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LETTER

Heat causes large earnings losses for informal-sector workers in India

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Abstract

Heat reduces labor productivity and output in formal manufacturing but little is known about its impacts on the earnings and welfare of workers in the informal sector that comprise 82% of the labor force in low-income and lower-middle-income countries. This study reports the results from daily surveys of nearly 400 workers in two slums in Delhi for a month in the summer of 2019. Every degree Celsius increase in wet bulb temperature was associated with a fall in gross earnings of 13($\pm$3.5) percentage points, a fall in earnings net of work-related expenditure of 19($\pm$4.5) percentage points, an increase in the self-reported probability of sickness of the worker or a family member of 6($\pm$0.5) percentage points, and a decrease in the probability that a worker went to work of 2($\pm$0.5) percentage points. Net earnings were 40% lower during the two heatwaves that occurred during the study period. Over 320 million informal-sector workers in low-income and lower-middle-income countries are currently exposed to temperatures similar to those observed in this study.

1. Introduction

High temperatures are associated with a loss in incomes at the country level (Dell *et al* 2012, Burke *et al* 2015), as well as at the firm level in the manufacturing sector (Chen and Yang 2017, Zhang *et al* 2018, Adhvaryu *et al* 2020, Somanathan *et al* 2021). Losses per degree C increase at high temperatures have been estimated to be of the order of 2%. However, the estimates for manufacturing pertain to the formal economy. 63% of the world's labor force is in the informal sector with this percentage rising to 82% in low-income and lower-middle-income countries (ILO 2021). Altogether, there are 1.9 billion people working in the informal sector worldwide. The International Labour Organization defines informal employment as 'all remunerative work (i.e. both self-employment and wage employment) that is not registered, regulated or protected by existing legal or regulatory frameworks, as well as non-remunerative work undertaken in an income-producing enterprise. Informal workers do not have secure employment contracts, workers' benefits, social protection or workers' representation' (ILO 2015).

A systematic review and meta-analysis found that exposure to heat has adverse effects on health and productivity (Flouris *et al* 2018). A study in southern India comparing workers in indoor formal sector occupations with outdoor informal sector workers found that the latter were twice as likely to report heat related illness and 11 times more likely to report productivity losses due to heat (Venugopal *et al* 2021). However, only a few studies estimate productivity or labor supply losses from heat for workers in the informal sector. The results of some of these studies suggest that there may be earnings losses due to heat for informal-sector workers. Earnings losses in such studies are inferred from impacts on labor supply (Das 2015, Heyes and Saberian 2022) or productivity (Sahu *et al* 2013, Sett and Sahu 2014). However, earnings losses may occur via both channels and previous studies each provide information about only one of them. In this paper, we surveyed a sample of about 400 urban informal-sector workers in Delhi daily for about a month during the summer of 2019, asking them directly about earnings, hours worked, and other indicators. This allows us to capture both labor supply and productivity effects. Moreover, the panel nature of the data allow us to control for worker fixed effects, generating more reliable estimates of the impact of high temperatures.

2. Data

Two slums in north-west Delhi were chosen for their proximity to the first author's institution. Selection of workers into the survey was by systematic random sampling as follows. A target sample size of 400 was set. Beginning at a street corner near the center of each slum, the surveyors asked at every 20th house if the principal earner was either self-employed or working without an employment contract, and therefore, on daily wages or a piece rate. If these criteria were met and the worker was willing to participate, they were enrolled in the study. Otherwise, the team moved on to the neighboring houses seeking a replacement until the conditions were met. The principal earners were surveyed daily about their work, rest, and health, during the hottest time of the year, May and June, before the arrival of the monsoon in 2019. The subjects were working in about twenty different occupations in the informal sector, either self-employed or on daily or piece-rate wages. These included launderers, construction workers, painters, coolies (manual laborers in transport or other sectors), cycle rickshaw drivers, electric rickshaw drivers, auto (three-wheeled taxi) drivers, taxi drivers, food vendors, street vendors, rag pickers, petty traders, fruit sellers, waste and scrap dealers, roadside barbers, cobblers, roadside cycle/auto mechanics, and others. As this survey required a continuous visit to these households for one month, we promised an incentive of INR500 (=USD7) in the form of a coupon at a department store chain, to be given at the end of the survey, to each household if they cooperated. These coupons were distributed to all surveyed households on the 25th of June 2019 after the survey.

The survey was carried out by enumerators employed by a survey firm that we contracted. The data pertain to the period May 21 through June 21. Enumerators surveyed the principal earners daily about their work, rest, and health the previous day using Kobotools software on mobile devices. Subjects were asked about their hours worked, hours rested during the day, hours slept the previous night, total earnings, total work-related expenditures, whether they or any of their family members were sick, whether they went to a doctor, etc[3] Net daily earnings were constructed as earnings net of work-related expenditure.

We started with 11 668 observations on 397 workers between May 21 and June 21. Enumerators were required to upload a photo of the worker's interview location with a timestamp following the daily interview. Random checks within a few days of the start revealed that a few enumerators had faked the photos. These enumerators were discontinued and data collected by them dropped. There was some duplication of dates and some incorrectly formatted worker IDs. Some of these were clearly identified as typos and duly corrected. The rest were dropped. The data on total work-related expenditures, medical expenditures, and total earnings contained a few extreme outliers, so we dropped the top 0.5% of observations. To deal with outliers in hours slept we also dropped the top 0.5% of observations and the bottom 1% of observations. We are left with a final dataset of 9972 observations on 396 workers.

The survey data were matched with temperature data from the meteorological station at Delhi Airport which has half-hourly data on weather variables. Wet bulb temperature, a measure of heat that is relevant to human physiology, was constructed as a nonlinear function of temperature and relative humidity at the half-hourly frequency (equations (13) and (14) in Lemke and Kjellstrom (2012)), and then averaged to get a daily wet bulb temperature.

3. Estimation and results

3.1. Descriptive statistics

Figure 1 shows the variation in daily temperature measures during the study period. Temperatures were towards the upper end of the range experienced by people worldwide. Minimum temperature ranged from 22 °C to 35 °C, maximum temperature from 32 °C to 48 °C, and wet bulb temperature from 24 °C to 30 °C. This range of wet bulb temperatures is estimated to be dangerous and not survivable if exposure in dry conditions lasts for a few hours or more with vulnerability varying by age (Vanos *et al* 2023). We applied the official definition of a heatwave as defined by the India Meteorological Department[4] to airport station data and found that there were two heatwaves, one at the end of May and early June, and the second around the 10th of June, for a total of 10 heatwave days. 2019 was a hot year, but not the hottest in recent years. From 1997 to 2023 there were three years with more heatwave days during the study period (May–June) and one year with as many. Only six years in this 27-year span had no heatwave days at all.

Summary statistics for all the variables used are given in table A.1 in the appendix. Figure 2 plots the web bulb temperature and the negative of the log of the mean over all workers of daily earnings. The rough correspondence between the two curves suggests a negative relationship between temperature and earnings that we will investigate more closely.

[3] The questionnaire is in appendix A.2.

[4] https://imdpune.gov.in/library/public/DWE-2018_final.pdf accessed 31 May 2024.

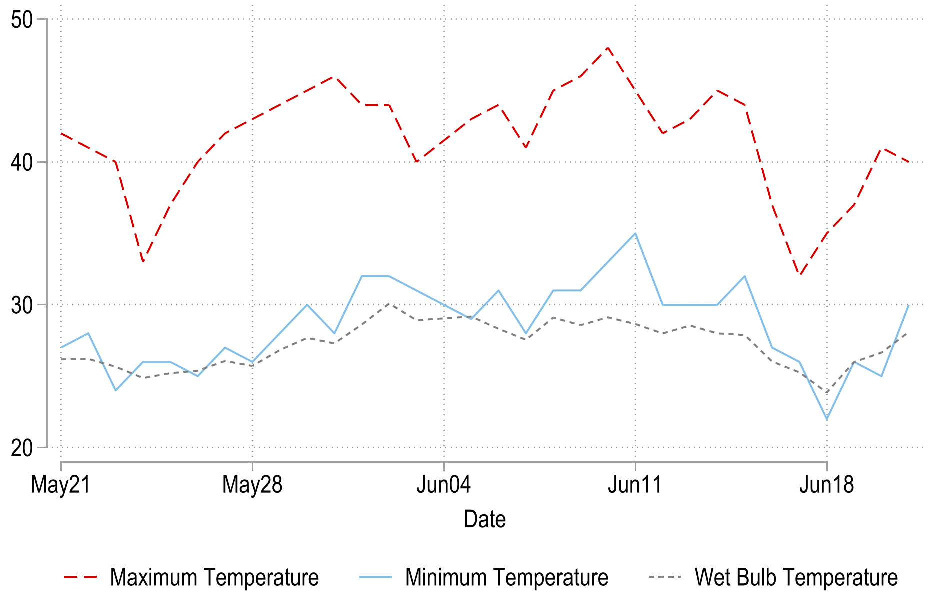

Figure 1. Temperatures in Celsius degrees during the study period in 2019.

