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UNSAFE TEMPERATURES, UNSAFE JOBS: THE IMPACT OF AMBIENT TEMPERATURES ON WORK RELATED INJURIES

MATTIA FILOMENA AND MATTEO PICCHIO

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Abstract

We estimate the impact of temperatures on work related accident rates in Italy by using daily data on weather conditions matched to administrative daily data on work related accidents. The identification strategy of the causal effect relies on the plausible exogeneity of short-term daily temperature variations in a given spatial unit. We find that both high and cold temperatures impair occupational health by increasing workplace injury rates. The positive effect of warmer weather conditions on work related accident rates is larger for men, in manufacturing and service sectors, and for workplace injuries. Colder temperatures are particularly harmful for commuting accidents and in rainy days.

JEL Class.: J28; J81; Q52; Q54.

Keywords: Climate change; temperatures; weather conditions; work related accidents; safety.

Indirizzi:

Mattia Filomena. Department of Economics and Social Sciences, Marche Polytechnic University, Ancona, Italy. E-mail: m.filomena@pm.univpm.it.

Matteo Picchio. Corresponding author, Department of Economics and Social Sciences, Marche Polytechnic University, Ancona, Italy; Department of Economics, Ghent University, Ghent, Belgium; IZA – Institute of Labor Economics, Bonn, Germany; GLO – Global Labor Organization, Essen, Germany. E-mail: m.picchio@staff.univpm.it. Tel.: +39 071 220 7176.

Unsafe temperatures, unsafe jobs: The impact of ambient temperatures on work related injuries

Mattia Filomena and Matteo Picchio

1 Introduction

In the past decade, global warming has given risen to a rapidly growing body of the scientific literature interested in understanding the impact of weather conditions on several economic outcomes (Dell et al., 2014) like, just to mention some, labor productivity (Neidell, 2017), well-being, and allocation of time (Connolly, 2018). Connolly (2018) found that warmer summer temperatures are likely to reduce well-being by shifting leisure activities indoors and to have a negative effect on labor productivity. Adhvaryu et al. (2020) realized that worker productivity increases when temperatures at the workplace are reduced by the use of low-heat LED lighting. Somanathan et al. (2021) estimated reduced worker productivity and increased absenteeism in hot days. Noelke et al. (2016) studied the effect of increasing ambient temperature on emotional well-being in the US population, finding reduced happiness and increased stress, anger and fatigue, especially for less educated and older people.

A second strand of the literature has focused on the relationship between temperature extremes exposure and health. In this case, the outcome variable is mainly represented by mortality rates (see e.g. Deschênes and Moretti, 2009; Deschênes and Greenstone, 2011), low birth weight (Deschênes et al., 2009), and hospitalization rates (see e.g. Piver et al., 1999; Schwartz et al., 2004). Deschênes (2014) reviewed both the economic and epidemiological literature and concluded that temperature extremes lead to significant reductions in health, generally measured with excess mortality. More in detail, heat impacts on mortality are more immediate, whereas cold temperature exposure leads to mortality impacts that tend to accumulate over time.

A limited number of studies have instead investigated the relation between changing climatic conditions and occupational health, although the exposure to excessive heat limits workers' physical functions and capabilities, increasing therefore the risk of injury (ILO, 2019). The recent comprehensive meta-analysis in Fatima et al. (2021) is based on 22 studies, most of which: i) analyze the association between temperature and employment safety and health in particular local areas and/or sectors; ii) are time-trend analysis, "impairing the possibility to make any causal inference from the study results" (Bonafede et al., 2016). Nevertheless, understanding the causal effect of rising temperatures on employment health and safety is relevant for policy makers, not only for designing effective public health policies, but also from the economic perspective, given the costs implied by work related injuries and illnesses and their importance for labor productivity. Our paper contributes to this strand of the literature by estimating the causal effect of temperatures on work related injuries in Italy.

Only three studies dealt with the identification of the causal effect of temperatures on work related injuries: Marinaccio et al. (2019), Dillender (2021), and Park et al. (2021) relied on plausibly exogenous short-term variations of temperatures in a given spatial unit, so as their estimates are not driven by potential endogenous changes in labor inputs (Park et al., 2021). The results for Texas in Dillender (2021) indicated that both high and low temperatures increased injury rates and that high temperatures had more severe adverse effects in warmer climates. Using data on workplace accidents in California, Park et al. (2021) found that hotter temperature increased the likelihood of injury on the job in both indoor and outdoor settings, whereas no evidence for significant impacts of extreme cold temperature emerged. Their results also suggest that temperature exposure increased labor market inequality, because lower wage or younger workers experienced greater injury rates, and that there are adaptation potentials because the effect of temperature on work related injuries fell over time. The epidemiological study in Marinaccio et al. (2019) estimated, for each Italian province from 2006 to 2010, the association between temperatures and the number of injuries, controlling for indicators from the interaction among municipality, year, month and day of the week. Therefore, they based their identification strategy on the variation of local temperatures from the average local temperature across the same day of the week of the same month. Although they added also covariates for special days of the year, like influenza peaks or holidays, they did not fully control for calendar date fixed effects and other daily climatic conditions, like wind and precipitation, which may be correlated with temperatures and the risk of injury.

In this paper, we estimate the effect of temperatures on work related accident rates in Italy in the period 2008-2021. Italy is an interesting case study for different reasons. First, it is vulnerable to climate change, and it is projected to highly suffer from increases in temperatures and from the modification of rainfall patterns. According to the 2019 Global Climate Risk Index (Eckstein et al., 2021), which summarizes the fatalities and the losses in terms of GDP, Italy ranked 35th in the world and 6th among the OECD countries. The forecasts in Spano et al. (2020) predicted that in Italy the average temperatures will raise by 2°C in the period 2021-2050 and by 5°C by the end of the century, relatively to the period 1981-2010. Second, in terms of rate of both fatal and non-fatal accidents at work, Italy is characterized by a high incidence: in 2019 it was above the median among the EU-27 countries.[1] Third, since Italy is ageing quite intensively and the health of the elderly is more exposed to the heat stress (Levi et al., 2018), the consequences in terms of public health and labor market issues are amplified by having more workers at greater risk of heat stress and potentially more severely affected than in other countries. Lastly, Italy is characterized by relevant economic and social inequalities across regions. Prior research has found that the burden of rising temperatures will fall more on workers in sectors more exposed to heat and living in warmer regions (Connolly, 2018). Hence, this rises questions about the impact of climate change on inequalities that in Italy are particularly relevant. Understanding how the climate change may affect occupational safety is relevant for depicting a more complete picture of the health effects and costs of the climate change.

One of the main problems in studying the effect of weather conditions on work related accidents is to have granular data on both accidents and weather conditions, so as to relate the weather conditions experienced by workers in a particular day and in a given local area with the work related accidents occurred in the same day and area (Dillender, 2021). We were able to address this challenge by matching daily data on work related accidents from the *Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro* (INAIL), which is the Italian national workers compensation authority for work related accidents, with daily meteorological data from Copernicus, the European Union's Earth Observation Programme. The former dataset contains information about the Italian province where the work related accident took place, the second one reports the meteorological conditions with a 0.25°x0.25° latitude-longitude grid. We matched the meteorological data with provincial accident rates by using the latitude and longitude of the provincial capital. With the resulting matched dataset, we estimated the impact of local temperatures on local accident rates by fixed effects estimators. As in Dillender (2021), in our benchmark model we employed month-year-province fixed effects and calendar date fixed effects, so that we

[1] See figures reported in the Eurostat Statistics Explained on Accidents at Work Statistics on https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Accidents_at_work_statistics.

relied on the plausible exogeneity of short-term variation of daily local temperatures. In a sensitivity analysis, we replaced month-year-province fixed effects with day-province fixed effects: in this alternative, identification hinges on the variation of local temperatures from the local temperature registered in the same day of the year averaged over the observed time-window.

Our findings complement the results in Dillender (2021), Park et al. (2021) and Marinaccio et al. (2019). Dillender (2021) and Park et al. (2021) limited their studies to two states of the US, Texas and California, respectively. Therefore, their results cannot be easily generalized to a country with different labor market institutions, economy, climate, and demographic structure.

With respect to Marinaccio et al. (2019), who studied Italy in the period 2006-2010, we focused on more recent years and on a much longer time window. The past decade is quite interesting, because it was characterized by a surge in temperatures: the last seven years were globally the warmest on record.[2] Moreover, we tackled the issue of the identification of the causal effect of temperatures on work related injuries more deeply: we used multiway high dimensional fixed effects, both at the level of calendar dates and for each interaction among local area, month, and year, and we added further controls for daily climate conditions. In addition, we examined also commuting accidents to isolate the importance of extreme weather conditions on the risk faced by workers while going to work. Finally, we delved into the issues of adaptation and changing inequalities. Adaptation, i.e. people may adapt by modifying their behaviors or by investing to avoid negative consequences, has not been investigated yet in Italy. Inequalities may be emphasized by the climate change, especially the North and South divide, for example if different geographical areas are differently affected by rising temperatures.

This article is organized as follows. Section 2 illustrates our data sources and summary statistics of the sample used in the empirical analysis. Section 3 presents the econometric model and the strategy for the identification of the effect of temperatures on work related accidents. Section 4 reports and discusses the main findings. Section 5 concludes and draws policy implications.

2 Data and sample

We conducted the empirical analysis by merging different data sources. We gathered meteorological data from Copernicus, the European Union's Earth Observation Programme.

[2] See https://climate.copernicus.eu/esotc/2021/globe-in-2021.

More specifically, we used the E-OBS, a daily gridded land-only observational dataset over Europe.[3] We downloaded meteorological data with a horizontal grid resolution of 0.25° on daily temperature (average, maximum and minimum), precipitation amount and wind speed from January 1 2008 until December 31 2021.

We obtained data on work related accidents from INAIL. The INAIL dataset contains information on all the work related accidents, both at the workplace and commuting.[4] It comprises the day of the accident, the Italian province in which the accident took place, some information on the injured person (like sex and age), if the accident was at the workplace or commuting (*in itinere*), some administrative and health features of the injury and degree of impairment, and some firm characteristics (like sector). After dropping accidents of persons younger than 16, we collapsed the number of accidents by province and day over the observed time window and divided it by the number of people at work in that year derived from the National Institute of Statistics (Istat).[5] We therefore computed daily provincial accident rates per 100,000 workers. We also derived the same statistics by sex, by sector, by the severity of the injury, measured either by the number of days of absence of the injured worker or by the degree of impairment or caused by the accident, and by whether the accident was at the workplace or in itinere.

We matched the meteorological data with provincial accident rates by using the latitude and longitude of the provincial capital. Hence, we used the meteorological conditions in the 0.25°x0.25° latitude-longitude grid where the provincial capital is located as an approximation of the conditions in the whole province.[6] After matching the two main data sources, we decided to remove days of national public holidays in Italy and those days in summer and during the Christmas period when typically workers are not at work.[7] In these days the accident rates decrease artificially because the number of people actually at work diminishes. We could not use data for the province of Brindisi, because the information on the wind speed was missing. The final sample was made up of 481,496 observations, coming from 106 provinces observed for at maximum 4,624 days.[8]

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[3]For more details see https://cds.climate.copernicus.eu/cdsapp#!/dataset/insitu-gridded-observations-europe?tab=overview (last accessed October 3rd, 2022).

[4]The INAIL data (https://dati.inail.it/opendata/default/Daticadenzasemestrale/index.html, last accessed October 3rd, 2022) does not include accidents of some special categories of workers, like firemen, policemen, servicemen and journalists, because they are covered by other insurers.

[5]Yearly provincial time series on employment by gender and sector are downloadable from http://dati.istat.it/ (last accessed October 3rd, 2022).

[6]A 0.25°x0.25° latitude-longitude square corresponds approximately to 27.8 square kilometres.

[7]We removed 25/04, 01/05, 02/06, 01/11, 08/12 and the time span from 23/12 to 06/01 and from 08/08 to 22/08.

