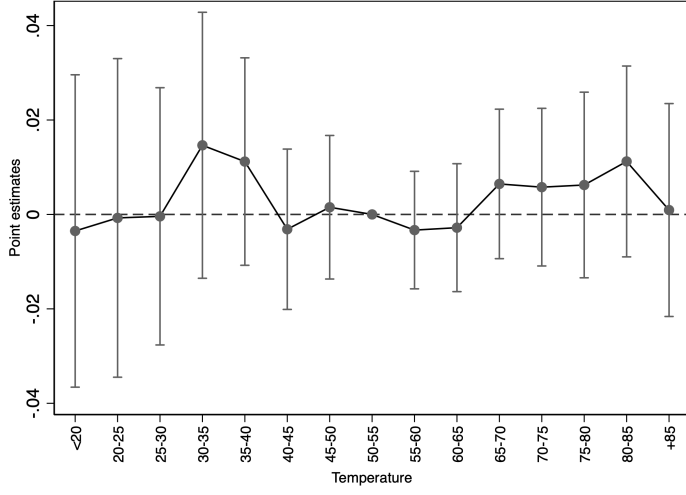
Figure A.7: Non-linear estimates: Parole, temperature, calendar day



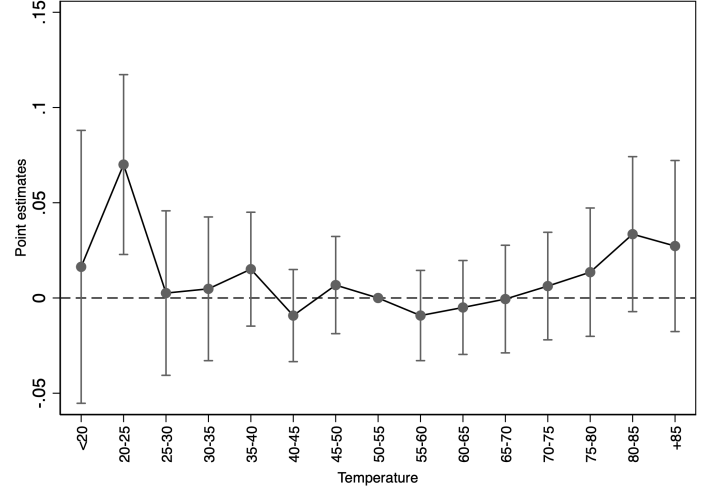
Notes: This figure plots the coefficients on the temperature indicator variables from estimation of a non-linear variant of the specification reported on column (1) from Table 7. The non-linear variant replaces the continuous temperature measure with a series of temperature indicator variables of width 5 degrees Fahrenheit. Grey lines show the 95 percent confidence intervals based on standard errors clustered on venue-month.