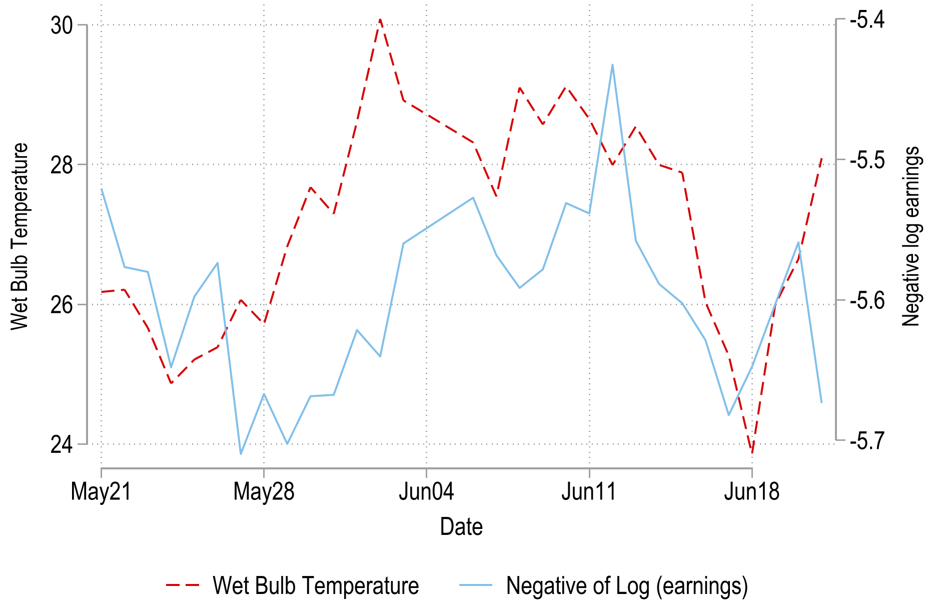

Figure 2. Daily Wet bulb temperature and the negative of the log of mean earnings.

3.2. Regression results

Our regressions take the form

$$y_{it} = \alpha_i + \beta_1 T_t + \sum_{j=1}^{k} \beta_j X_{jt} + \epsilon_{it} \quad (1)$$

where i denotes a worker, t denotes a day, y is an outcome pertaining to earnings, expenditure, rest, work hours, or health, T_t is one of maximum temperature, minimum temperature, average temperature, or wet bulb temperature on day t, X_j are controls, and ϵ is the error term. y is modeled as a linear function of temperature with a common slope but possibly different intercepts α_i for each worker i[5]. When T is any one of maximum, minimum, or average temperature, then relative humidity is included in the vector of controls X. Since wet bulb temperature is already computed as a non-linear function of relative humidity and temperature, we do not separately control for relative humidity in those regressions. X includes a dummy for the Eid holiday that fell on the 5th of

[5] The α_is are called 'worker fixed effects', since, unlike temperature, they do not vary over time, but are a measure of a worker's expected earnings.

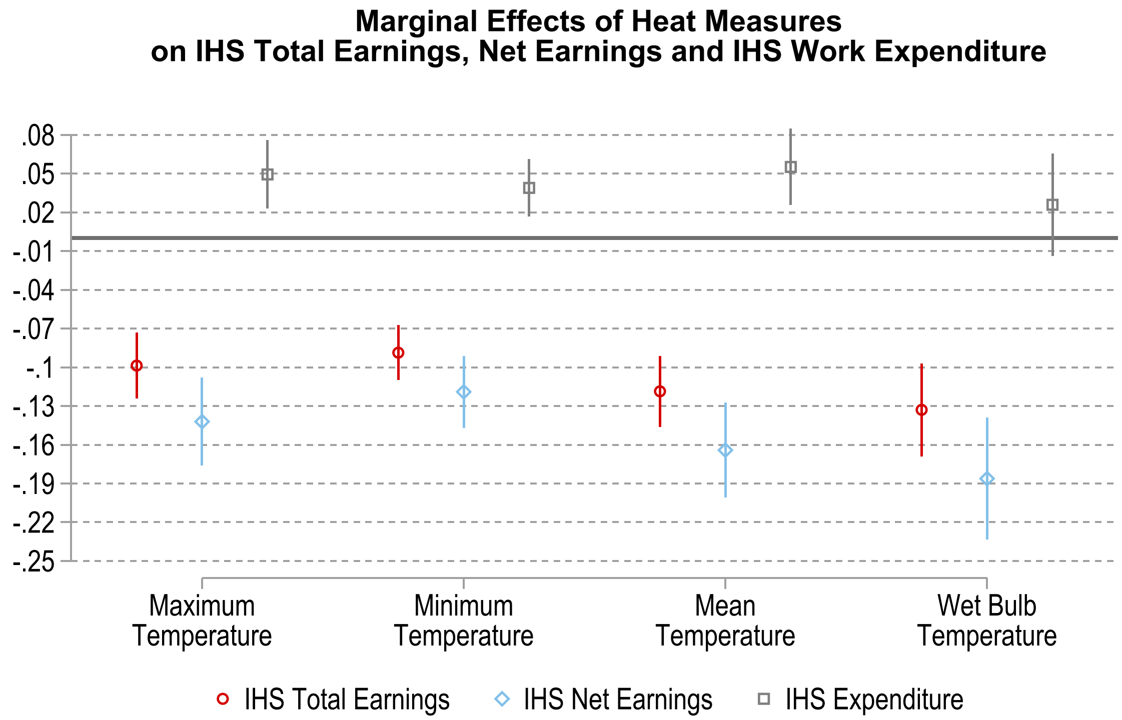

Figure 3. Coefficients from regressions of inverse hyperbolic sine functions of daily total earnings, net earnings, and work-related expenditures on daily minimum, average, and wet bulb temperature in degrees Celsius. All regressions include worker fixed effects. The maximum, minimum and average temperature regressions also control for relative humidity. Standard errors are clustered by worker. The coefficients in the figure are taken from tables A.2–A.4.

June, and day-of-the-week fixed effects, since some days of the week may be better for business, and therefore, earnings, than other days. Precipitation is not included as a control because there was none recorded throughout this period. The schools were closed for summer holidays throughout the period so we do not expect any correlation between temperatures and omitted demand-side variables. Of course, we do expect that temperatures would affect the demand for labor or for products sold by self-employed workers. This is a channel that we want to capture.

We control for relative humidity in our regressions because avoiding confounding of the effects of temperature with those of relative humidity is important. Both heat and humidity are known to adversely affect health and productivity. Maximum temperature is strongly and negatively correlated with relative humidity in our data (the correlation coefficient is −0.82) while minimum temperature is somewhat less so. Climate models generally predict no change in relative humidity as the globe warms (Douville *et al* 2022).

3.2.1. Earnings

We first examine the effects of heat on daily earnings measured in rupees. We are interested in estimating the effects of a one-degree change in temperature on the percentage change in earnings. Since earnings are sometimes zero and net earnings are sometimes negative, we use the inverse hyperbolic sine of earnings instead of the log of earnings as the dependent variable. This function is defined for all real numbers and has almost the same derivative as the log function when the absolute value of earnings is greater than 2, which it is for all non-zero values (Norton 2022). So we can interpret a temperature coefficient as a semi-elasticity—the change in y as a proportion of y for a unit change in T. We use the same function to transform total work-related expenditure and net earnings (earnings less work-related expenditure)[6].

The estimated coefficients on the temperature measures, β_1 in equation (1) for gross earnings, earnings net of work-related expenditure, and work-related expenditure, together with their 95% confidence intervals, are depicted in figure 3. The other statistics from these regressions are reported in appendix tables A.2–A.4.

Temperature has a negative effect on both gross and net earnings, that is large for all the temperature measures. The point estimates for gross earnings are −10, −9, −12, and −13 percentage points for a 1 °C increase in maximum, minimum, mean, and wet bulb temperature respectively. Those for net earnings are larger. A one-degree increase in mean temperature is

[6] Since there are zero and negative values in some of the earnings variables, the semi-elasticities can be different from the coefficients. We re-calculated semi-elasticities using the method of Norton (2022), and found that they are almost identical to the coefficients that we report below.

associated with a decline in net earnings of about 16% while a one-degree increase in wet bulb temperature is associated with a decline in net earnings of close to 19%. It should be noted that wet bulb temperature increases by about half a degree with every degree increase in mean temperature, due to the negative relation between temperature and relative humidity. Thus the larger effect sizes with respect to wet bulb temperature are to be expected. The effects of different temperature measures on work-related expenditure are positive and the point estimates are smaller.

We note that humidity has large, statistically significant, negative effects on earnings—for example, a 1-percentage-point increase in relative humidity is associated with a fall in net earnings of 3.5% in the regression with mean temperature (appendix table A.3, column (3)). In subsequent regressions with other outcomes, we control for relative humidity in all specifications (except those with wet bulb temperature). We consistently find negative and statistically significant effects of relative humidity on various measures of worker welfare as seen in the appendix tables. We also explored the use of specific humidity in place of relative humidity. We find that an increase of 0.1 g of water vapor per kg of air is associated with a fall in net earnings of nearly 10% (appendix table A.5). These findings regarding the negative effects of humidity are in line with the physiology literature but have generally not been found in the epidemiology literature, perhaps because most studies have been conducted in temperate countries at lower temperatures (Baldwin *et al* 2023). The fit of the regression, as measured by the Akaike information criterion (AIC), is considerably improved with the inclusion of a humidity measure (the AIC is smaller), and the fit is better when relative humidity, rather than specific humidity, is used[7].

3.2.2. Labor supply

The probability that a worker did not go to work in the whole sample was quite high: 17%. This is affected by heat, as seen in figure 4. The probability increases by 1 to 2 percentage points per degree for all the temperature measures. The probability of not working due to it being too hot, as expected, increases by substantially more with each degree increase in temperature. Remarkably, the probability that workers did not work because they did not find work was unaffected by temperature. These data are in response to the question of why a worker did not work on a given day, asked as a follow up to the yes/no question of whether or not the respondent worked. It suggests that the reason workers did not work on a hot day was not due to a demand-side effect, but was a supply-side effect. In order to probe further into whether demand-side effects play a role in the marginal effects of temperature on the probability of not going to work, we classified workers into occupations that are likely to face a decrease in demand on hotter days and those that are not[8]. There is no significant difference in the marginal effects for the two groups, again suggesting that the effects of heat on lost earnings due to not working are coming from the supply side, and not the demand side (tables A.19 and A.20).