[8]The meteorological data were not available in all the days of the observed time window for the follow-

Figure 1 and Table 1 show descriptive statistics of work related accident rates after collapsing the data by province. Figure 1 depicts the variability of the accident rates and fatal accident rates across Italian provinces over the observed time-window. Table 1 reports that on average the daily provincial accident rate was about 6.8 per 100,000 workers. The fatal accident rate was 1.1 per million workers. These figures diminish to 5.9 and 0.8 if we only focus on workplace accidents. The workplace accident rate was larger for men: it was 7.0 per 100,000 workers for men against 4.3 for women. The gender difference was particular large in terms of fatal workplace accident rate, with the male one (1.28 per million) being almost twelve times larger than the female one (0.11 per million). About 1.14 workplace accidents per million workers caused macro permanent impairment and 1.48 workplace accidents per 100,000 workers induced an absence from work of more than 30 days. Finally, the highest workplace accident rates are registered in the manufacturing sector.

Figure 1: Work related daily accident rates per 100,000 workers averaged over 2008–2021

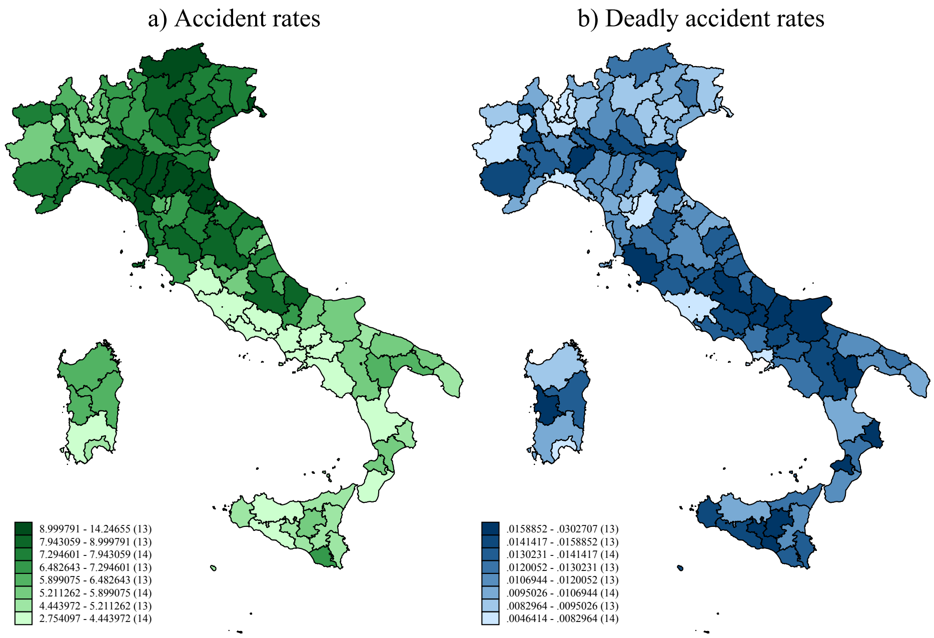


Table 2 reports descriptive statistics about the daily average temperature after col-

ing provinces: Matera, Catanzaro, Reggio di Calabria, Trapani, Palermo, Messina, Agrigento, Caltanisetta, Enna, Catania, Ragusa, Siracusa, and Vibo Valentia. They had between 3,913 and 4,623 daily observations instead of 4,624.

Table 1: Summary statistics of the daily provincial accident rates (per 100,000 workers)

Rates per 100,000 workers	Average	Std. Dev.	Min.	Max.
a) Overall work related accident rates				
Accident rate	6.7552	4.5748	0.0000	103.1551
Fatal accident rate	0.0106	0.0802	0.0000	9.5422
b) Accident rates at the workplace or in itinere				
Accident rate in itinere	0.8985	0.9832	0.0000	66.3987
Accident rate at the workplace	5.8567	4.0654	0.0000	82.3370
Fatal accident rate in itinere	0.0027	0.0367	0.0000	6.6251
Fatal accident rate at the workplace	0.0079	0.0708	0.0000	9.5422
c) Workplace accident rates by gender				
Workplace accident rate for men	6.9586	5.4583	0.0000	97.4866
Workplace accident rate for women	4.3101	3.3770	0.0000	111.4045
Fatal workplace accident rate for men	0.0128	0.1151	0.0000	9.1709
Fatal workplace accident rate for women	0.0011	0.0430	0.0000	13.1449
d) Workplace accident rates by seriousness of the consequences				
Workplace accident rate causing macro permanent impairment[(a)]	0.0114	0.0835	0.0000	9.5422
Workplace accident rate not causing macro permanent impairment	5.8452	4.0598	0.0000	78.2042
Severe workplace accident rate[(b)]	1.4843	1.2345	0.0000	42.8736
Not severe workplace accident rate	4.3723	3.3110	0.0000	52.1362
e) Workplace accident rates by sector				
Workplace accident rate in agriculture	1.1299	6.0229	0.0000	1,785.7140
Workplace accident rate in manufacturing	6.7139	5.8719	0.0000	115.5999
Workplace accident rate in services	5.7766	4.1568	0.0000	93.6815
Fatal workplace accident rate in agriculture	0.0033	0.3157	0.0000	934.5794
Fatal workplace accident rate in manufacturing	0.0120	0.1673	0.0000	45.7875
Fatal workplace accident rate for women in services	0.0063	0.0768	0.0000	13.7781
# of observations				482,079
# of days				4,624
# of provinces				106

Notes: Summary statistics are weighed by the provincial employment.

[(a)] A macro permanent impairment corresponds to an estimated biological damage larger than 50% according to the administrative quantification.

[(b)] We defined as "severe" those accidents which caused a number of days of absence from work equal to or more than 30.

lapsing the data by province and date.[9] The mean of the daily average temperature is about 14.5°C. After splitting its support in 16 (almost) equally spaced bins, the mode is the interval (12°C, 14°C], in which 9.3% of the observations lies. Less than 5% of the observations corresponds to a daily average temperature larger than 26°C.

Table 2: Summary statistics of daily average temperatures collapsed by province and day

	Mean	Std. Dev	Min.	Max.
Daily average temperature	14.5201	7.2869	-18.9500	35.6200
Fraction of days below 0°C	0.0160	0.1253	0.0000	1.0000
Fraction of days (0,2]°C	0.0255	0.1576	0.0000	1.0000
Fraction of days (2,4]°C	0.0414	0.1993	0.0000	1.0000
Fraction of days (4,6]°C	0.0555	0.2290	0.0000	1.0000
Fraction of days (6,8]°C	0.0684	0.2524	0.0000	1.0000
Fraction of days (8,10]°C	0.0836	0.2768	0.0000	1.0000
Fraction of days (10,12]°C	0.0925	0.2897	0.0000	1.0000
Fraction of days (12,14]°C	0.0932	0.2907	0.0000	1.0000
Fraction of days (14,16]°C	0.0904	0.2867	0.0000	1.0000
Fraction of days (16,18]°C	0.0858	0.2801	0.0000	1.0000
Fraction of days (18,20]°C	0.0813	0.2733	0.0000	1.0000
Fraction of days (20,22]°C	0.0797	0.2708	0.0000	1.0000
Fraction of days (22,24]°C	0.0770	0.2665	0.0000	1.0000
Fraction of days (24,26]°C	0.0641	0.2450	0.0000	1.0000
Fraction of days (26,28]°C	0.0343	0.1820	0.0000	1.0000
Fraction of days above 28°C	0.0114	0.1060	0.0000	1.0000
# of observations				482,079

Like in Dillender (2021), we used the deviation in the daily temperature from the average temperature in the corresponding month-year-province, conditional on calendar date fixed effects, to identify the causal effect of temperatures on accidents.[10] Figure 2 graphically displays this identification source, focusing on both the whole sample (Figure 2a) and four selected provinces, the most populated ones, in a particular month of our time window (Figure 2b).

3 Econometric model

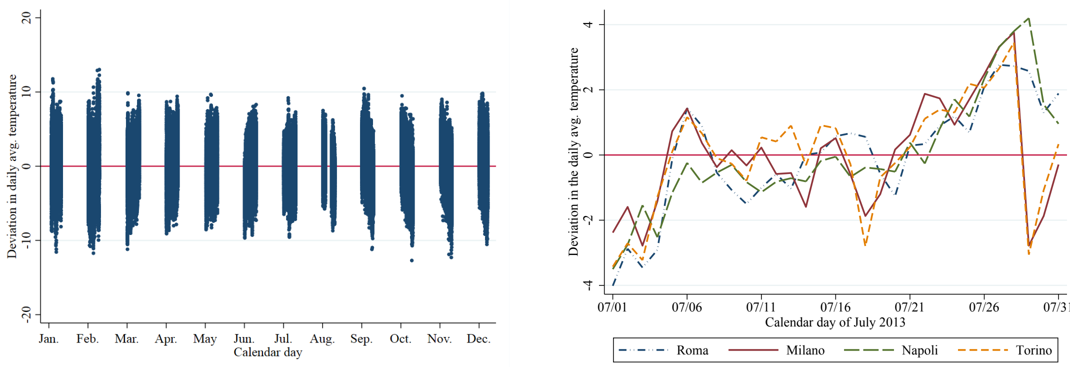
In the last few years, the empirical literature studying how weather conditions affect economic outcomes with data from nonexperimental settings has rapidly grown (Dell et al.,

[9]For 3,098 observations the average daily temperature was either below the minimum temperature or above the maximum temperature. In these cases, we replaced the original value with the midpoint between the maximum and minimum daily temperature.

[10]In a sensitivity analysis, we instead use the deviation in the daily temperature from the average temperature in the same day of the year-province, conditional on calendar date fixed effects.

Figure 2: Deviation in the daily temperature from the average temperature in the corresponding month-year-province

(a) All years and all provinces **(b)** The 4 most populated provinces, July 2013



2014). In this framework, the most convincing identification strategy of the causal effect is based on longitudinal high-frequency data and on short-term variation over time of the weather outcome within a given spatial entity. By exploiting this (plausibly) exogenous variation in weather variables, it is possible to identify the impact of temperatures on outcomes like work related injuries.

As in Dillender (2021), in our benchmark model the identification strategy for drawing causal inference is based on the deviation of the daily temperature from the average temperature in the corresponding month-year-province, conditional on calendar date fixed effects. Hence, we do not identify responses to gradual and systemic changes in temperatures as predicted by the scientific literature on climate change and our results may have low external validity for processes like global warming (Dell et al., 2014). Albeit imperfect, our results may be nonetheless useful to assess channels through which climate change may affect the employment quality, the sustainability of the social insurance system, and the labor productivity.

Operationally, we estimated the following linear model

$$y_{it} = f(temp_{it}; \boldsymbol{\beta}) + \boldsymbol{\alpha}\mathbf{x}_{it} + \delta_t + \gamma_{im} + \varepsilon_{it}, \tag{1}$$

where $i = 1, \ldots, 106$ indexes the 106 provinces and $t = 1, \ldots, 4624$ refers to the different calendar dates in our observed time window; y_{it} is the measure for the work related accident rates; δ_t is the calendar date fixed effects; γ_{im} is the month-year-province fixed effects; $f(temp_{it}; \boldsymbol{\beta})$ is a step function of the daily average temperature and $\boldsymbol{\beta}$ is the parameter vector associated to the linear combination of indicators of temperature intervals; $\mathbf{x}_{it}$ is a $1 \times K$ vector of other weather characteristics which are likely to be correlated both to the daily temperature and to the risk of accident; finally, ε_{it} is the idiosyncratic error term.

The calendar date fixed effects δ_t control for daily shocks common at national level. They are therefore able to purge the estimates from the fact that the work related accident rates may vary over particular days of the week, different months of the year, and different years. For example, they account for eventual higher absenteeism in bridging days (Böheim and Leoni, 2020) or on Mondays and Fridays (Vahtera et al., 2001), which may be correlated to the weather and, at the same time, may affect the accident rate, as absenteeism artificially lowers it down.

The month-year-province fixed effects γ_{im} capture eventual different patterns across provinces of the labor market conditions and the business cycle. They allow us to base the identification strategy on the exogeneity of the daily temperature deviation from the month-year average temperature in the corresponding province.

In order not to impose too strict parametric restrictions on $f(temp_{it}; \boldsymbol{\beta})$, we opted for a step function to map the relation between daily average temperatures and work related accident rates. More precisely, we divided the support of the daily average temperature in equally sized bins of two Celsius degrees, apart from the first bin for daily temperatures below 0°C, and the last one for those above 28°C. We chose the bin (10,12]°C as the reference point and the corresponding indicator variable is excluded from the set of regressors entering Equation (1).