Figure A.8: Non-linear randomization test: Asylum application

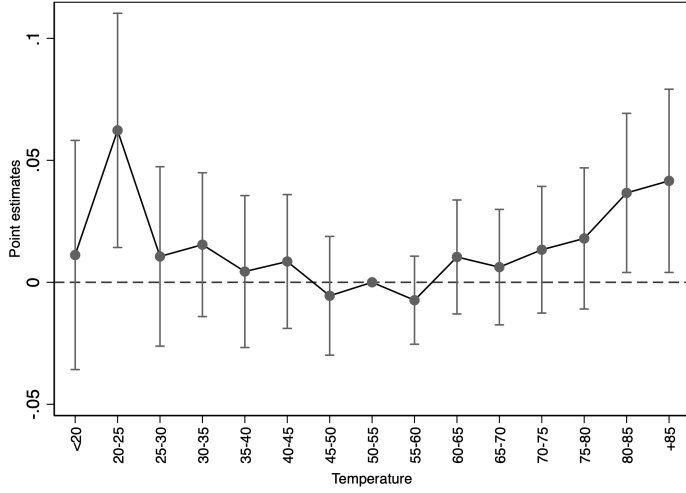
(a) Middle East



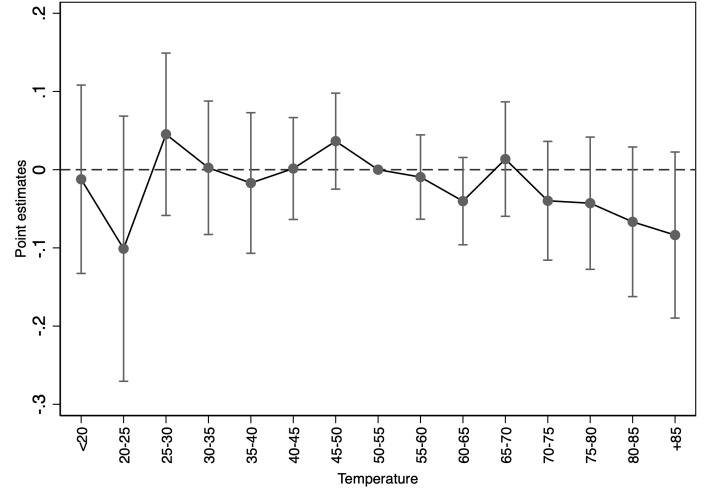
(b) Female judge



(c) Type of application

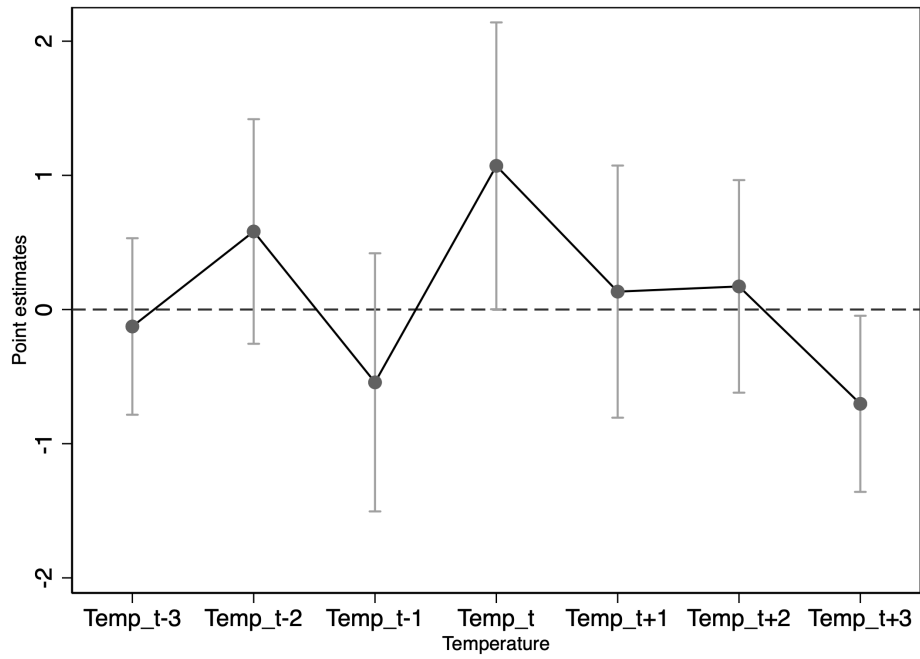


(d) Total cases

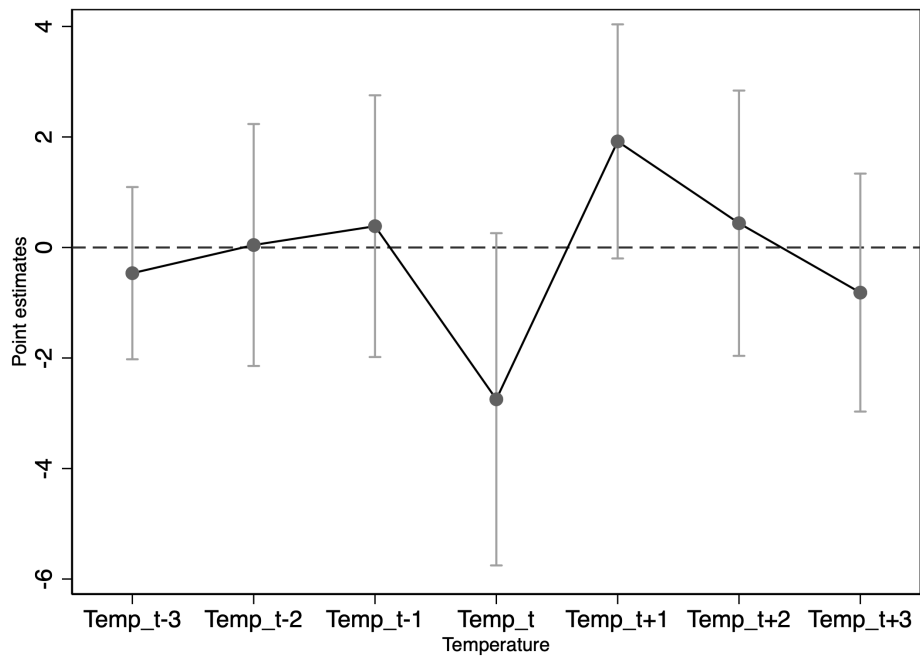


Notes: These figures plot the coefficients for the temperature indicator variables from estimation of the non-linear specification reported in column (1) of Table A.3 using different dependent variables. The dependent variable is in panel (a) a dummy taking value one if an applicant is Middle Eastern origin, zero otherwise in panel (b) a dummy taking value one if a judge is female, in panel (c) a dummy for type of application and in panel (d) the total number of cases heard by a judge on a day. Grey lines show the 95 percent confidence interval based on standard errors clustered on city-month.

Figure A.9: Timing of exposure
(a) Type of application



(b) Total number of cases



Notes: These figures plot the coefficients that result from running the specification in columns (1) and (4) of Table A.5 but including three lags and three leads of the temperature variable. Grey lines show the 95 percent confidence intervals based on standard errors clustered on city-month.