3.2.3. Health

Figure 5 presents the regression results for whether workers said that they or a family member were sick or visited a doctor, whether workers slept well, and whether they went to work. A one-degree increase in the various temperature measures raises the probability of someone in the family being sick by 5 to 7 percentage points. A one-degree increase in the different temperature measures reduces the probability of going to work by between 1 and 2 percentage points. The probability of sleeping well also falls by about 1 to 2 percentage points for every degree increase in the temperature measures. Figure 6 shows that hours slept at night fall by 0.16 to 0.21 hours per degree increase in the various temperature measures. These results are consistent with the idea that heat interferes with sleep.

Medical expenditure increases by 9 percentage points with every degree increase in maximum or minimum temperature, by 14 percentage points with every degree increase in average temperature, and by nearly 15 percentage points for every degree increase in wet bulb temperature (figure 7). These are substantial increases. Since visits to a doctor did not increase with temperature, this suggests that the increased expenditure at higher temperatures was on medication to relieve symptoms associated with the effects of heat.

3.2.4. Adaptation expenditure

Our survey asked workers what their work-related expenditure on raw materials, fuel, repairs, travel, and other items was on each day. If they mentioned expenditure in the 'other' category, they were asked

[7] To save space, we do not report further results with specific humidity, but we note that specific humidity, like relative humidity, has highly statistically significant effects on other outcomes such as whether a worker went to work (the coefficient is negative), or whether any member of the family was sick (the coefficient is positive). The fit of these regressions with mean temperature is best when specific or relative humidity is included as a control, and worst when it is not. The fit is between these when wet bulb temperature is used instead. This ranking of the fit of models applies to most of the other outcomes as well. These additional results are available from the authors upon request.

[8] Occupations we think are likely to see a decrease in demand due to heat include washermen, manual rickshaw drivers, E-rickshaw drivers, snack sellers, petty traders, and cobblers. Those that are unlikely to see such a decrease include construction workers and painters, coolies (daily wage casual laborers in unskilled work, principally loading and unloading goods), door-to-door vendors, juice sellers, ice cream sellers, rag pickers, fruit sellers, and kabadiwallahs (door-to-door waste and scrap dealers).

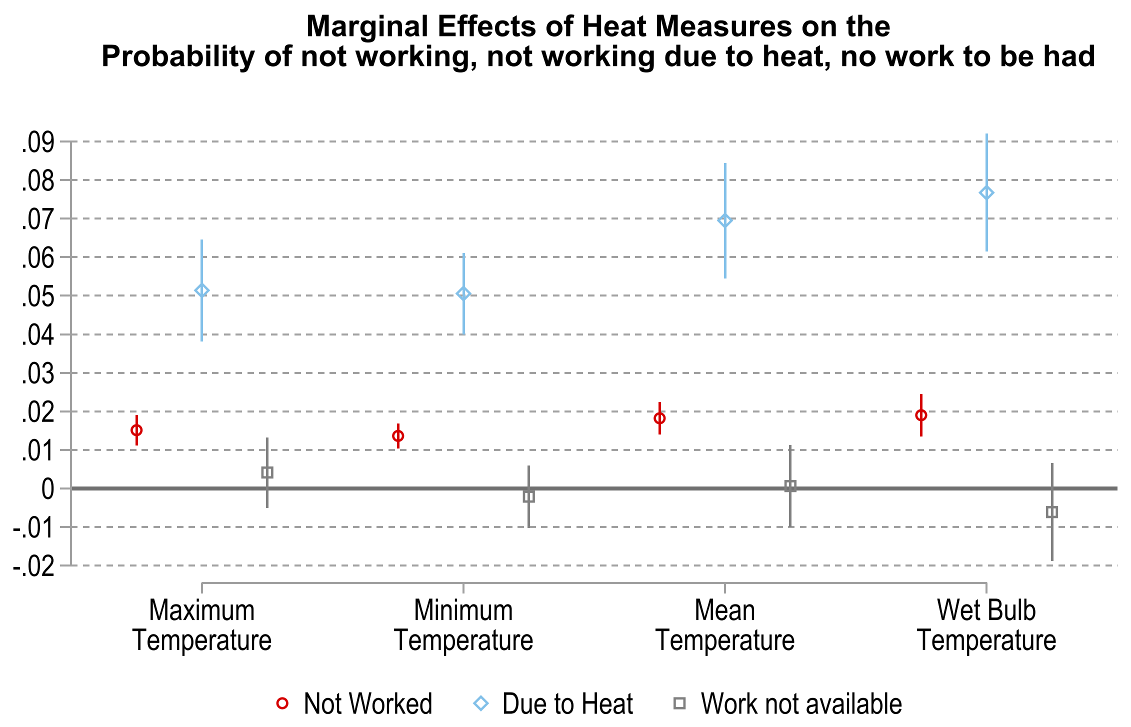

Figure 4. Coefficients and 95% confidence intervals from equation (1) where the outcomes are dummy variables for whether a worker did not go to work, did not work due to heat, and did not work because no work was available. All regressions include worker fixed effects. The maximum, minimum and average temperature regressions also control for relative humidity. Standard errors are clustered by worker. The coefficients in the figure are taken from tables A.6–A.8.

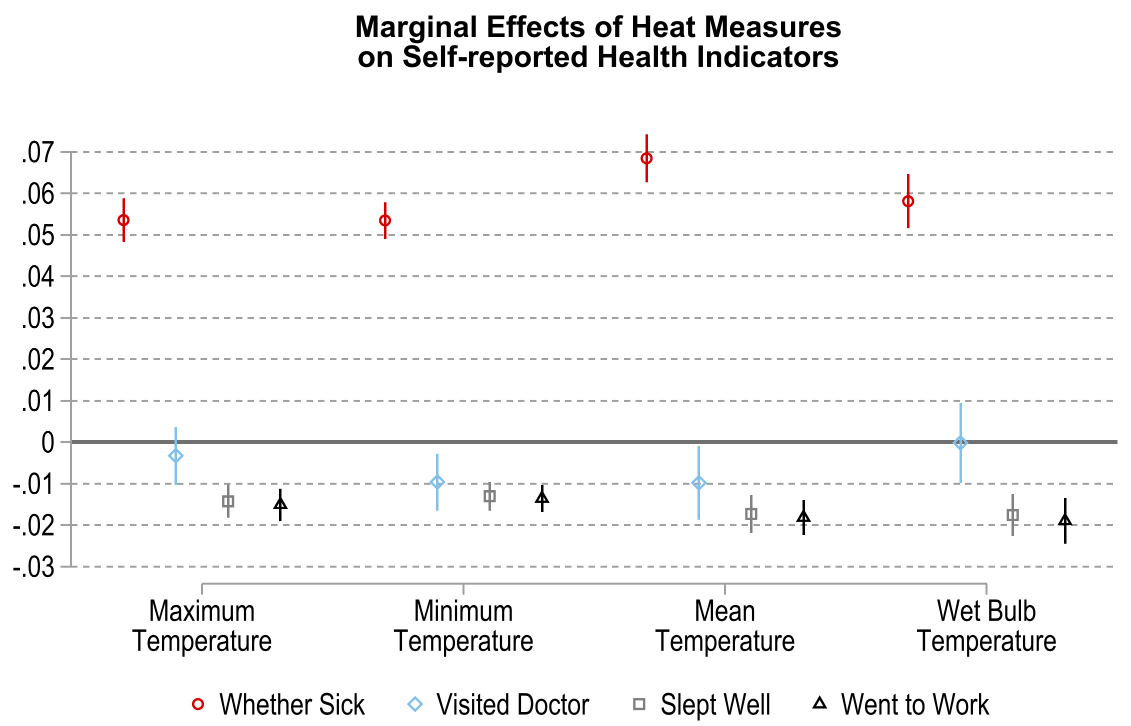

Figure 5. Coefficients and 95% confidence intervals from equation (1) where the outcomes are dummy variables for whether a worker or family member was sick, visited a doctor, whether a worker slept well, and went to work. All regressions include worker fixed effects. The maximum, minimum and average temperature regressions also control for relative humidity. Standard errors are clustered by worker. The coefficients in the figure are taken from tables A.9–A.12.

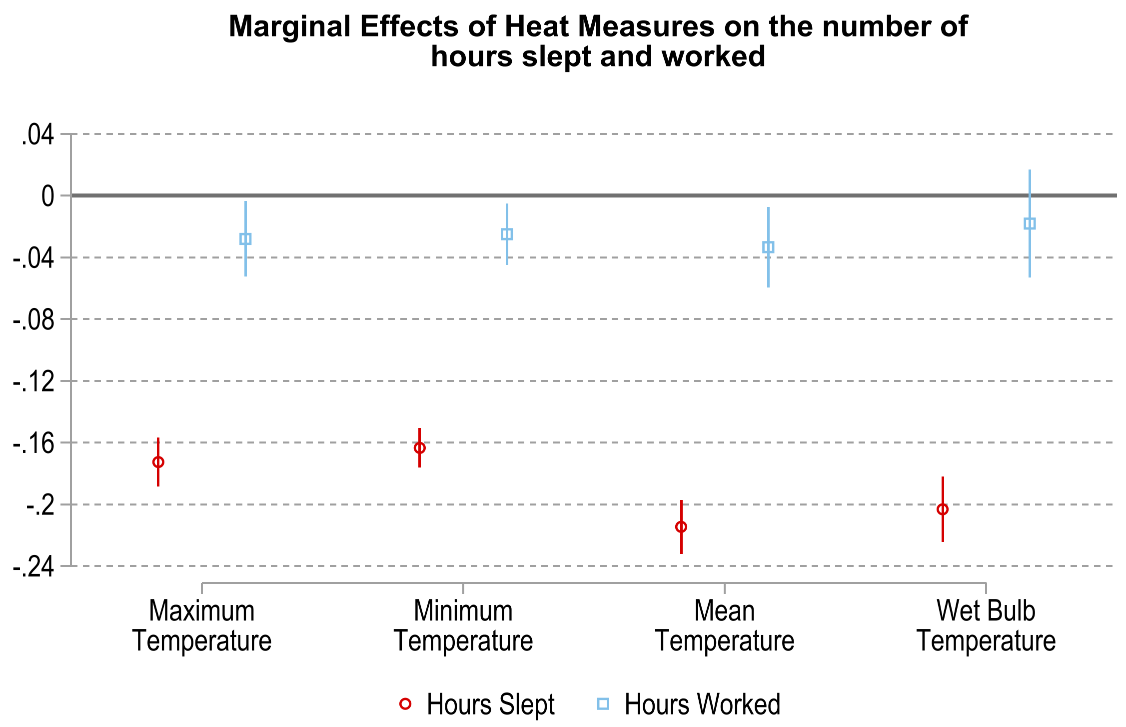

Figure 6. Coefficients and 95% confidence intervals from equation (1) where the outcomes are the number of hours slept, worked, and rested during the day. All regressions include worker fixed effects. The maximum, minimum and average temperature regressions also control for relative humidity. Standard errors are clustered by worker. The coefficients in the figure are taken from tables A.13 and A.14.