The vector $\mathbf{x}_{it}$ contains the constant term, a dummy for dry days (i.e. days with no precipitation), a cubic polynomial of daily precipitation and of the average wind speed, the average temperature, precipitation, wind speed in the previous three days and in the following three days.

Finally, the idiosyncratic error term may be correlated within both calendar date t and province i. The former correlation may be due to the fact that, when there are anomalous heat or cold waves in particular days, they often affect large areas, generating correlation across observations in those anomalous days. About the latter, each local area has its own features in terms of geography, climate, infrastructures and employment and production structure. This makes us suspect that observations are not independent over time within a province. Hence, in estimating the variance-covariance matrix, we use the two-way cluster variance estimator proposed by Cameron et al. (2011). The number of clusters is sufficiently large in both dimensions, since in our sample we have 106 provinces and

4,624 calendar dates.

4 Estimation results

4.1 Main findings

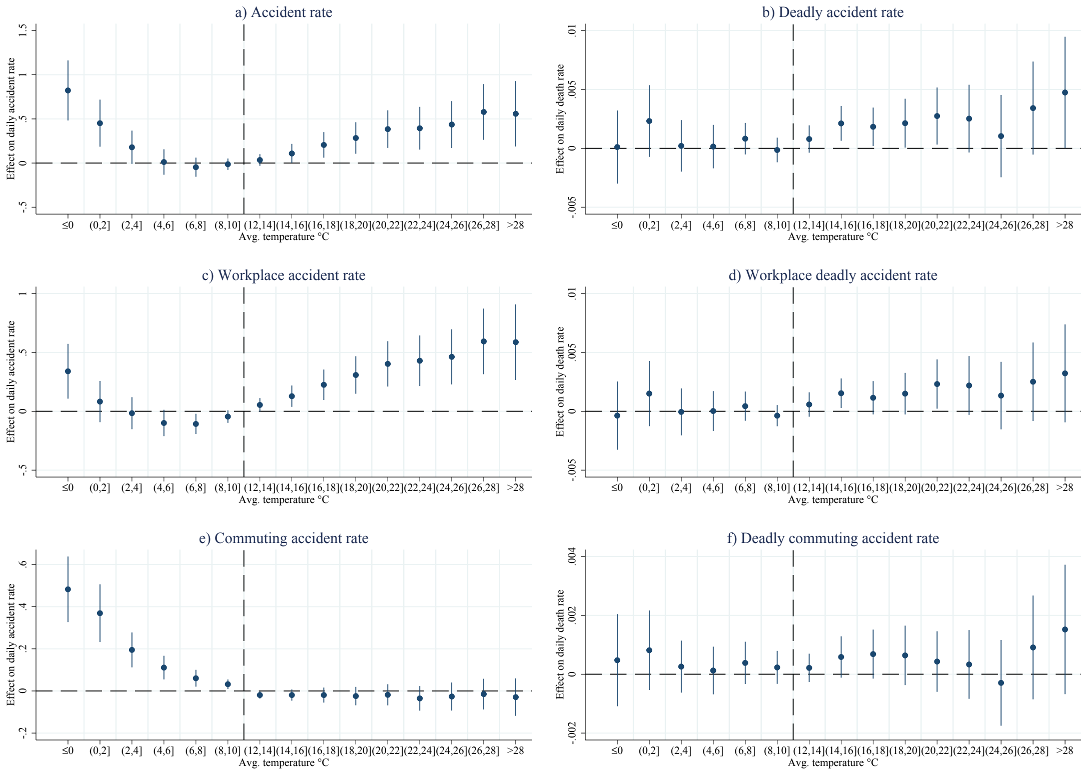
Our main findings are reported in Figures 3–11, which display the estimated coefficients of each temperature bin, along with their 95% confidence intervals. The full set of estimation results are instead reported in the Appendix.

Panel a) of Figure 3 shows that the work related injury rate increases with both cold and warm temperatures. A daily average temperature smaller than 0°C (of 0-2°C) significantly increases the work related accident rate by 0.823 (0.452) per 100,000 workers, relatively to a day with an average temperature of 10-12°C. With respect to the sample average work related accident rate (6.755), it is a 12.2% increase. The lowest work related accident rate is registered when daily average temperatures are between 6 and 8°C. When they are above 14°C, we detect a significant and increasing positive impact of temperatures on the injury rate. When the daily average temperatures are above 28°C the injury rate per 100,000 workers is 0.558 points larger than the reference (10-12°C). This effect is 8.3% of the sample average. Panel b) of Figure 3 reports the impact of temperatures on the fatal accident rate. It shows that warmer temperatures result in higher fatal injury rates. With a daily average temperature above 28°C, the fatal injury rate per 100,000 workers is larger than that at the reference (10-12°C) by 0.005 points, which is about 45% of the sample average.

Panels from (c) to (f) display estimates of the effects distinguishing between workplace accidents and commuting injuries. Hot temperatures only impacted on workplace injuries, while cold temperatures are particularly relevant for commuting accidents. The former effect may be due to a higher risk of injuries for exposure to heat especially in outdoor workplaces like construction (Marinaccio et al., 2019), or in industries which do not provide adequate air-conditioning systems. About the latter, extremely low temperatures may strongly affect safety because of dangerous road conditions, for example due to frost and/or rain leading to slipperiness.

To highlight these possible mechanisms, Figure 4 shows the estimation results after splitting the sample in dry days and days with precipitations. As in Dillender (2021), the temperature effect on the workplace accident rate is not influenced by the rain, as the profile of the relation in dry days is very similar to the one in rainy days. The impact of extremely cold temperatures on commuting accidents becomes much more important in rainy days, probably due to the combined effect of frost and rain; when it is rainy and the temperatures are below 0°C, the commuting accident rate per 100,000 workers is 0.859 points larger than the one in a rainy day with 10-12°C .

Figure 3: Effect of today's average temperature on today's accident rates, disaggregated by workplace and commuting accidents

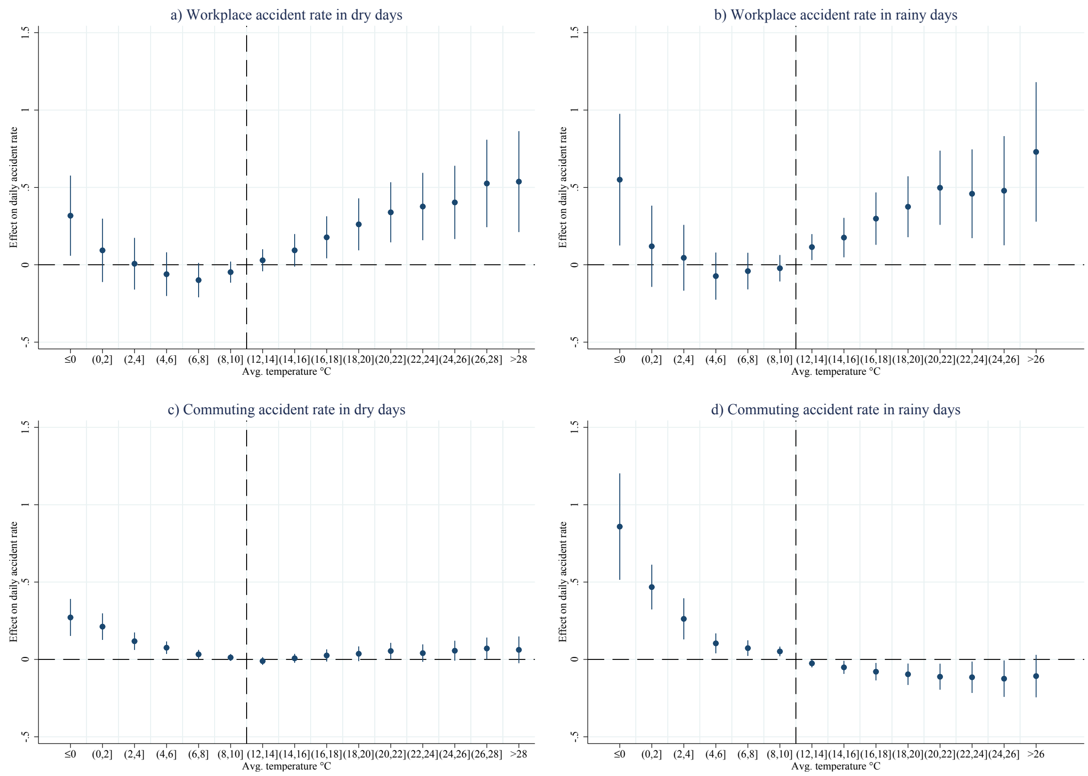


Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

4.2 Effect heterogeneity

In this subsection, we dig further into the issue of effect heterogeneity by exploring if the effect of extreme temperatures on workplace injuries is different between men and women, by sector, and by injury severity. Gender differences and segregation in occupations and industries are still important (Blau and Kahn, 2017) and they may imply that

Figure 4: Effect of today's average temperature on today's accident rates, workplace and commuting accidents in dry and rainy days



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

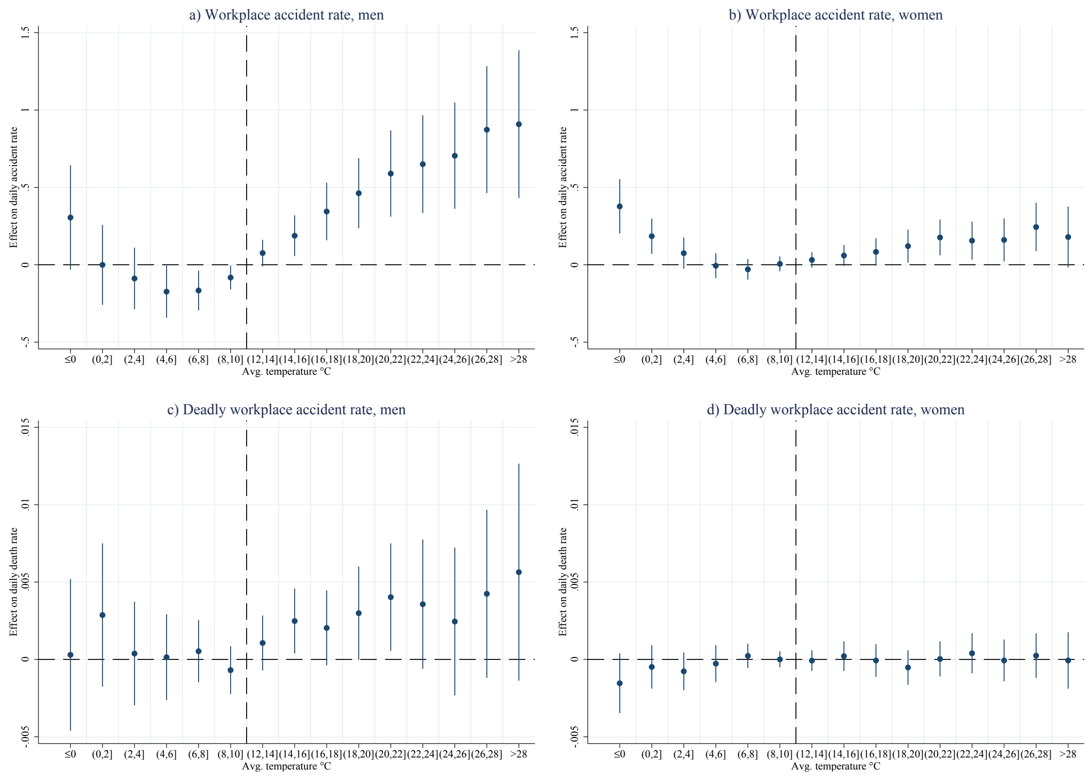
men and women are employed in workplaces which are differently affected by ambient temperatures. Similarly, since sectors are characterized by different production technologies, their employees may be differently exposed to ambient temperatures or working in environments which are differently equipped and equippable with systems for climate control. Finally, we checked whether the impact of ambient temperatures is confined to mild workplace accidents or it also involves serious severe injuries. By doing so, we enriched the analysis of the previous subsection, which already provided evidence in terms of fatal injuries.

Figure 5 reports the effect of temperatures on both accident and fatal accident rates by gender. Like in Marinaccio et al. (2019), we found that extremely cold temperatures (below 2°C) are especially important for women. In contrast, the male workplace accident rate is more sensitive to heat and when the temperature is above 28°C, the injury rate per 100,000 workers is almost 1 point higher than at 10-12°C. These gender differences in the findings are in line with those in Park et al. (2021) and may be driven by men being more likely to be employed in outdoor jobs, like construction or transport, or industrial physically demanding jobs, which are more likely to suffer from the heat stress.