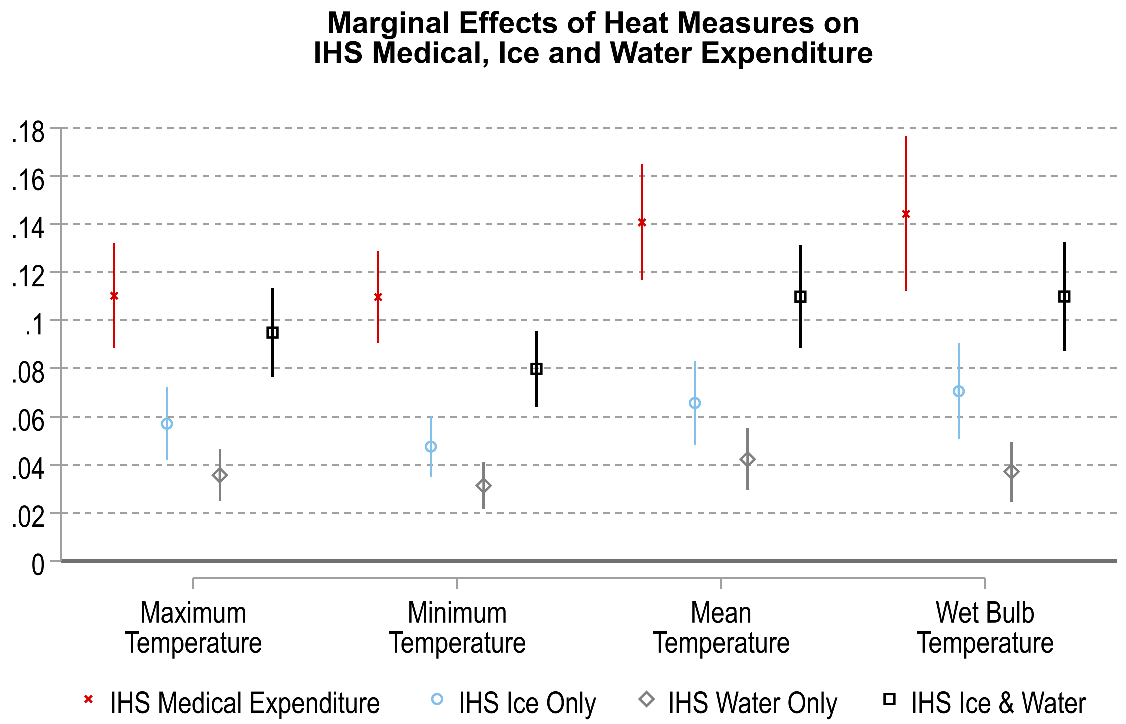

Figure 7. Coefficients from regressions of inverse hyperbolic sine functions of medical, ice, water, and ice & water expenditures on daily maximum, minimum, average, and wet bulb temperature in degrees Celsius. All regressions include worker fixed effects. The maximum, minimum and average temperature regressions control for relative humidity. Standard errors are clustered by worker. Full results from these regressions are given in tables A.15–A.18.

to specify the items. There were many instances in which water or ice was mentioned. These are presumably among the ways that workers coped with the heat and stayed hydrated while they went about their work. Figure 7 shows the marginal effects of temperature measures on an inverse hyperbolic sine function of expenditure on ice, water, and ice and water with the same controls as before. It shows that these expenditures increased with temperature for all the measures.

3.3. Impacts of heatwaves

As remarked in section 3.1, there were two officially designated heatwaves during the study period that together accounted for about one-third of the days. We report the effect of a heatwave on some of the main outcomes by using an indicator variable for whether or not there was a heatwave as the temperature measure in equation (1) with all other controls being the same. Workers on average had net earnings that were 40% lower on heatwave days than on non-heatwave days, were 6 percentage points less likely to go to work, and were 25 percentage points more likely to be sick or have a family member who was sick ($p < 0.01$ in all three cases, see table A.21). These results are not surprising given our previous findings. However, some caution is warranted in assessing the size of these effects since there were only two heatwaves.

4. Discussion

We have shown that higher summer temperatures in a sub-tropical city are associated with less sleep, more self-reported sickness and medical expenditures, and lower earnings among workers in the informal sector. The effect on earnings (net of costs) is very large—a 19% drop in earnings per °C increase in wet bulb temperature and a 16% drop per °C increase in daily mean temperature. The effect size is very large, considerably larger than the effect size for GDP (Dell *et al* 2012, Burke *et al* 2015) or manufacturing sector output (Somanathan *et al* 2021) reported in the literature. For example, in Indian garment plants around Delhi, worker output falls by about 12% at outdoor wet bulb temperatures above 27 °C compared to a baseline of 17 °C (Somanathan *et al* 2021). The much larger effect seen in this study may be partly due to the fact that the workers in this study work outdoors and are, therefore, more vulnerable to the effects of heat.

Outdoor workers under training at a construction site in Hong Kong were found to have a productivity decline of 3% for a 1 °C increase in wet bulb globe temperature in a range similar to that of wet bulb temperature in this study (Yi and Chan 2017). Again, this effect size is much smaller than that found here, which is likely due to a combination of the fact that work conditions in the Hong Kong study were less harsh, that only productivity loss on the job was measured, and workers in our study have much poorer living conditions. Sahu *et al* (2013) found that the productivity of rice harvesters in eastern India as measured by bundles harvested per hour declined by about 5% per degree increase in wet bulb temperature at a range of temperatures similar to those in this study. Sett and Sahu (2014) found a linear decrease in productivity and stress on cardiac parameters of brick workers as the maximum air temperature crosses 34.9 °C. The income loss was 2 percent due to reduced speed from heat stress. These are also informal-sector outdoor workers exposed to very high temperatures. Kjellstrom *et al* (2018) combine data from Sahu *et al* (2013) and Wyndham (1969) and conclude that the productivity loss for high-intensity work such as agricultural labor in going from a wet bulb temperature of 27 °C–28 °C is about 5 percentage points (figure 1a in their paper). They also plot estimates from the International Standards Organization (figure 1(b) in their paper) that imply a larger productivity loss for high-intensity work of about 12 percentage points for the same increment in wet bulb temperature. These estimates are considerably smaller than the loss that we find here for a 1 °C increase in wet bulb temperature of nearly 19 percentage points. We note that wet bulb temperature in our study ranges from 24 to 30 °C with a mean of 27.4 °C. One reason that the effects on earnings seen in this study may be larger than in the literature is because the earlier studies estimate losses only while workers are working. This study estimates a comprehensive measure of income lost that includes inability to go to work due to heat in addition to productivity losses on the job. Although an absence of work opportunities on hotter days could in theory also contribute to the higher estimate, we did not find evidence that this was the case.

This study was conducted in a setting that is at the upper end of the global temperature range. However, we estimate that there are over 320 million workers in the informal sector in low-income and lower-middle-income countries who were exposed to an average temperature of 32 °C or higher during at least one month of the year[9]. This is the 25th percentile of the temperature range in our data. In other words, more than one-sixth of workers in the informal sector worldwide, may already be suffering heat-related losses of the magnitudes seen in this study.

A strength of this study is that it uses data at the daily frequency for a large number of workers to identify temperature effects on earnings, labor supply, and self-reported health indicators. It's principal

[9] We use gridded temperature data from the Hadcrut5 dataset to identify 1^o x 1^o grid cells that had at least one month with an average temperature above 32 °C in 2018–2022. We use World Bank data on informal sector employment at the country level and merge it with population data at the grid cell level. We attribute informal sector employment to each grid cell with a centroid within a country assuming the informal sector employment share is the same for all grid cells within a country.

limitation is that it is from a single location in a single season when temperatures were towards the upper end of the global range. It is important to conduct similar studies in many locations and climates, and all seasons, to better understand how global warming has affected the majority of the world's workers who are in the informal sector in developing countries. Further research is needed to learn how best to protect workers from health and income losses.

Data availability statement

The data that support the findings of this study are available at https://doi.org/10.7910/DVN/1Q5HZD (Das and Somanathan 2024).

Acknowledgments

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Conflict of interest

The authors declare no competing interests.

Appendix

A.1. Appendix tables

Table A.1. Summary statistics.

	Mean	Minimum	Maximum	SD
Min temperature	28.82	22	35	2.92
Max temperature	41.82	32	48	3.79
Mean temperature	35.32	29	41	3.10
Relative humidity (%)	34.52	19	57	11.92
Wet bulb temp	27.35	24	30	1.52
Total earnings	268.10	0	870	162.62
Net earnings	241.91	−400	870	154.15
Total expenditure	25.70	0	460	62.61
Total medical expenditure	17.75	0	470	55.04
Whether sick	0.44	0	1	0.50
Visited doctor	0.38	0	1	0.48
Slept well	0.90	0	1	0.30
Did not work	0.17	0	1	0.37
Hours slept	6.20	3	9	1.33
Hours worked	9.93	0	21	2.38
Didn't work due to heat	0.56	0	1	0.50
Didn't work- no work available	0.58	0	1	0.49
Expenditure on ice	1.48	0	100	5.87
Expenditure on water	1.04	0	60	4.94
Expenditure on ice or water	2.60	0	100	7.62

The dataset contains 9972 observations from 396 workers. Weather data from May 21 to June 23, 2019 has been used. Daily earnings and expenditures are in rupees. 1 USD = 21 rupees at PPP or 70 rupees at current exchange rates in 2019 (Source: https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm).

Table A.2. Gross earnings regressions from equation (1).

VARIABLES	(1) IHS Earnings	(2) IHS Earnings	(3) IHS Earnings	(4) IHS Earnings
Max temperature	−0.0987***			
	(0.0129)			
Relative humidity (%)	−0.0286***	−0.0134***	−0.0256***	
	(0.004 14)	(0.002 40)	(0.003 47)	
Eid holiday dummy	−1.656***	−1.791***	−1.680***	−1.602***
	(0.168)	(0.167)	(0.168)	(0.171)
Monday	−0.0844	0.0887	−0.0172	0.0635
	(0.0794)	(0.0734)	(0.0752)	(0.0732)
Tuesday	−0.219**	−0.160*	−0.240***	−0.171*
	(0.0940)	(0.0892)	(0.0928)	(0.0915)
Wednesday	−0.0833	−0.0606	−0.106	−0.0503
	(0.0812)	(0.0795)	(0.0809)	(0.0790)
Thursday	0.0299	−0.0853	−0.0407	−0.0181
	(0.0734)	(0.0746)	(0.0745)	(0.0737)
Friday	0.117	0.107	0.0947	0.127*
	(0.0719)	(0.0716)	(0.0719)	(0.0714)
Saturday	−0.107	0.0279	−0.0417	0.0239
	(0.0775)	(0.0763)	(0.0762)	(0.0759)
Min temperature		−0.0887***		
		(0.0108)		
Mean temperature			−0.119***	
			(0.0140)	
Wet bulb temp				−0.133***
				(0.0183)
Constant	10.49***	8.365***	10.45***	8.966***
	(0.689)	(0.375)	(0.611)	(0.509)
Observations	9919	9919	9919	9919
R-squared	0.036	0.038	0.040	0.036
Number of Workers	396	396	396	396
AIC	42 604	42 586	42 570	42 607

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.3. Net earnings regressions.

VARIABLES	(1) IHS Net Earnings	(2) IHS Net Earnings	(3) IHS Net Earnings	(4) IHS Net Earnings
Max temperature	−0.142***			
	(0.0173)			
Relative humidity (%)	−0.0402***	−0.0172***	−0.0346***	
	(0.005 38)	(0.002 93)	(0.004 45)	
Eid holiday dummy	−1.764***	−1.969***	−1.811***	−1.694***
	(0.192)	(0.192)	(0.191)	(0.194)
Monday	−0.188*	0.0626	−0.0843	0.0241
	(0.0991)	(0.0895)	(0.0930)	(0.0892)
Tuesday	−0.337***	−0.234**	−0.353***	−0.266**
	(0.110)	(0.103)	(0.109)	(0.106)
Wednesday	−0.104	−0.0593	−0.128	−0.0546
	(0.0964)	(0.0947)	(0.0963)	(0.0940)
Thursday	0.0336	−0.122	−0.0650	−0.0353
	(0.0880)	(0.0899)	(0.0895)	(0.0883)
Friday	0.160*	0.152*	0.132	0.176**
	(0.0838)	(0.0830)	(0.0836)	(0.0830)
Saturday	−0.115	0.0750	−0.0198	0.0661
	(0.0945)	(0.0923)	(0.0922)	(0.0912)
Min temperature		−0.119***		
		(0.0142)		
Mean temperature			−0.164***	
			(0.0187)	
Wet bulb temp				−0.186***
				(0.0240)
Constant	12.44***	9.086***	12.10***	10.14***
	(0.916)	(0.490)	(0.815)	(0.667)
Observations	9883	9883	9883	9883
R-squared	0.035	0.036	0.039	0.034
Number of workers	396	396	396	396
AIC	46 128	46 122	46 093	46 138

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.4. Total expenditure regressions.

VARIABLES	(1) IHS Total Expenditure	(2) IHS Total Expenditure	(3) IHS Total Expenditure	(4) IHS Total Expenditure
Max temperature	0.0493***			
	(0.0134)			
Relative humidity (%)	0.0210***	0.0127***	0.0187***	
	(0.003 93)	(0.002 22)	(0.003 37)	
Eid holiday dummy	−0.246**	−0.172*	−0.226**	−0.163*
	(0.0961)	(0.0969)	(0.0954)	(0.0924)
Monday	0.174***	0.0870	0.136**	0.0743
	(0.0629)	(0.0566)	(0.0590)	(0.0580)
Tuesday	0.187***	0.147**	0.189***	0.0653
	(0.0645)	(0.0605)	(0.0635)	(0.0627)
Wednesday	0.0350	0.0162	0.0407	−0.0297
	(0.0656)	(0.0641)	(0.0649)	(0.0637)
Thursday	−0.0493	0.002 64	−0.0156	−0.0464
	(0.0545)	(0.0553)	(0.0548)	(0.0545)
Friday	−0.0953*	−0.0947*	−0.0870	−0.123**
	(0.0531)	(0.0536)	(0.0537)	(0.0535)
Saturday	−0.0182	−0.0833	−0.0519	−0.121**
	(0.0556)	(0.0552)	(0.0547)	(0.0551)
Min temperature		0.0389***		
		(0.0113)		
Mean temperature			0.0551***	
			(0.0150)	
Wet bulb temp				0.0259
				(0.0201)
Constant	−1.114	0.132	−0.918	1.021*
	(0.695)	(0.381)	(0.642)	(0.557)
Observations	9921	9921	9921	9921
R-squared	0.008	0.007	0.008	0.002
Number of workers	396	396	396	396
AIC	38 502	38 504	38 495	38 554

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.5. Net earnings regressions controlling for specific humidity.

	Regression-IHS Net Earnings			
VARIABLES	(1) IHS Net Earnings	(2) IHS Net Earnings	(3) IHS Net Earnings	(4) IHS Net Earnings
Mean temperature	−0.0976***	−0.164***	−0.0597***	
	(0.0124)	(0.0187)	(0.0101)	
Specific humidity (g/kg)	−0.963***			
	(0.125)			
Eid holiday dummy	−1.703***	−1.811***	−2.041***	−1.694***
	(0.192)	(0.191)	(0.193)	(0.194)
Monday	−0.0693	−0.0843	0.0448	0.0241
	(0.0921)	(0.0930)	(0.0886)	(0.0892)
Tuesday	−0.402***	−0.353***	−0.0560	−0.266**
	(0.111)	(0.109)	(0.0997)	(0.106)
Wednesday	−0.121	−0.128	0.0457	−0.0546
	(0.0958)	(0.0963)	(0.0930)	(0.0940)
Thursday	−0.0840	−0.0650	0.002 48	−0.0353
	(0.0900)	(0.0895)	(0.0877)	(0.0883)
Friday	0.125	0.132	0.218***	0.176**
	(0.0836)	(0.0836)	(0.0828)	(0.0830)
Saturday	−0.0261	−0.0198	0.0947	0.0661
	(0.0923)	(0.0922)	(0.0913)	(0.0912)
Relative humidity (%)		−0.0346***		
		(0.004 45)		
Wet bulb temp				−0.186***
				(0.0240)
Constant	9.696***	12.10***	7.106***	10.14***
	(0.555)	(0.815)	(0.365)	(0.667)
Observations	9883	9883	9883	9883
R-squared	0.038	0.039	0.029	0.034
Number of workers	396	396	396	396
AIC	46 104	46 092	46 192	46 138

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.6. Regression-probability of not working.

VARIABLES	(1) Didn't work	(2) Didn't work	(3) Didn't work	(4) Didn't work
Max temperature	0.0151***			
	(0.001 99)			
Relative humidity (%)	0.004 64***	0.002 31***	0.004 19***	
	(0.000 635)	(0.000 359)	(0.000 528)	
Eid holiday dummy	0.253***	0.274***	0.257***	0.249***
	(0.0266)	(0.0263)	(0.0265)	(0.0271)
Monday	0.0113	−0.0154	0.000 942	−0.0124
	(0.0121)	(0.0112)	(0.0115)	(0.0112)
Tuesday	0.0394***	0.0304**	0.0427***	0.0285**
	(0.0142)	(0.0136)	(0.0141)	(0.0138)
Wednesday	0.0194	0.0160	0.0230*	0.0127
	(0.0124)	(0.0121)	(0.0123)	(0.0121)
Thursday	0.000 706	0.0185	0.0116	0.007 41
	(0.0111)	(0.0112)	(0.0112)	(0.0111)
Friday	−0.0103	−0.008 90	−0.006 96	−0.0126
	(0.0107)	(0.0107)	(0.0107)	(0.0106)
Saturday	0.0252**	0.004 42	0.0152	0.003 70
	(0.0120)	(0.0118)	(0.0118)	(0.0118)
Min temperature		0.0136***		
		(0.001 64)		
Mean temperature			0.0182***	
			(0.002 14)	
Wet bulb temp				0.0190***
				(0.002 79)
Constant	−0.644***	−0.319***	−0.639***	−0.363***
	(0.106)	(0.0569)	(0.0936)	(0.0774)
Observations	9971	9971	9971	9971
R-squared	0.037	0.039	0.041	0.036
Number of workers	396	396	396	396
AIC	5346	5327	5311	5362

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.7. Regression-probability of not working due to heat.