To understand if the type of industry in which workers are employed plays a relevant role, we estimated Equation (1) separately for the primary, secondary, and tertiary sectors. Figure 6 displays the estimates for each sector. Extremely hot temperatures affect the workplace accident rate in all the sectors similarly. The magnitude of this effect is however the largest in the manufacturing sector, with an increase of about 0.676 accidents per 100,000 workers when the temperature is above 28°C, with respect to the reference temperature. Extremely cold temperatures are relevant only in the service sector. When the temperature is below 0°C, the injury rate per 100,000 workers is 0.450 higher than in the case in which the temperature is 10-12°C.

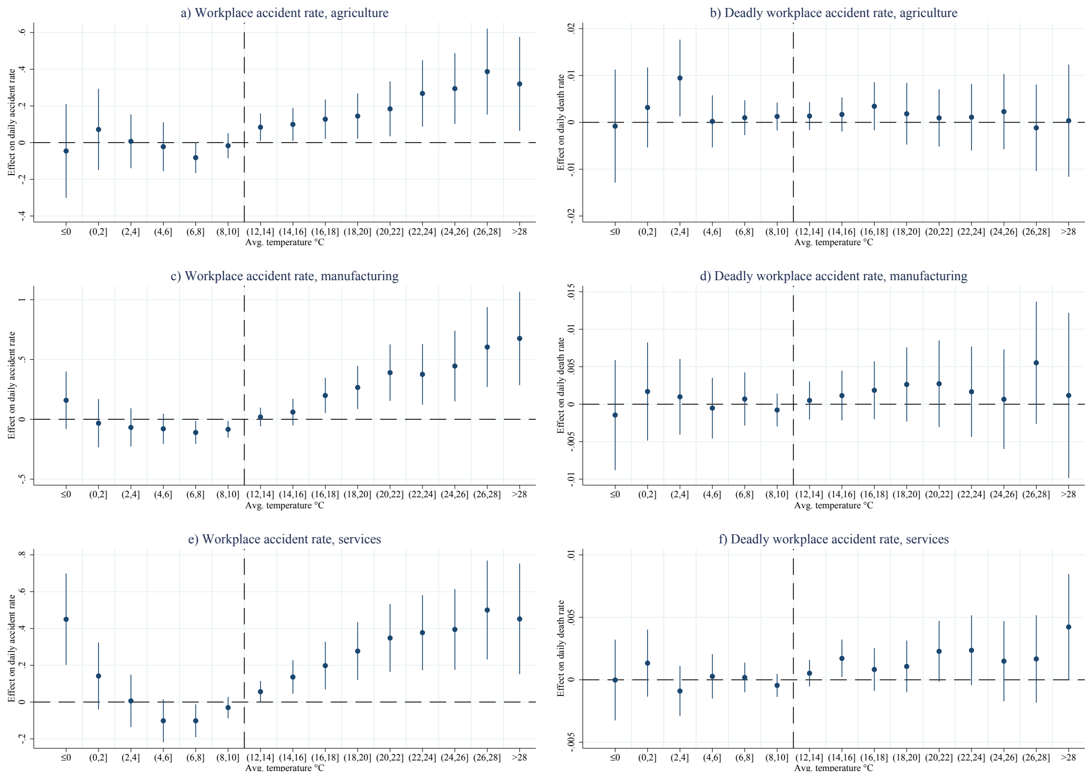
To check whether the injury severity is sensitive to cold and warm ambient temperatures, we graphically presented the results by the severity of the injuries defined in two different ways in Figure 7. In panels (a) and (b) the severity is measured by the number of days of absence from work caused by the injury. In panels (c) and (d), the severity is defined on the basis of the degree of health impairment caused by the accident. In line with the evidence shown so far that fatal accident rate are marginally affected, we found that temperatures exert an effect on workplace accidents only through less severe injuries. This is true in case of both cold and warm temperatures.

Figure 5: Effect of today's average temperature on today's accident rates, workplace accidents by gender



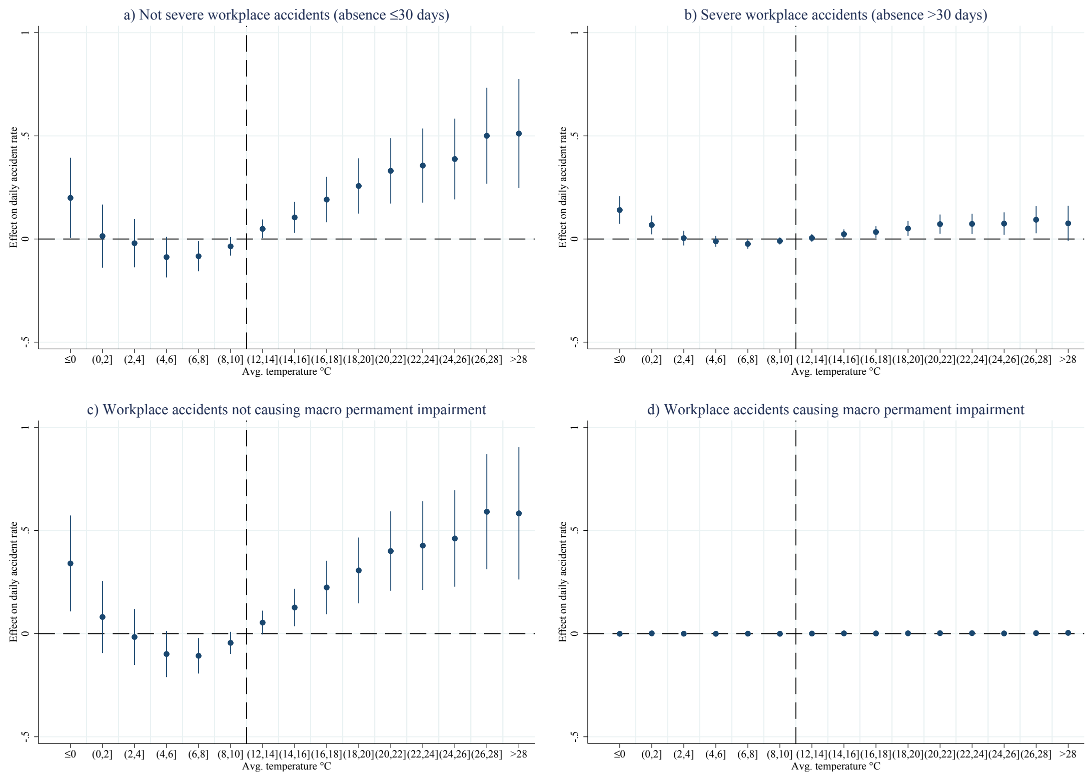
Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment by gender during the year of the observation.

Figure 6: Effect of today's average temperature on today's accident rates, workplace accidents by sector



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment by sector during the year of the observation.

Figure 7: Effect of today's average temperature on today's accident rates, workplace accidents by severity



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

4.3 Quantification of the effect of rising temperatures

Our estimates suggest that the impact of temperatures on the accident rate is nonlinear, with both cold and warm temperatures implying a higher risk of injuries. Therefore, it is not straightforward to quantify what our findings imply in terms of impact of rising temperatures on the number of injured workers. In order to have a clearer idea on the effect of rising temperatures on work related accidents, we predicted the accident rates both using the actual temperatures and after increasing them by two degrees Celsius, which is the expected increase in average temperatures in Italy in the period 2021–2050 (Spano et al., 2020).

Table 3 reports the predicted impact on the daily accident rate and the number of accidents per year at national level induced by an increase by two degrees Celsius, by using 2014 as the reference year, which is the intermediate year of our time window. Moreover, hot temperatures are not only harmful for workers but also a cost for firms as workplace accidents lower labor productivity. In the last column of Table 3, we show the nationwide yearly impact on lost days.[11] An increase by 2°C in daily temperatures would translate, *ceteris paribus*, in a significant yearly increase of more than 8,400 work related accidents and about 200,000 lost working days. Workplace and commuting accidents would be asymmetrically affected, with a decrease of about 1,800 commuting accidents and an increase of approximately 10,300 workplace accidents, which translate in 236,000 yearly lost days. Furthermore, the impact is strongly different in magnitude across gender, with an yearly increase of about 3,000 for women and more than 15,000 workplace accidents for men that account for more than 400,000 days out from work. Focusing on the number of yearly work related accidents by sector, our estimates predict an increase of about 9,000 workplace injuries per year in both manufacturing and services, while the predicted days lost in the manufacturing industries are twice as big as those in the other sectors.

4.4 Adaptation and inequality

The relevance of the policy implications of our findings in light of the climate change depends on whether firms and workers can adapt to changes in temperatures over time (Kahn, 2016; Park et al., 2021). The adaptation hypothesis suggests that the dangerous effect of warmer (colder) temperatures should be smaller in warmer (colder) climates. People who live in historically warmer regions should be more used to cope with ex-

[11] The full set of estimates of the effect of daily average temperature on lost days rates per 100,000 workers is available upon request to the authors.

Table 3: Prediction of the effect of a 2°C increase in daily average temperatures with respect to 2014 temperatures

Increase induced by +2°C in:	Daily accident rate	Yearly accidents nationwide	Daily fatal accident rate	Yearly deaths nationwide	Yearly lost days nationwide
Work related accidents	0.04730***	8,445.351***	0.00023	40.705	199,860.70**
	(0.01713)	(2,942.932)	(0.00021)	(35.481)	(81,428.04)
Workplace accidents	0.05946***	10,276.050***	0.00021	35.387	235,989.80***
	(0.01469)	(2,534.556)	(0.00018)	(30.750)	(67,586.67)
Commuting accidents	-0.01218**	-1,830.694**	0.00002	5.319	-33.627.38
	(0.00509)	(848.953)	(0.00009)	(15.237)	(36,112.83)
Workplace accidents, men	0.09260***	15,622.510***	0.00036	59.41	408,126.80***
	(0.02172)	(3,653.724)	(0.00030)	(50.483)	(93,637.50)
Workplace accidents, women	0.01808**	3,222.708**	0.00003	4.435	10,714.44
	(0.00855)	(1,531.328)	(0.00008)	(14.005)	(60,276.80)
Workplace accidents, agriculture	0.03773***	3,396.497***	-0.00006	-6.369	123,604.20*
	(0.01152)	(1,037.514)	(0.00051)	(46.895)	(65,227.18)
Workplace accidents, manufacturing	0.05924***	8,636.818***	0.00020	28.929	301,482.00***
	(0.01720)	(2,497.145)	(0.00043)	(61.675)	(103,828.30)
Workplace accidents, services	0.05009***	9,285.128***	0.00022	37.539	139,307.00**
	(0.01428)	(2,664.112)	(0.00019)	(34.642)	(65,516.80)