VARIABLES	(1) Too hot	(2) Too hot	(3) Too hot	(4) Too hot
Max temperature	0.0514***			
	(0.006 70)			
Relative humidity (%)	0.0131***	0.006 98***	0.0142***	
	(0.002 19)	(0.001 36)	(0.002 05)	
Eid holiday dummy	−0.268***	−0.193***	−0.255***	−0.321***
	(0.0444)	(0.0423)	(0.0434)	(0.0456)
Monday	0.134***	0.0353	0.0895***	0.0614*
	(0.0367)	(0.0327)	(0.0340)	(0.0335)
Tuesday	0.126***	0.0928***	0.141***	0.118***
	(0.0351)	(0.0320)	(0.0339)	(0.0331)
Wednesday	0.156***	0.133***	0.157***	0.143***
	(0.0320)	(0.0310)	(0.0312)	(0.0314)
Thursday	0.0682**	0.130***	0.0996***	0.0971***
	(0.0328)	(0.0324)	(0.0324)	(0.0324)
Friday	0.107***	0.116***	0.119***	0.102***
	(0.0324)	(0.0328)	(0.0324)	(0.0323)
Saturday	0.0583*	−0.003 49	0.0311	−0.000 486
	(0.0328)	(0.0332)	(0.0332)	(0.0334)
Min temperature		0.0506***		
		(0.005 35)		
Mean temperature			0.0695***	
			(0.007 60)	
Wet bulb temp				0.0767***
				(0.007 77)
Constant	−2.134***	−1.218***	−2.482***	−1.606***
	(0.358)	(0.200)	(0.341)	(0.218)
Observations	2114	2114	2114	2114
R-squared	0.075	0.097	0.110	0.088
Number of workers	343	343	343	343
AIC	1475	1425	1392	1442

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.8. Regression-probability of no work available.

VARIABLES	(1) No Work Available	(2) No Work Available	(3) No Work Available	(4) No Work Available
Max temperature	0.004 14			
	(0.004 64)			
Relative humidity (%)	0.002 89**	0.001 37	0.001 86	
	(0.001 41)	(0.000 931)	(0.001 33)	
Eid holiday dummy	0.295***	0.305***	0.303***	0.317***
	(0.0383)	(0.0383)	(0.0387)	(0.0400)
Monday	0.008 22	0.004 54	0.003 23	0.001 65
	(0.0289)	(0.0292)	(0.0289)	(0.0291)
Tuesday	−0.0258	−0.0372	−0.0332	−0.0489
	(0.0335)	(0.0326)	(0.0333)	(0.0329)
Wednesday	0.001 53	−0.003 15	−0.001 75	−0.005 09
	(0.0303)	(0.0306)	(0.0306)	(0.0305)
Thursday	−0.0192	−0.0180	−0.0167	−0.0172
	(0.0278)	(0.0281)	(0.0276)	(0.0276)
Friday	−0.0134	−0.0156	−0.0143	−0.0175
	(0.0256)	(0.0259)	(0.0258)	(0.0256)
Saturday	0.0666**	0.0640**	0.0633**	0.0544*
	(0.0297)	(0.0301)	(0.0299)	(0.0294)
Min temperature		−0.002 12		
		(0.004 11)		
Mean temperature			0.000 615	
			(0.005 38)	
Wet bulb temp				−0.006 13
				(0.006 45)
Constant	0.276	0.567***	0.466**	0.726***
	(0.240)	(0.147)	(0.234)	(0.177)
Observations	2114	2114	2114	2114
R-squared	0.065	0.065	0.064	0.062
Number of workers	343	343	343	343
AIC	922.3	923	923.4	927.6

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.9. Regression- whether sick.

VARIABLES	(1) Whether Sick	(2) Whether Sick	(3) Whether Sick	(4) Whether Sick
Max temperature	0.0535***			
	(0.002 64)			
Relative humidity (%)	0.0194***	0.0118***	0.0186***	
	(0.000 911)	(0.000 564)	(0.000 810)	
Eid holiday dummy	−0.0787***	−0.0124	−0.0732***	−0.0661***
	(0.0246)	(0.0249)	(0.0246)	(0.0250)
Monday	0.164***	0.0706***	0.132***	0.0717***
	(0.0164)	(0.0147)	(0.0155)	(0.0148)
Tuesday	0.177***	0.155***	0.197***	0.108***
	(0.0155)	(0.0153)	(0.0158)	(0.0151)
Wednesday	0.0836***	0.0784***	0.102***	0.0458***
	(0.0133)	(0.0136)	(0.0136)	(0.0134)
Thursday	0.007 64	0.0758***	0.0476***	0.0241*
	(0.0121)	(0.0124)	(0.0122)	(0.0122)
Friday	0.0622***	0.0711***	0.0768***	0.0476***
	(0.0130)	(0.0127)	(0.0129)	(0.0127)
Saturday	0.0664***	−0.009 47	0.0319**	−0.0270**
	(0.0138)	(0.0132)	(0.0133)	(0.0131)
Min temperature		0.0534***		
		(0.002 22)		
Mean temperature			0.0684***	
			(0.002 92)	
Wet bulb temp				0.0581***
				(0.003 33)
Constant	−2.541***	−1.569***	−2.697***	−1.184***
	(0.143)	(0.0823)	(0.132)	(0.0927)
Observations	9971	9971	9971	9971
R-squared	0.073	0.099	0.105	0.036
Number of Workers	396	396	396	396
AIC	11 208	10 915	10 856	11 592

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.10. Regression- visited doctor.

VARIABLES	(1) Visited Doctor	(2) Visited Doctor	(3) Visited Doctor	(4) Visited Doctor
Max temperature	−0.003 30			
	(0.003 58)			
Relative humidity (%)	−0.002 12*	−0.003 04***	−0.003 58***	
	(0.001 14)	(0.000 813)	(0.001 18)	
Eid holiday dummy	0.0934***	0.0885**	0.0973***	0.0906***
	(0.0350)	(0.0355)	(0.0350)	(0.0349)
Monday	−0.003 84	0.006 58	−0.004 09	0.001 89
	(0.0217)	(0.0204)	(0.0209)	(0.0206)
Tuesday	−0.0208	−0.0238	−0.0294	−0.0107
	(0.0210)	(0.0199)	(0.0206)	(0.0207)
Wednesday	−0.008 14	−0.0108	−0.0130	−0.007 78
	(0.0221)	(0.0221)	(0.0221)	(0.0222)
Thursday	−0.0234	−0.0324*	−0.0256	−0.0263
	(0.0197)	(0.0194)	(0.0192)	(0.0192)
Friday	−0.0359*	−0.0414**	−0.0396**	−0.0336*
	(0.0191)	(0.0191)	(0.0190)	(0.0193)
Saturday	−0.004 67	−0.001 33	−0.005 40	0.008 02
	(0.0227)	(0.0228)	(0.0227)	(0.0227)
Min temperature		−0.009 63***		
		(0.003 48)		
Mean temperature			−0.009 85**	
			(0.004 50)	
Wet bulb temp				−0.000 204
				(0.004 91)
Constant	0.602***	0.781***	0.870***	0.389***
	(0.189)	(0.128)	(0.201)	(0.136)
Observations	4381	4381	4381	4381
R-squared	0.006	0.008	0.007	0.004
Number of workers	384	384	384	384
AIC	3063	3053	3057	3068

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.11. Regression- slept well.

VARIABLES	(1) Slept Well	(2) Slept Well	(3) Slept Well	(4) Slept Well
Max temperature	−0.0143***			
	(0.002 02)			
Relative humidity (%)	−0.004 53***	−0.002 35***	−0.004 13***	
	(0.000 659)	(0.000 363)	(0.000 581)	
Eid holiday dummy	−0.006 25	−0.0255*	−0.009 46	−0.003 09
	(0.0138)	(0.0139)	(0.0136)	(0.0136)
Monday	−0.0419***	−0.0167**	−0.0322***	−0.0191**
	(0.009 01)	(0.007 57)	(0.008 34)	(0.007 55)
Tuesday	−0.0606***	−0.0524***	−0.0640***	−0.0489***
	(0.0108)	(0.0102)	(0.0111)	(0.009 65)
Wednesday	−0.0333***	−0.0303***	−0.0368***	−0.0263***
	(0.008 83)	(0.008 60)	(0.009 02)	(0.008 26)
Thursday	−0.0287***	−0.0457***	−0.0390***	−0.0347***
	(0.008 12)	(0.008 98)	(0.008 67)	(0.008 33)
Friday	−0.0377***	−0.0392***	−0.0410***	−0.0353***
	(0.008 49)	(0.008 90)	(0.008 89)	(0.008 41)
Saturday	−0.0462***	−0.0265***	−0.0368***	−0.0250***
	(0.008 98)	(0.008 17)	(0.008 52)	(0.007 90)
Min temperature		−0.0131***		
		(0.001 72)		
Mean temperature			−0.0174***	
			(0.002 31)	
Wet bulb temp				−0.0176***
				(0.002 56)
Constant	1.693***	1.392***	1.695***	1.412***
	(0.110)	(0.0641)	(0.105)	(0.0727)
Observations	9971	9971	9971	9971
R-squared	0.018	0.022	0.025	0.014
Number of workers	396	396	396	396
AIC	−1338	−1375	−1402	−1300

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.12. Regression- went to work.