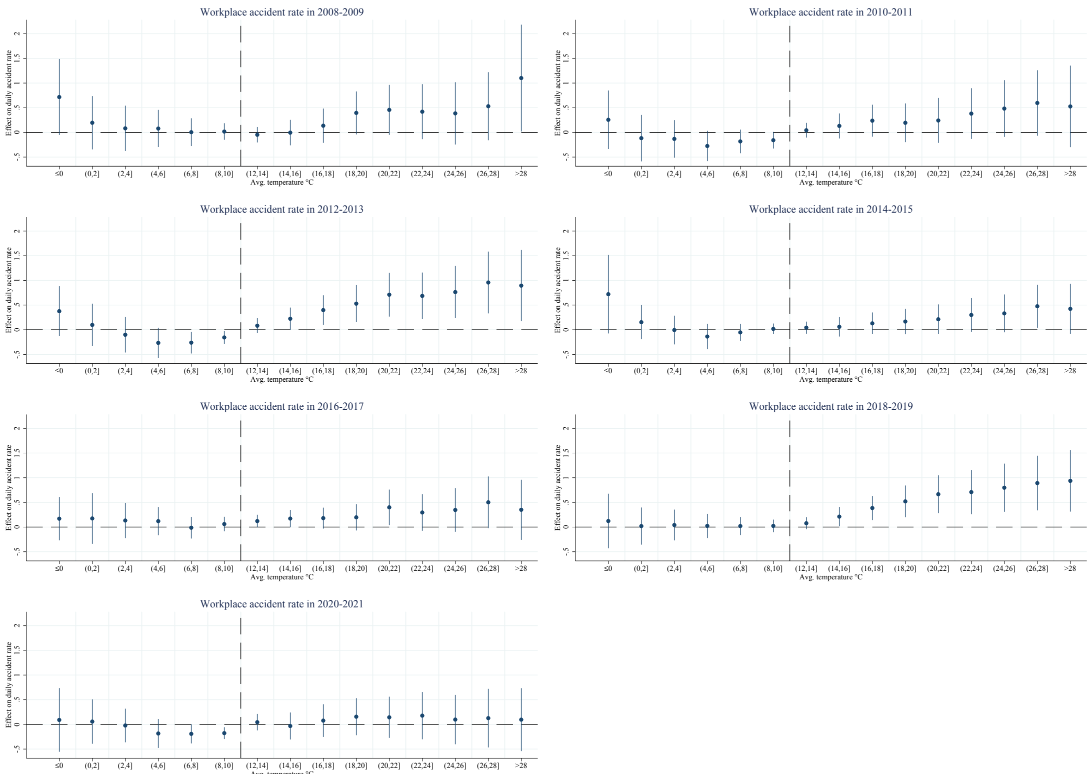
The figures reported in this table were estimated by: i) computing in each province the difference between the predicted accident rates using the actual 2014 temperatures and the predicted accident rates after adding 2°C to the daily average temperatures; ii) averaging over the 2014 sample. The nationwide yearly figures are obtained by multiplying the result of steps i) and ii) by the 2014 employment, the 107 provinces, and the 330 days of 2014. Standard errors are in parenthesis and were estimated using the delta method.

tremely hot temperatures than people living in historically colder areas. Investigating if an adaptive behavior is at work is extremely relevant to assess the importance that climate change and global warming may have in the long run (Kahn, 2016; Connolly, 2018).

Dillender (2021) provided evidence on adaptation by using mining data and estimating the effect of temperatures on same-day claim rates for outdoor workers separately for sites in warmer and cooler climates. His findings showed that workers in climates where hot days are rare are better able to deal with a hot day than workers in climates where hot days are more common. These results are consistent with avoidance behavior being more feasible when higher temperatures are a rare event, rather than acclimation as a mitigating factor of extreme temperatures. Park et al. (2021) exploited the 2005 mandatory illness prevention standard adopted in California for outdoor workplaces on hot days to assess if this institutional change has been effective to generate adaptation to extreme heat. They found that the effect of hotter temperatures on injury risk were significantly lower in the period following the policy adoption and that even firms in very warm areas were able to adapt to extreme heat.

In order to asses if the adaptation hypothesis is at work in Italy, we performed two empirical exercises. First, in order to check if Italian workers and firms have been able to adapt to changes in climate conditions over time, we estimated the effect by allowing if to be different over time in the spirit of Park et al. (2021). We divided our sample in 7 groups, one for each two-year period. In case of adaptation, the impact of temperatures on workplace accidents should decrease over time. The 7 graphs in Figure 8 do not reveal a clear time trend pointing to a detrimental effect of hot temperatures. Higher temperatures are particularly harmful between 2008 and 2013 and again in 2018-2019. Such a non-monotonic trend in the heat-sensitivity of the injuries over time might reveal limits of adaptation. However, in the last two-year period the estimated coefficients are very close to zero. This may suggest that an adaptation effect to warm temperatures has started in the very last years of our time window. Whether this is the case should be confirmed in future empirical investigations.

Figure 8: Effect of today's average temperature on today's workplace accident rates over time

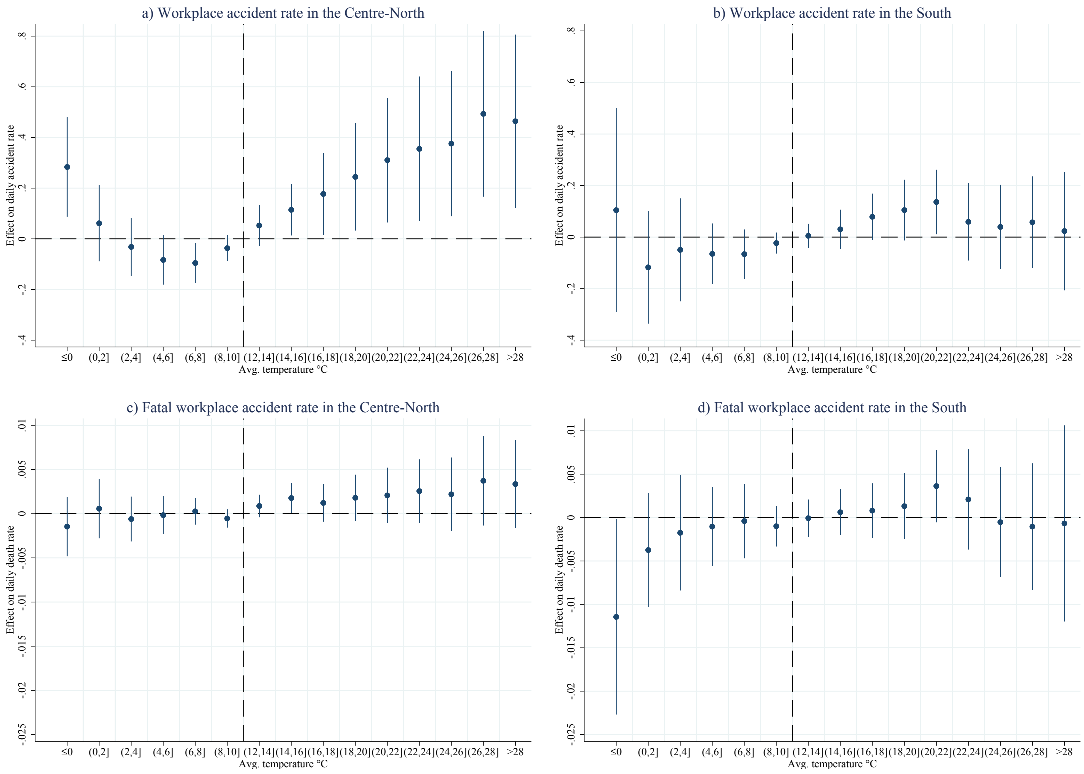


Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation. The 2020-2021 estimates are obtained without using data during the Italian COVID-19 lockdown (March-May 2020).

Second, we splitted the provinces of our sample in those in the Centre-North and those in the South. The North and the South of Italy are characterised by relevant differences in many socio-economic aspects and in the climate. Questioning this dimension of heterogeneity may provide important evidence in terms of the capability to adapt to extreme temperatures in different climates. Furthermore, it may be of help to understand if climate change may exacerbate geographical inequalities, for example if extremely hot temperatures have a stronger effect in the South than in the rest of the country. Figure 9 shows the temperature effect on the workplace accident rate. Graphs (a) and (b) focus on all the workplace injuries in the Centre-North and in the South, respectively. Graphs (c) and (d) report the temperature effect on the fatal injury rate. By contrasting graph (a) with graph (b), we realized that the U-shaped relationship between temperatures and workplace accident rates detected at national level is driven by the Centre-North and almost non-existent in the South. In terms of the North-South economic divide, this finding suggests that the climate change should not exacerbate the economic gap between the North and the South of the country when it comes to workplace injuries and their productivity, economic, and health costs. In terms of adaptation, if one considers the Centre-North as a colder climate area than the South, our findings contrast with those in Dillender (2021) for the US, because we found that in Italy extremely warm temperatures more strongly impacted on the workplace injury rate in the supposedly colder climate provinces. However, our attribution of the colder/warmer climate label to the geographical Centre-North and South may be a too rough approximation of the real climatic features of the two macro regions and may conceal relevant climatic heterogeneity within the two macro areas.

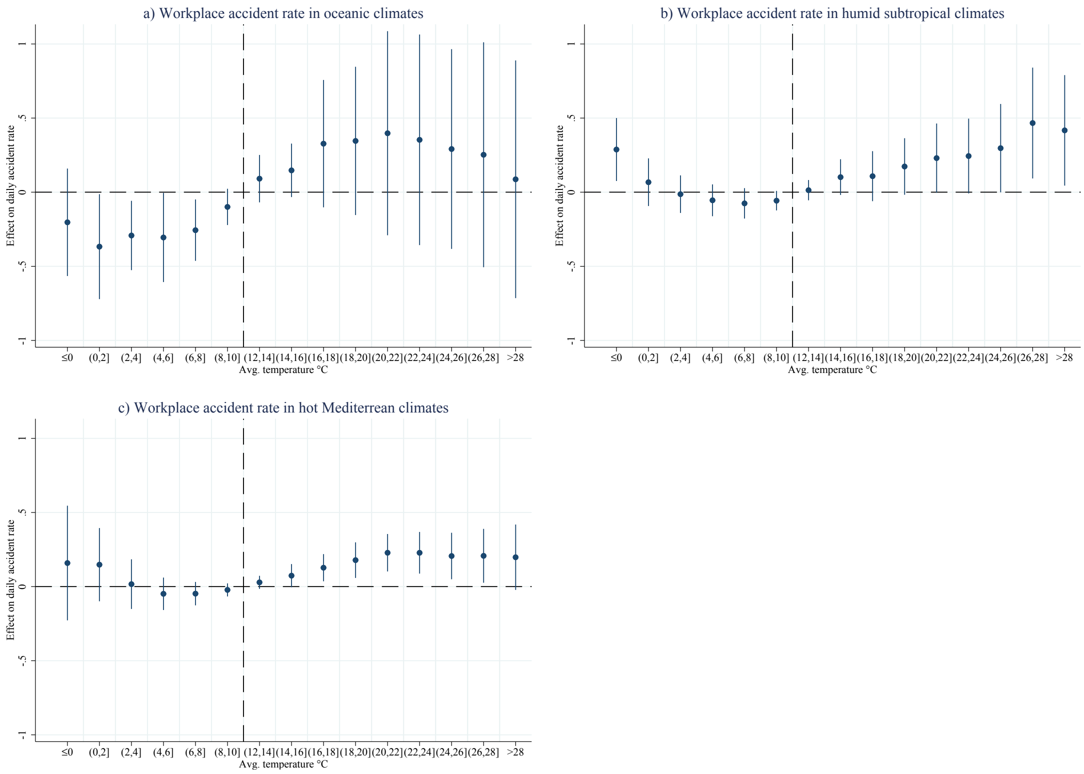
In order to have a classification of the provinces which is more consistent with their actual climate, we followed Fatima et al. (2021) and used the Köppen-Geiger climate classification (Beck et al., 2018). We distinguished the Italian provinces in three different climatic zones: oceanic, humid subtropical, and hot Mediterranean. Figure 10 shows the temperature effects by climatic area. On the one hand, we found that extremely low temperatures increase the injury rate only in humid subtropical climates and in oceanic climates, supporting the adaptation hypothesis. On the other hand, we found statistically significant evidence for extremely hot temperatures playing a role in the warmest and most humid climates, i.e. in hot Mediterranean and humid subtropical climates, a finding which does not confirm the adaptation hypothesis. As in Dillender (2021), we detected evidence more in line with avoidance behavior where warmer temperatures are rarer, rather than acclimation as a mitigating factor of extreme temperatures.