VARIABLES	(1) Went to Work	(2) Went to Work	(3) Went to Work	(4) Went to Work
Max temperature	−0.0151***			
	(0.001 99)			
Relative humidity (%)	−0.004 64***	−0.002 31***	−0.004 19***	
	(0.000 635)	(0.000 359)	(0.000 528)	
Eid holiday dummy	−0.253***	−0.274***	−0.257***	−0.249***
	(0.0266)	(0.0263)	(0.0265)	(0.0271)
Monday	−0.0113	0.0154	−0.000 942	0.0124
	(0.0121)	(0.0112)	(0.0115)	(0.0112)
Tuesday	−0.0394***	−0.0304**	−0.0427***	−0.0285**
	(0.0142)	(0.0136)	(0.0141)	(0.0138)
Wednesday	−0.0194	−0.0160	−0.0230*	−0.0127
	(0.0124)	(0.0121)	(0.0123)	(0.0121)
Thursday	−0.000 706	−0.0185	−0.0116	−0.007 41
	(0.0111)	(0.0112)	(0.0112)	(0.0111)
Friday	0.0103	0.008 90	0.006 96	0.0126
	(0.0107)	(0.0107)	(0.0107)	(0.0106)
Saturday	−0.0252**	−0.004 42	−0.0152	−0.003 70
	(0.0120)	(0.0118)	(0.0118)	(0.0118)
Min temperature		−0.0136***		
		(0.001 64)		
Mean temperature			−0.0182***	
			(0.002 14)	
Wet bulb temp				−0.0190***
				(0.002 79)
Constant	1.644***	1.319***	1.639***	1.363***
	(0.106)	(0.0569)	(0.0936)	(0.0774)
Observations	9971	9971	9971	9971
R-squared	0.037	0.039	0.041	0.036
Number of workers	396	396	396	396
AIC	5346	5327	5311	5362

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.13. Regression- hours slept.

VARIABLES	(1) Hours Slept	(2) Hours Slept	(3) Hours Slept	(4) Hours Slept
Max temperature	−0.173***			
	(0.008 05)			
Relative humidity (%)	−0.0576***	−0.0323***	−0.0540***	
	(0.002 49)	(0.001 57)	(0.002 26)	
Eid holiday dummy	−0.0414	−0.265***	−0.0699	−0.0310
	(0.0678)	(0.0693)	(0.0678)	(0.0674)
Monday	−0.378***	−0.0751**	−0.269***	−0.0917***
	(0.0351)	(0.0320)	(0.0330)	(0.0323)
Tuesday	−0.437***	−0.350***	−0.491***	−0.265***
	(0.0385)	(0.0384)	(0.0390)	(0.0376)
Wednesday	−0.196***	−0.170***	−0.250***	−0.0958***
	(0.0366)	(0.0364)	(0.0366)	(0.0367)
Thursday	0.004 54	−0.205***	−0.123***	−0.0543
	(0.0324)	(0.0337)	(0.0330)	(0.0332)
Friday	−0.156***	−0.184***	−0.203***	−0.117***
	(0.0360)	(0.0370)	(0.0367)	(0.0360)
Saturday	−0.257***	−0.0228	−0.149***	0.0190
	(0.0345)	(0.0344)	(0.0344)	(0.0338)
Min temperature		−0.163***		
		(0.006 46)		
Mean temperature			−0.215***	
			(0.008 90)	
Wet bulb temp				−0.203***
				(0.0108)
Constant	15.61***	12.18***	15.86***	11.84***
	(0.422)	(0.234)	(0.392)	(0.300)
Observations	9663	9663	9663	9663
R-squared	0.105	0.136	0.149	0.069
Number of workers	396	396	396	396
AIC	28 404	28 069	27 916	28 784

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.14. Regression- hours worked.

VARIABLES	(1) Hours Worked	(2) Hours Worked	(3) Hours Worked	(4) Hours Worked
Max temperature	−0.0281**			
	(0.0124)			
Relative humidity (%)	−0.0106***	−0.006 10***	−0.009 58***	
	(0.003 78)	(0.002 27)	(0.003 24)	
Eid holiday dummy	−0.0854	−0.123	−0.0914	−0.127
	(0.135)	(0.133)	(0.133)	(0.137)
Monday	−0.214***	−0.164**	−0.195***	−0.158**
	(0.0655)	(0.0636)	(0.0638)	(0.0641)
Tuesday	−0.143*	−0.126*	−0.149**	−0.0834
	(0.0738)	(0.0706)	(0.0726)	(0.0743)
Wednesday	−0.183**	−0.177**	−0.190**	−0.147**
	(0.0753)	(0.0732)	(0.0747)	(0.0744)
Thursday	−0.0364	−0.0678	−0.0564	−0.0381
	(0.0617)	(0.0609)	(0.0611)	(0.0610)
Friday	0.007 22	0.005 78	0.001 30	0.0213
	(0.0629)	(0.0632)	(0.0631)	(0.0629)
Saturday	−0.0594	−0.0193	−0.0398	−0.009 78
	(0.0646)	(0.0649)	(0.0643)	(0.0640)
Min temperature		−0.0250**		
		(0.0101)		
Mean temperature			−0.0334**	
			(0.0132)	
Wet bulb temp				−0.0181
				(0.0177)
Constant	11.56***	10.94***	11.53***	10.49***
	(0.644)	(0.350)	(0.570)	(0.488)
Observations	7847	7847	7847	7847
R-squared	0.004	0.004	0.004	0.002
Number of workers	396	396	396	396
AIC	29 495	29 494	29 492	29 504

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.15. Regression-IHS medical expenditure.

VARIABLES	(1) IHS Medical Expenditure	(2) IHS Medical Expenditure	(3) IHS Medical Expenditure	(4) IHS Medical Expenditure
Max temperature	0.110***			
	(0.0110)			
Relative humidity (%)	0.0341***	0.0185***	0.0325***	
	(0.003 36)	(0.001 89)	(0.002 83)	
Eid holiday dummy	0.0913	0.227**	0.102	0.0452
	(0.109)	(0.111)	(0.110)	(0.112)
Monday	0.278***	0.0857	0.211***	0.106
	(0.0748)	(0.0696)	(0.0720)	(0.0701)
Tuesday	0.234***	0.187**	0.274***	0.160**
	(0.0727)	(0.0725)	(0.0742)	(0.0727)
Wednesday	0.0837	0.0740	0.122*	0.0389
	(0.0660)	(0.0669)	(0.0670)	(0.0663)
Thursday	−0.105*	0.0349	−0.0229	−0.0564
	(0.0603)	(0.0621)	(0.0609)	(0.0610)
Friday	0.0153	0.0341	0.0457	3.50×10^{-05}
	(0.0610)	(0.0606)	(0.0610)	(0.0608)
Saturday	0.108	−0.0481	0.0373	−0.0520
	(0.0677)	(0.0668)	(0.0665)	(0.0653)
Min temperature		0.110***		
		(0.009 75)		
Mean temperature			0.141***	
			(0.0123)	
Wet bulb temp				0.144***
				(0.0163)
Constant	−5.091***	−3.077***	−5.405***	−3.190***
	(0.581)	(0.338)	(0.533)	(0.458)
Observations	9919	9919	9919	9919
R-squared	0.017	0.024	0.026	0.015
Number of workers	396	396	396	396
AIC	39 046	38 975	38 959	39 067

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.16. Regression-IHS ice.

VARIABLES	(1) IHS Ice	(2) IHS Ice	(3) IHS Ice	(4) IHS Ice
Max temperature	0.0570***			
	(0.007 77)			
Relative humidity (%)	0.0164***	0.007 11***	0.0141***	
	(0.002 34)	(0.001 19)	(0.002 02)	
Eid holiday dummy	0.000 315	0.0826**	0.0196	−0.0174
	(0.0363)	(0.0380)	(0.0365)	(0.0372)
Monday	0.151***	0.0506**	0.110***	0.0642***
	(0.0287)	(0.0222)	(0.0258)	(0.0225)
Tuesday	0.139***	0.0981***	0.145***	0.103***
	(0.0294)	(0.0261)	(0.0299)	(0.0257)
Wednesday	0.0433**	0.0250	0.0525***	0.0192
	(0.0184)	(0.0182)	(0.0195)	(0.0175)
Thursday	0.007 36	0.0704***	0.0471**	0.0344
	(0.0220)	(0.0242)	(0.0233)	(0.0225)
Friday	0.0389*	0.0413**	0.0496**	0.0309
	(0.0202)	(0.0210)	(0.0211)	(0.0205)
Saturday	0.0658***	−0.0106	0.0273	−0.007 80
	(0.0219)	(0.0203)	(0.0206)	(0.0197)
Min temperature		0.0475***		
		(0.006 42)		
Mean temperature			0.0657***	
			(0.008 88)	
Wet bulb temp				0.0705***
				(0.0102)
Constant	−2.756***	−1.401***	−2.611***	−1.706***
	(0.412)	(0.226)	(0.389)	(0.285)
Observations	9971	9971	9971	9971
R-squared	0.025	0.026	0.032	0.020
Number of workers	396	396	396	396
AIC	21 493	21 483	21 424	21 539

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.17. Regression-IHS water.