Figure 9: Effect of today's average temperature on today's accident rates, workplace accidents by geographical area



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

Figure 10: Effect of today's average temperature on today's accident rates, workplace accidents by climatic area

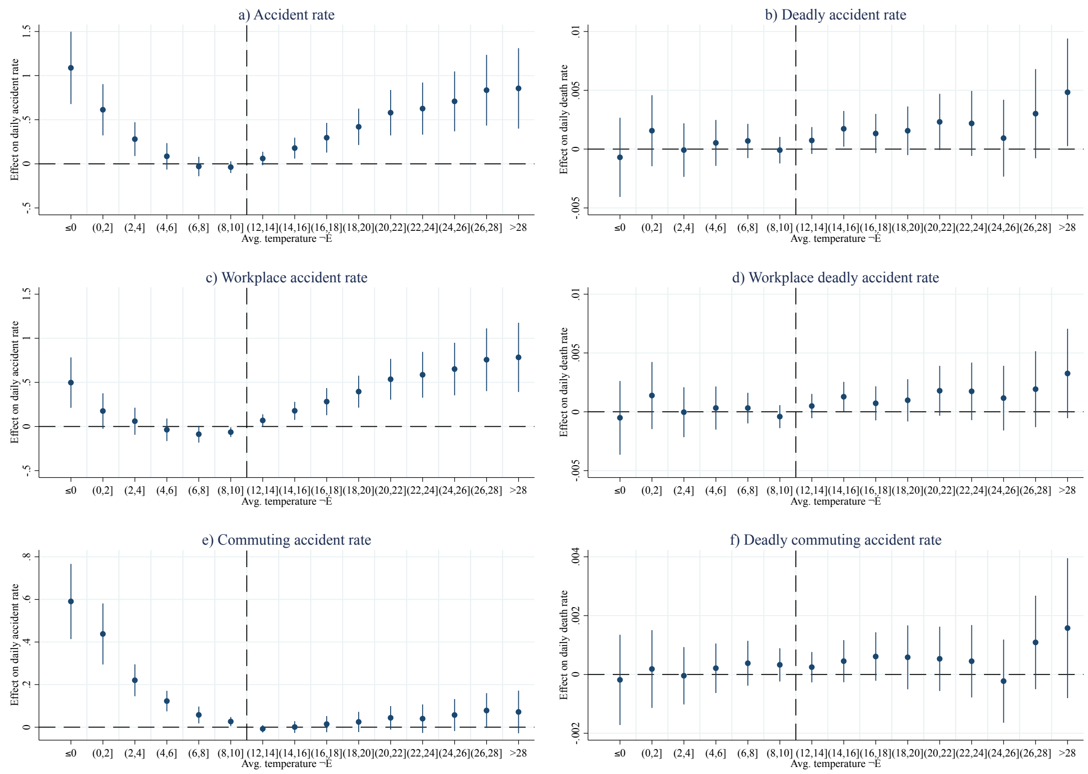


Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

4.5 Sensitivity analysis

To assess the robustness of our findings, we performed three sensitivity checks. The first one was aimed at understanding if using a different set of fixed effects, and therefore a different local variation of the daily temperatures as plausibly exogenous identifying information, may lead to different findings. We replaced the fixed effects defined by the triple interaction among province, month, and year with the fixed effects defined by the interaction between province and day of the year. Hence, in this sensitivity analysis, we exploited the variation of the provincial temperature in a given day of the year from the the 2008-2021 average temperature registered in the same province and same day of the year. Figure 11 displays the estimation results, which confirm the findings from our benchmark model.

Figure 11: Effect of today's average temperature on today's accident rates by using the deviation in the daily temperature from the average temperature in the same day of the year-province



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

As a second sensitivity check, we replicated the empirical analysis using a different weather data source. Auffhammer et al. (2013) pointed out that, when relying on deviations from averages to identify the impact of weather variables on economic outcomes, one should conduct robustness analysis by using more than one data source. Many gridded weather datasets are constructed starting from observed weather acquired from weather stations which are located with an irregular distribution and density in space. Then, through interpolation techniques, irregular distributed station data are converted to regular distributed (gridded) data. In doing so, idiosyncratic measurement errors may arise, leading to attenuation biases (Fisher et al., 2012). We gathered further climatic data from the JRC MARS Meteorological database of the Agri4Cast project.[12] This database contains meteorological observations on a daily basis from weather stations interpolated on a 25x25 km grid. We replicated the main regressions and Figure 12 displays the temperature impact on accident rates. The results shown in Figure 12 are very similar to the ones in Figure 3.

Finally, we replaced temperature bins with equally sized bins for the Heat Index (HI) calculated as in Blazejczyk et al. (2012). This is an index that combines air temperature and relative humidity to determine a measure of perceived temperature by the human body.[13] Figure 13 displays the results of the impact of HI on workplace accident rates for our benchmark specifications. The results are very similar to the ones obtained using daily average temperatures.

5 Conclusions

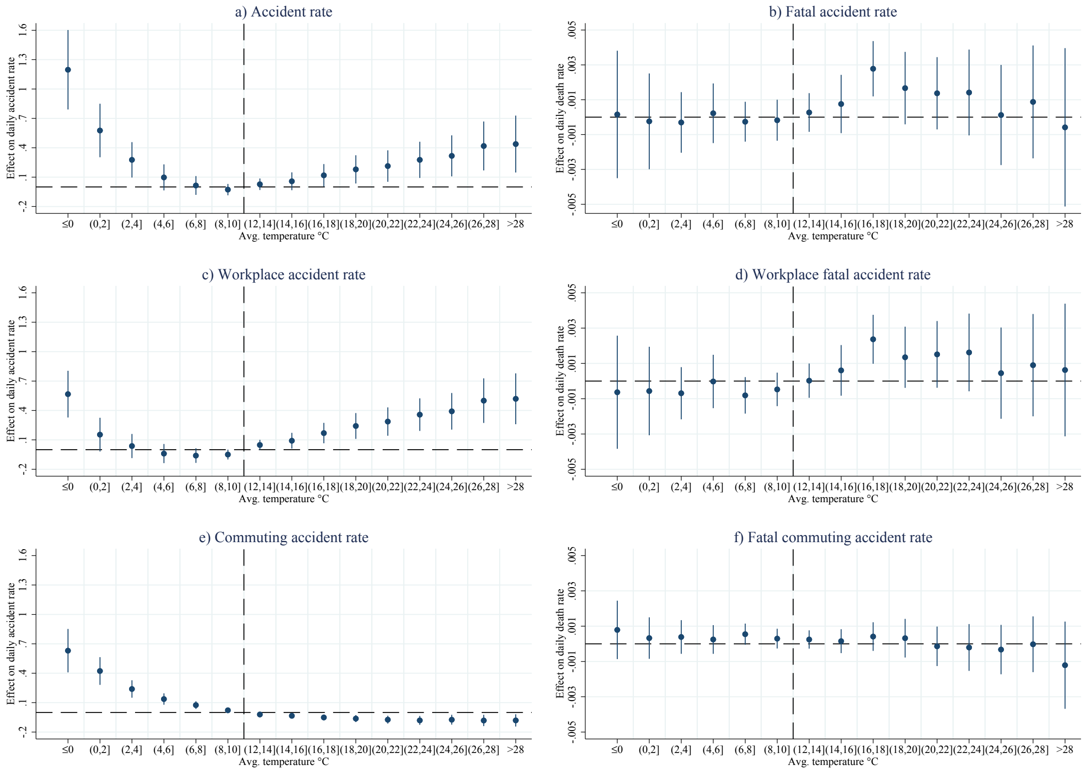
Although economists' interest on global warming is significantly increased in recent years, understanding the causal implications of climate change on health and economic outcomes is a major challenge (Connolly, 2018). Nevertheless, it is of utmost importance to highlight its impact in terms of occupational safety and economic costs, especially in light of a predicted continuous increase in temperatures.

In this article, we contributed to this growing body of the literature and estimated the causal effect of ambient temperatures on work related accident rates in Italy during the period 2008-2021 by matching daily meteorological data with daily information on work related injuries. Exploiting an identification strategy based on short-term variation of local

[12]For more information on the JRC MARS Meteorological database, see https://agri4cast.jrc.ec.europa.eu/dataportal/index.aspx (last accessed on November 7th, 2022).

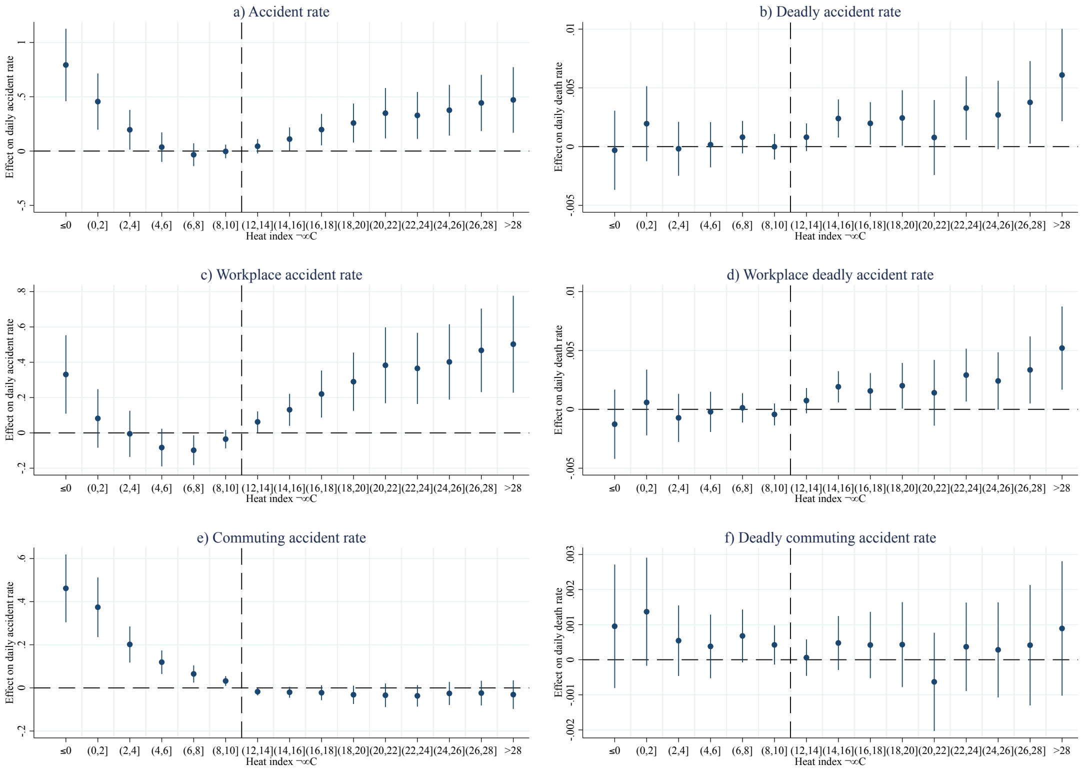
[13]The HI corresponds to the daily temperature when the latter is below 20°C.

Figure 12: Effect of today's average temperature on today's accident rates by using Agri4Cast data



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

Figure 13: Effect of HI on today's accident rates



Notes: The vertical segments are 95% confidence intervals. The vertical dashed lines indicate the reference category (10, 12]°C, whose coefficient is normalized to zero. Each regression is weighted by the provincial employment during the year of the observation.

daily temperatures, we provided evidence that work related accident rate increases with both cold and warm temperatures. On the one hand, hot temperatures are significantly harmful in terms of workplace injuries, in particular for men and for workers employed in manufacturing and service sectors. On the other hand, extremely cold temperatures increase the commuting accident rate, especially in rainy days. We tried to quantify the economic relevance of our results by predicting the variation in the number of injuries and lost labor days induced by a 2°C increase in daily average temperatures. We found that a 2°C rise in daily average temperatures generates an increase in the number of lost labor days especially for men and in the manufacturing sector (respectively +408,000 and +301,000 lost days per year at national level).

In addition, we investigated if workers and firms have been able to adapt to increasingly warmer temperatures and if increasing temperatures may exacerbate North-South economic inequalities. We did not find evidence for a decreasing trend over time in the heat-sensitivity of the injury rate. Moreover, when splitting the provinces in climatic areas, we found that hotter temperatures play a role in warmer and more humid climates, a finding which does not support the hypothesis that acclimation has been a mitigating factor of extreme temperatures. The temperature effects are stronger in the Centre-North and almost absent in the South, suggesting that the climate change should not exacerbate the economic gap between the North and the South of the country, at least in terms of workplace injuries and their associated productivity, economic, and health costs.

Our results highlight the importance of relevant firms and policy interventions aimed at safeguarding workplace safety, occupational health and labor productivity in case of rising temperatures. Different tools may be employed to adapt to a changing climate. First, firms may allow a greater flexibility in working hours through mandatory pauses during the hottest hours, a reduction in working time, or a greater turnover throughout the day. For example, shifting outdoor activities to cooler moments within the day may be particularly helpful for outdoor workers, who are directly exposed to heat-related stress and experience fewer options to adapt to extreme temperatures. Second, Park et al. (2021) pointed out that possible limits to adaptation may be not physical but endogenous to workers and firms' investments. Inefficient ventilation and temperature control in the workplace and the lack of mandatory safety regulations are likely to emphasize the harmful impact of hot temperatures on workplace safety and labor productivity. Policy makers should subsidize investments in technologies and mandate workplace safety standards to prevent work related injuries from exposure to extreme temperatures.

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Appendix

A Full set of estimation results

Table A.1: Estimation results of the main model used to draw Figure 3

	Accident rate (1)	Workplace accident rate (2)	Commuting accident rate (3)	Fatal accident rate (4)	Fatal workplace accident rate (5)	Fatal commuting accident rate (6)
Temperature - Reference: (10,12]°C						
≤0°C	0.82265***	0.33987***	0.48278***	0.00011	-0.00037	0.00048
	(0.17156)	(0.11732)	(0.07859)	(0.00157)	(0.00146)	(0.00079)
(0, 2]°C	0.45167***	0.08227	0.36940***	0.00232	0.00150	0.00082
	(0.13446)	(0.08816)	(0.06921)	(0.00154)	(0.00140)	(0.00068)
(2, 4]°C	0.17898*	-0.01618	0.19516***	0.00021	-0.00005	0.00026
	(0.09498)	(0.06854)	(0.04182)	(0.00110)	(0.00101)	(0.00045)
(4, 6]°C	0.01180	-0.09922*	0.11102***	0.00015	0.00002	0.00013
	(0.07284)	(0.05640)	(0.02827)	(0.00093)	(0.00085)	(0.00041)
(6, 8]°C	-0.04692	-0.10730**	0.06038***	0.00082	0.00044	0.00039
	(0.05466)	(0.04331)	(0.02015)	(0.00068)	(0.00063)	(0.00036)
(8, 10]°C	-0.01290	-0.04498*	0.03207***	-0.00014	-0.00037	0.00023
	(0.03246)	(0.02691)	(0.01150)	(0.00053)	(0.00045)	(0.00028)
(12, 14]°C	0.03478	0.05414*	-0.01936**	0.00079	0.00058	0.00022
	(0.03322)	(0.02917)	(0.00866)	(0.00059)	(0.00052)	(0.00024)
(14, 16]°C	0.10884**	0.12822***	-0.01937	0.00212***	0.00153**	0.00059
	(0.05470)	(0.04584)	(0.01343)	(0.00075)	(0.00063)	(0.00035)
(16, 18]°C	0.20556***	0.22500***	-0.01944	0.00183**	0.00115	0.00068
	(0.07307)	(0.06536)	(0.01797)	(0.00082)	(0.00071)	(0.00042)
(18, 20]°C	0.28383***	0.30815***	-0.02432	0.00214**	0.00150*	0.00064
	(0.09006)	(0.08040)	(0.02203)	(0.00105)	(0.00089)	(0.00051)
(20, 22]°C	0.38454***	0.40267***	-0.01813	0.00274**	0.00231**	0.00043
	(0.10738)	(0.09713)	(0.02529)	(0.00122)	(0.00106)	(0.00052)
(22, 24]°C	0.39423***	0.42931***	-0.03508	0.00252*	0.00219*	0.00033
	(0.12213)	(0.10848)	(0.02945)	(0.00145)	(0.00126)	(0.00059)
(24, 26]°C	0.43614***	0.46248***	-0.02633	0.00104	0.00133	-0.00029
	(0.13381)	(0.11809)	(0.03365)	(0.00176)	(0.00144)	(0.00073)
(26, 28]°C	0.57876***	0.59366***	-0.01490	0.00342*	0.00251	0.00091
	(0.15917)	(0.14057)	(0.03674)	(0.00199)	(0.00168)	(0.00089)
>28°C	0.55792***	0.58704***	-0.02912	0.00475**	0.00322	0.00152
	(0.18682)	(0.16193)	(0.04484)	(0.00239)	(0.00210)	(0.00111)
Dry day	0.00179	0.02201	-0.02023**	-0.00004	-0.00001	-0.00002
	(0.02217)	(0.01743)	(0.00881)	(0.00049)	(0.00040)	(0.00025)
Precipitation (mm)	0.00799**	-0.00263	0.01062***	-0.00006	-0.00002	-0.00004
	(0.00368)	(0.00286)	(0.00150)	(0.00009)	(0.00006)	(0.00006)
Precipitation^2	-0.00887	0.00430	-0.01318***	0.00029	0.00016	0.00013
	(0.00805)	(0.00687)	(0.00345)	(0.00027)	(0.00017)	(0.00019)
Precipitation^3	-0.00050	-0.00604*	0.00554**	0.00000	-0.00007	0.00008
	(0.00398)	(0.00328)	(0.00244)	(0.00016)	(0.00009)	(0.00012)
Wind speed (m/s)	-0.00405	-0.03330	0.02925	0.00036	-0.00042	0.00079*
	(0.03911)	(0.03566)	(0.01772)	(0.00107)	(0.00086)	(0.00044)
Wind speed^2	0.19698	0.81775	-0.62077	-0.01294	0.00627	-0.01921*
	(0.94814)	(0.91936)	(0.39923)	(0.02556)	(0.02026)	(0.01032)
Wind speed^3	0.40055	-3.39196	3.79251	0.02749	-0.06739	0.09488
	(6.58761)	(6.54151)	(2.71847)	(0.16198)	(0.13884)	(0.05831)
Avg. lag. temp.[(a)]	-0.00650	-0.00198	-0.00452	-0.00009	-0.00006	-0.00004
	(0.01013)	(0.00813)	(0.00318)	(0.00012)	(0.00011)	(0.00006)
Avg. for. temp.[(b)]	0.00821	0.00706	0.00115	-0.00005	-0.00003	-0.00002
	(0.01114)	(0.00837)	(0.00410)	(0.00011)	(0.00010)	(0.00005)
Avg. lag. wind[(a)]	0.01837	0.01582	0.00254	0.00034*	0.00024	0.00010
	(0.01627)	(0.01547)	(0.00329)	(0.00018)	(0.00017)	(0.00008)
Avg. for. wind[(b)]	-0.00126	-0.00458	0.00332	-0.00004	-0.00005	0.00001
	(0.00976)	(0.00830)	(0.00333)	(0.00024)	(0.00021)	(0.00009)
Avg. lag. prec.[(a)]	-0.00406*	-0.00373*	-0.00033	0.00002	0.00003	-0.00001
	(0.00220)	(0.00194)	(0.00075)	(0.00004)	(0.00004)	(0.00002)
Avg. for. prec.[(b)]	0.00531**	0.00299	0.00232**	-0.00001	0.00000	-0.00002
	(0.00253)	(0.00197)	(0.00097)	(0.00004)	(0.00003)	(0.00002)
# of observations	481,946	481,946	481,946	481,946	481,946	481,946
# of calendar dates	4,624	4,624	4,624	4,624	4,624	4,624
# of provinces	106	106	106	106	106	106
Adj. R-Square	0.75113	0.74389	0.38326	0.0076821	0.0065595	0.0056741

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.2: Estimation results used to draw Figure 4

	Workplace accident rate in dry days (1)	Workplace accident rate in rainy days (2)	Commuting accident rate in dry days (3)	Commuting accident rate in rainy days (4)
Temperature - Reference: (10,12]°C				
≤0°C	0.31740**	0.55021**	0.27148***	0.85860***
	(0.13073)	(0.21459)	(0.06031)	(0.17356)
(0, 2]°C	0.09332	0.11952	0.21212***	0.46773***
	(0.10334)	(0.13240)	(0.04326)	(0.07297)
(2, 4]°C	0.00688	0.04524	0.11786***	0.26240***
	(0.08425)	(0.10718)	(0.02851)	(0.06706)
(4, 6]°C	-0.06072	-0.07312	0.07591***	0.10402***
	(0.07122)	(0.07683)	(0.02042)	(0.03251)
(6, 8]°C	-0.09919*	-0.04075	0.03309**	0.07317***
	(0.05597)	(0.05964)	(0.01456)	(0.02554)
(8, 10]°C	-0.04751	-0.02231	0.01262	0.05182***
	(0.03441)	(0.04312)	(0.01110)	(0.01566)
(12, 14]°C	0.02917	0.11436***	-0.01051	-0.02532*
	(0.03595)	(0.04232)	(0.01259)	(0.01323)
(14, 16]°C	0.09356*	0.17580***	0.00729	-0.05109**
	(0.05305)	(0.06430)	(0.01458)	(0.02131)
(16, 18]°C	0.17749**	0.29835***	0.02567	-0.07903***
	(0.06851)	(0.08542)	(0.01999)	(0.02846)
(18, 20]°C	0.26146***	0.37507***	0.03658	-0.09578***
	(0.08473)	(0.09927)	(0.02405)	(0.03486)
(20, 22]°C	0.33923***	0.49786***	0.05459**	-0.11160***
	(0.09796)	(0.12091)	(0.02651)	(0.04248)
(22, 24]°C	0.37642***	0.45907***	0.04091	-0.11519**
	(0.10971)	(0.14468)	(0.02843)	(0.05115)
(24, 26]°C	0.40314***	0.47882***	0.05652*	-0.12430**
	(0.11943)	(0.17794)	(0.03255)	(0.05933)
(26, 28]°C (>26°C for rainy days)	0.52559***	0.72965***	0.07103**	-0.10757
	(0.14254)	(0.22738)	(0.03544)	(0.06926)
>28°C	0.53749***		0.06224	
	(0.16455)		(0.04355)	
Precipitation (mm)		-0.00049		0.01288***
		(0.00272)		(0.00187)
Precipitation^2		0.00425		-0.01817***
		(0.00701)		(0.00394)
Precipitation^3		-0.00675*		0.00749***
		(0.00346)		(0.00258)
Wind speed (m/s)	-0.01429	-0.09585	0.01744	0.01662
	(0.04049)	(0.06070)	(0.01459)	(0.03475)
Wind speed^2	0.43691	2.17519	-0.54048	-0.28709
	(0.98702)	(1.41476)	(0.34702)	(0.72387)
Wind speed^3	-2.46558	-10.06752	5.11047**	1.13940
	(7.74932)	(8.90440)	(2.46078)	(4.22524)
Avg. lag. temp.[(a)]	-0.00024	0.00818	-0.00679**	0.00394
	(0.00914)	(0.01432)	(0.00279)	(0.00560)
Avg. for. temp.[(b)]	0.00736	0.01056	-0.00007	-0.00060
	(0.00947)	(0.01458)	(0.00324)	(0.00800)
Avg. lag. wind[(a)]	0.00523	0.03313**	0.00029	0.00371
	(0.01814)	(0.01455)	(0.00299)	(0.00677)
Avg. for. wind[(b)]	-0.00910	0.00898	0.00216	0.00173
	(0.00836)	(0.01151)	(0.00289)	(0.00550)
Avg. lag. prec.[(a)]	-0.00384	-0.00314	0.00094	-0.00110
	(0.00268)	(0.00259)	(0.00077)	(0.00102)
Avg. for. prec.[(b)]	0.00147	0.00602**	0.00122	0.00459**
	(0.00249)	(0.00260)	(0.00074)	(0.00194)
# of observations	334,775	146,315	334,775	146,315
# of calendar dates	4,587	3,842	4,587	3,842
# of provinces	106	106	106	106
Adj. R-Square	0.74698	0.75283	0.41756	0.37918

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.3: Estimation results by gender used to draw Figure 5