VARIABLES	(1) IHS Water	(2) IHS Water	(3) IHS Water	(4) IHS Water
Max temperature	0.0357***			
	(0.005 41)			
Relative humidity (%)	0.0123***	0.006 71***	0.0111***	
	(0.001 92)	(0.001 14)	(0.001 75)	
Eid holiday dummy	−0.0822***	−0.0327	−0.0724***	−0.0717***
	(0.0272)	(0.0268)	(0.0271)	(0.0275)
Monday	0.116***	0.0530***	0.0909***	0.0549***
	(0.0238)	(0.0168)	(0.0205)	(0.0169)
Tuesday	0.161***	0.138***	0.167***	0.116***
	(0.0267)	(0.0244)	(0.0277)	(0.0209)
Wednesday	0.0888***	0.0796***	0.0963***	0.0635***
	(0.0193)	(0.0182)	(0.0198)	(0.0168)
Thursday	0.0274*	0.0684***	0.0527***	0.0391***
	(0.0148)	(0.0175)	(0.0163)	(0.0150)
Friday	0.0617***	0.0644***	0.0691***	0.0519***
	(0.0158)	(0.0155)	(0.0160)	(0.0149)
Saturday	0.0970***	0.0485***	0.0732***	0.0388**
	(0.0189)	(0.0154)	(0.0167)	(0.0150)
Min temperature		0.0313***		
		(0.005 00)		
Mean temperature			0.0423***	
			(0.006 49)	
Wet bulb temp				0.0371***
				(0.006 31)
Constant	−1.818***	−1.025***	−1.780***	−0.891***
	(0.302)	(0.188)	(0.298)	(0.179)
Observations	9971	9971	9971	9971
R-squared	0.016	0.018	0.021	0.008
Number of workers	396	396	396	396
AIC	17 993	17 972	17 944	18 073

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.18. Regression-IHS ice and water.

VARIABLES	(1) Ice and Water	(2) Ice and Water	(3) Ice and Water	(4) Ice and Water
Max temperature	0.0949***			
	(0.009 34)			
Relative humidity (%)	0.0293***	0.0139***	0.0255***	
	(0.002 98)	(0.001 59)	(0.002 64)	
Eid holiday dummy	−0.0509	0.0852*	−0.0199	−0.0580
	(0.0429)	(0.0446)	(0.0431)	(0.0423)
Monday	0.255***	0.0873***	0.186***	0.104***
	(0.0339)	(0.0259)	(0.0304)	(0.0260)
Tuesday	0.291***	0.223***	0.302***	0.208***
	(0.0349)	(0.0310)	(0.0358)	(0.0281)
Wednesday	0.114***	0.0850***	0.130***	0.0638***
	(0.0209)	(0.0205)	(0.0222)	(0.0189)
Thursday	0.0176	0.123***	0.0840***	0.0575**
	(0.0238)	(0.0258)	(0.0248)	(0.0237)
Friday	0.0916***	0.0962***	0.110***	0.0735***
	(0.0220)	(0.0233)	(0.0232)	(0.0221)
Saturday	0.148***	0.0209	0.0845***	0.0146
	(0.0241)	(0.0214)	(0.0220)	(0.0207)
Min temperature		0.0799***		
		(0.007 95)		
Mean temperature			0.110***	
			(0.0109)	
Wet bulb temp				0.110***
				(0.0115)
Constant	−4.666***	−2.436***	−4.449***	−2.638***
	(0.502)	(0.286)	(0.483)	(0.319)
Observations	9971	9971	9971	9971
R-squared	0.044	0.047	0.057	0.030
Number of workers	396	396	396	396
AIC	25 763	25 736	25 631	25 906

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.19. Regression-probability of not working for workers facing decrease in demand.

VARIABLES	(1) Didn't work	(2) Didn't work	(3) Didn't work	(4) Didn't work
Max temperature	0.0166***			
	(0.003 70)			
Relative humidity (%)	0.005 28***	0.002 51***	0.004 55***	
	(0.001 14)	(0.000 572)	(0.000 939)	
Eid holiday dummy	0.240***	0.264***	0.246***	0.240***
	(0.0463)	(0.0466)	(0.0467)	(0.0487)
Monday	0.0116	−0.0153	0.000 492	−0.0143
	(0.0194)	(0.0192)	(0.0191)	(0.0193)
Tuesday	0.0837***	0.0706***	0.0846***	0.0670***
	(0.0254)	(0.0250)	(0.0252)	(0.0253)
Wednesday	0.0300	0.0249	0.0327	0.0208
	(0.0206)	(0.0207)	(0.0209)	(0.0206)
Thursday	0.0295	0.0478**	0.0413**	0.0369*
	(0.0192)	(0.0194)	(0.0194)	(0.0193)
Friday	0.003 27	0.004 58	0.006 45	0.001 42
	(0.0163)	(0.0160)	(0.0161)	(0.0160)
Saturday	0.0277	0.007 79	0.0175	0.004 95
	(0.0196)	(0.0201)	(0.0197)	(0.0200)
Min temperature		0.0133***		
		(0.003 18)		
Mean temperature			0.0187***	
			(0.004 15)	
Wet bulb temp				0.0185***
				(0.005 11)
Constant	−0.780***	−0.368***	−0.723***	−0.402***
	(0.193)	(0.106)	(0.177)	(0.140)
Observations	2862	2862	2862	2862
R-squared	0.046	0.046	0.049	0.041
Number of workers	132	132	132	132
AIC	1088	1089	1080	1100

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.20. Regression-probability of not working for workers facing no decrease in demand.

VARIABLES	(1) Didn't work	(2) Didn't work	(3) Didn't work	(4) Didn't work
Max temperature	0.0190***			
	(0.003 05)			
Relative humidity (%)	0.006 03***	0.003 09***	0.005 45***	
	(0.001 00)	(0.000 596)	(0.000 842)	
Eid holiday dummy	0.267***	0.293***	0.272***	0.265***
	(0.0407)	(0.0401)	(0.0403)	(0.0408)
Monday	0.0183	−0.0161	0.005 00	−0.0124
	(0.0200)	(0.0185)	(0.0189)	(0.0184)
Tuesday	0.0365	0.0249	0.0406*	0.0202
	(0.0230)	(0.0217)	(0.0226)	(0.0216)
Wednesday	0.0226	0.0178	0.0271	0.0121
	(0.0208)	(0.0201)	(0.0205)	(0.0199)
Thursday	−0.0154	0.006 04	−0.001 87	−0.008 84
	(0.0187)	(0.0186)	(0.0187)	(0.0186)
Friday	−0.0171	−0.0154	−0.0125	−0.0217
	(0.0191)	(0.0188)	(0.0190)	(0.0189)
Saturday	0.0200	−0.006 44	0.007 40	−0.008 23
	(0.0202)	(0.0202)	(0.0201)	(0.0202)
Min temperature		0.0170***		
		(0.002 46)		
Mean temperature			0.0229***	
			(0.003 24)	
Wet bulb temp				0.0224***
				(0.004 29)
Constant	−0.807***	−0.395***	−0.799***	−0.405***
	(0.162)	(0.0858)	(0.142)	(0.118)
Observations	4486	4486	4486	4486
R-squared	0.040	0.043	0.045	0.037
Number of workers	209	209	209	209
AIC	3199	3189	3179	3214

Robust standard errors clustered by worker in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A.21. Some effects of heatwaves.

VARIABLES	IHS Net Earnings	Go To Work	Whether Sick
heatwave	−0.515***	−0.0563***	0.246***
	(0.0901)	(0.0107)	(0.0149)
Relative humidity (%)	−0.0131***	−0.001 78***	0.0103***
	(0.003 03)	(0.000 376)	(0.000 570)
Eid holiday dummy	−2.104***	−0.289***	0.0481*
	(0.195)	(0.0263)	(0.0250)
Monday	−0.102	−0.002 44	0.149***
	(0.0960)	(0.0119)	(0.0157)
Tuesday	−0.196*	−0.0250*	0.142***
	(0.105)	(0.0139)	(0.0150)
Wednesday	−0.198*	−0.0303**	0.149***
	(0.109)	(0.0139)	(0.0150)
Thursday	−0.202**	−0.0266**	0.117***
	(0.0932)	(0.0115)	(0.0128)
Friday	0.166**	0.0107	0.0678***
	(0.0826)	(0.0107)	(0.0124)
Saturday	0.0604	−0.006 31	−0.004 13
	(0.0929)	(0.0119)	(0.0132)
Constant	5.757***	0.934***	−0.0938***
	(0.161)	(0.0199)	(0.0284)
Observations	9883	9971	9971
R-squared	0.028	0.033	0.052
Number of workers	396	396	396

Robust standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

The % change in net earnings due to a heatwave is 100* [exp(coeff of heatwave) − 1].

A.2. Daily Questionnaire: daily dairy of work, health and income

HH Identification
Occupation Code...............
HH ID...............................
Mobile number of the head of the HH.................................
Date Yesterday..............................

1. Daily routine of household head and health effects of family members, if any

- Did you sleep well last night? (Y/N)
- How many hours did you sleep?
- What time did you wake up?
- Did you or any other family member feel sick yesterday? (Y/N)
- If no, go to question no.2.
- If yes, what was it? (See code below)
- If yes, how many members (inclusive of you) suffered?
- Did you visit a doctor?
- If yes, how much did you pay as doctor fees?
- What was the expenditure on medicine?

Code	Common health symptoms	Code	Common health symptoms
1	Increase in body temperature	5	Nausea, dry throat
2	Problem in respiration	6	Severe body ache
3	Being unconscious	7	Feeling tired
4	Blurred vision	8	Any other

2. Work time and income

- Did you go for work yesterday? (Y/N)
- If no, what was the reason? (see code below)
- If yes, what time you left for work?

- What time you returned home?
- How many hours did you work?
- How many hours of rest did you take during the daytime yesterday?
- Did you do any extra work, other than your normal work?
- How much money did you earn yesterday?
- Earning in the morning:
- Earning in the afternoon:
- How much did you earn from extra work?
- How much did you spend on buying raw materials?
- How much did you spend on fuel?
- How much did you spend on repairs?
- How much did you spend on travel?
- Any other work- related expenditure? (amount)
- Please provide the description of the expenditure

No work Reasons	Code
Illness (self)	1
Illness (family member)	2
Work not available	3
Bad weather (extreme heat)	4
Bad weather (rain)	5
Any other	6

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