	Workplace accident rate Men (1)	Fatal workplace accident rate Men (2)	Workplace accident rate Women (3)	Fatal workplace accident rate Women (4)
Temperature - Reference: (10,12]°C				
≤0°C	0.30548*	0.00030	0.37745***	-0.00154
	(0.17035)	(0.00247)	(0.08844)	(0.00097)
(0, 2]°C	-0.00067	0.00287	0.18482***	-0.00049
	(0.13033)	(0.00234)	(0.05765)	(0.00070)
(2, 4]°C	-0.08847	0.00038	0.07508	-0.00077
	(0.10059)	(0.00169)	(0.05072)	(0.00061)
(4, 6]°C	-0.17364**	0.00014	-0.00617	-0.00027
	(0.08489)	(0.00140)	(0.04037)	(0.00060)
(6, 8]°C	-0.16628**	0.00053	-0.02937	0.00023
	(0.06433)	(0.00101)	(0.03363)	(0.00040)
(8, 10]°C	-0.08246**	-0.00069	0.00593	0.00001
	(0.03882)	(0.00078)	(0.02419)	(0.00026)
(12, 14]°C	0.07586*	0.00107	0.03139	-0.00008
	(0.04343)	(0.00089)	(0.02501)	(0.00034)
(14, 16]°C	0.18806***	0.00248**	0.05982*	0.00021
	(0.06670)	(0.00106)	(0.03395)	(0.00048)
(16, 18]°C	0.34430***	0.00204*	0.08317*	-0.00007
	(0.09395)	(0.00122)	(0.04465)	(0.00053)
(18, 20]°C	0.46252***	0.00299*	0.12050**	-0.00052
	(0.11433)	(0.00152)	(0.05356)	(0.00056)
(20, 22]°C	0.58967***	0.00403**	0.17645***	0.00003
	(0.14067)	(0.00175)	(0.05834)	(0.00057)
(22, 24]°C	0.65025***	0.00357*	0.15582**	0.00040
	(0.15947)	(0.00211)	(0.06209)	(0.00065)
(24, 26]°C	0.70482***	0.00245	0.16077**	-0.00007
	(0.17311)	(0.00241)	(0.07008)	(0.00068)
(26, 28]°C	0.87329***	0.00424	0.24399***	0.00025
	(0.20690)	(0.00274)	(0.07889)	(0.00073)
>28°C	0.90861***	0.00564	0.17940*	-0.00006
	(0.24085)	(0.00354)	(0.09938)	(0.00092)
Dry day	0.03602	-0.00016	0.00559	0.00021
	(0.02621)	(0.00066)	(0.01573)	(0.00019)
Precipitation (mm)	-0.01276***	-0.00006	0.01124***	0.00002
	(0.00388)	(0.00009)	(0.00264)	(0.00004)
Precipitation^2	0.01838**	0.00031	-0.01540**	-0.00004
	(0.00909)	(0.00026)	(0.00772)	(0.00010)
Precipitation^3	-0.01191**	-0.00014	0.00242	0.00002
	(0.00466)	(0.00014)	(0.00345)	(0.00005)
Wind speed (m/s)	-0.04338	-0.00098	-0.01884	0.00044
	(0.05351)	(0.00143)	(0.02955)	(0.00039)
Wind speed^2	0.98713	0.01813	0.61715	-0.01264
	(1.26034)	(0.03464)	(0.72459)	(0.00887)
Wind speed^3	-3.58576	-0.15111	-3.45662	0.07049
	(8.51282)	(0.23706)	(5.39383)	(0.05318)
Avg. lag. temp.[(a)]	-0.00914	-0.00008	0.00779	-0.00002
	(0.01194)	(0.00018)	(0.00570)	(0.00006)
Avg. for. temp.[(b)]	0.00612	-0.00001	0.00777	-0.00006
	(0.01268)	(0.00016)	(0.00523)	(0.00006)
Avg. lag. wind[(a)]	0.02993	0.00053*	-0.00279	-0.00016
	(0.02202)	(0.00028)	(0.00935)	(0.00010)
Avg. for. wind[(b)]	0.00243	-0.00006	-0.01517**	-0.00004
	(0.01208)	(0.00037)	(0.00660)	(0.00008)
Avg. lag. prec.[(a)]	-0.00426	0.00003	-0.00226	0.00004
	(0.00275)	(0.00006)	(0.00190)	(0.00003)
Avg. for. prec.[(b)]	0.00370	0.00002	0.00212	-0.00002
	(0.00285)	(0.00005)	(0.00169)	(0.00002)
# of observations	481,946	481,946	481,946	481,946
# of calendar dates	4,624	4,624	4,624	4,624
# of provinces	106	106	106	106
Adj. R-Square	.71459	.0053845	.48585	.0000303

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.4: Estimation results by sector to draw Figure 6

	Workplace accident rate in agriculture (1)	Fatal workplace accident rate in agriculture (2)	Workplace accident rate in manufacturing (3)	Fatal workplace accident rate in manufacturing (4)	Workplace accident rate in services (5)	Fatal workplace accident rate in services (6)
Temperature - Reference: (10,12]°C						
≤0°C	-0.04547	-0.00082	0.15892	-0.00145	0.45006***	-0.00002
	(0.12905)	(0.00609)	(0.12149)	(0.00371)	(0.12526)	(0.00163)
(0, 2]°C	0.07178	0.00318	-0.03287	0.00169	0.14164	0.00133
	(0.11170)	(0.00430)	(0.10195)	(0.00330)	(0.09191)	(0.00135)
(2, 4]°C	0.00720	0.00946**	-0.06802	0.00098	0.00651	-0.00090
	(0.07397)	(0.00413)	(0.08072)	(0.00254)	(0.07169)	(0.00101)
(4, 6]°C	-0.02208	0.00021	-0.07934	-0.00052	-0.10144*	0.00027
	(0.06712)	(0.00280)	(0.06398)	(0.00205)	(0.05886)	(0.00090)
(6, 8]°C	-0.08179*	0.00099	-0.11024**	0.00069	-0.10162**	0.00018
	(0.04256)	(0.00188)	(0.04834)	(0.00179)	(0.04513)	(0.00060)
(8, 10]°C	-0.01687	0.00126	-0.08387**	-0.00078	-0.02981	-0.00045
	(0.03445)	(0.00150)	(0.03520)	(0.00110)	(0.02916)	(0.00047)
(12, 14]°C	0.08403**	0.00134	0.01941	0.00050	0.05644*	0.00052
	(0.03796)	(0.00152)	(0.03937)	(0.00129)	(0.02944)	(0.00054)
(14, 16]°C	0.09939**	0.00168	0.06056	0.00115	0.13628***	0.00171**
	(0.04545)	(0.00184)	(0.05602)	(0.00167)	(0.04586)	(0.00076)
(16, 18]°C	0.12759**	0.00343	0.19921***	0.00185	0.19800***	0.00082
	(0.05405)	(0.00259)	(0.07420)	(0.00195)	(0.06538)	(0.00086)
(18, 20]°C	0.14455**	0.00183	0.26609***	0.00263	0.27706***	0.00107
	(0.06217)	(0.00332)	(0.09142)	(0.00250)	(0.07925)	(0.00104)
(20, 22]°C	0.18402**	0.00094	0.39003***	0.00273	0.34829***	0.00228*
	(0.07556)	(0.00309)	(0.11914)	(0.00291)	(0.09312)	(0.00123)
(22, 24]°C	0.26816***	0.00110	0.37581***	0.00166	0.37743***	0.00236*
	(0.09131)	(0.00358)	(0.12789)	(0.00304)	(0.10290)	(0.00141)
(24, 26]°C	0.29459***	0.00229	0.44541***	0.00065	0.39468***	0.00149
	(0.09730)	(0.00405)	(0.14850)	(0.00335)	(0.11050)	(0.00162)
(26, 28]°C	0.38709***	-0.00117	0.60429***	0.00553	0.50024***	0.00167
	(0.11807)	(0.00466)	(0.16835)	(0.00411)	(0.13556)	(0.00176)
>28°C	0.32014**	0.00035	0.67601***	0.00116	0.45175***	0.00423*
	(0.12917)	(0.00604)	(0.19676)	(0.00556)	(0.15175)	(0.00214)
Dry day	-0.00466	0.00009	-0.02042	-0.00073	0.02656	0.00018
	(0.02273)	(0.00104)	(0.02892)	(0.00098)	(0.01871)	(0.00037)
Precipitation (mm)	-0.00474	-0.00009	-0.01493***	-0.00016	0.00279	0.00003
	(0.00342)	(0.00013)	(0.00376)	(0.00014)	(0.00304)	(0.00005)
Precipitation^2	0.01581	0.00040	0.02435**	0.00056	-0.00430	0.00001
	(0.01025)	(0.00048)	(0.01054)	(0.00040)	(0.00789)	(0.00015)
Precipitation^3	-0.00798	-0.00024	-0.01867***	-0.00017	-0.00177	-0.00002
	(0.00496)	(0.00026)	(0.00580)	(0.00028)	(0.00363)	(0.00008)
Wind speed (m/s)	0.01055	-0.00033	-0.02989	0.00056	-0.03944	-0.00081
	(0.03467)	(0.00224)	(0.04418)	(0.00202)	(0.03918)	(0.00081)
Wind speed^2	-0.31352	-0.00986	0.52195	-0.02278	0.99731	0.01755
	(0.91319)	(0.04444)	(1.18440)	(0.05593)	(1.01789)	(0.01697)
Wind speed^3	2.70451	0.04592	-0.74019	0.10270	-4.86661	-0.13456
	(4.88843)	(0.25065)	(9.44851)	(0.46148)	(7.22392)	(0.10158)
Avg. lag. temp.[(a)]	-0.01045	0.00031	-0.00282	-0.00016	0.00106	-0.00005
	(0.00679)	(0.00031)	(0.00822)	(0.00031)	(0.00778)	(0.00011)
Avg. for. temp.[(b)]	0.00712	-0.00017	0.00478	-0.00032	0.00926	0.00005
	(0.00801)	(0.00028)	(0.00943)	(0.00026)	(0.00776)	(0.00010)
Avg. lag. wind[(a)]	0.00914	-0.00021	0.02787	-0.00000	0.01540	0.00032*
	(0.00864)	(0.00049)	(0.02570)	(0.00037)	(0.01384)	(0.00019)
Avg. for. wind[(b)]	-0.00413	0.00038	-0.00811	0.00055	-0.00529	-0.00031
	(0.01338)	(0.00041)	(0.01392)	(0.00050)	(0.00831)	(0.00023)
Avg. lag. prec.[(a)]	-0.00153	-0.00004	-0.00482*	-0.00005	-0.00430**	0.00006
	(0.00213)	(0.00010)	(0.00267)	(0.00008)	(0.00199)	(0.00004)
Avg. for. prec.[(b)]	-0.00090	-0.00011	-0.00166	-0.00003	0.00496**	0.00002
	(0.00195)	(0.00009)	(0.00254)	(0.00008)	(0.00197)	(0.00003)
# of observations	479,962	479,962	481,946	481,946	481,946	481,946
# of calendar dates	4,624	4,624	4,624	4,624	4,624	4,624
# of provinces	106	106	106	106	106	106
Adj. R-Square	.23526	-.0060052	.62377	.00098	.67257	.0059741

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

(a) Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

(b) Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.5: Estimation results by injury severity used to draw Figure 7

	Workplace accident rate absence $<$ 30 days (1)	Workplace accident rate absence $\geq$ 30 days (2)	Workplace accident rate without macro permanent impairment (3)	Workplace accident rate with macro permanent impairment (4)
Temperature - Reference: (10,12]°C				
≤0°C	0.19943**	0.14044***	0.34038***	-0.00051
	(0.09802)	(0.03374)	(0.11728)	(0.00191)
(0, 2]°C	0.01418	0.06809***	0.08081	0.00146
	(0.07717)	(0.02304)	(0.08812)	(0.00170)
(2, 4]°C	-0.02051	0.00433	-0.01610	-0.00008
	(0.05889)	(0.01804)	(0.06848)	(0.00126)
(4, 6]°C	-0.08781*	-0.01141	-0.09867*	-0.00055
	(0.04967)	(0.01314)	(0.05643)	(0.00104)
(6, 8]°C	-0.08363**	-0.02367**	-0.10735**	0.00005
	(0.03679)	(0.01170)	(0.04335)	(0.00082)
(8, 10]°C	-0.03550	-0.00948	-0.04455	-0.00043
	(0.02267)	(0.00864)	(0.02697)	(0.00061)
(12, 14]°C	0.04913**	0.00501	0.05376*	0.00039
	(0.02309)	(0.00931)	(0.02914)	(0.00064)
(14, 16]°C	0.10464***	0.02358**	0.12673***	0.00148*
	(0.03788)	(0.01166)	(0.04582)	(0.00078)
(16, 18]°C	0.19115***	0.03385**	0.22389***	0.00111
	(0.05546)	(0.01410)	(0.06535)	(0.00088)
(18, 20]°C	0.25723***	0.05091***	0.30645***	0.00169
	(0.06760)	(0.01826)	(0.08038)	(0.00111)
(20, 22]°C	0.33039***	0.07228***	0.40030***	0.00237*
	(0.07989)	(0.02343)	(0.09705)	(0.00128)
(22, 24]°C	0.35608***	0.07323***	0.42690***	0.00241*
	(0.09065)	(0.02482)	(0.10833)	(0.00142)
(24, 26]°C	0.38780***	0.07467***	0.46136***	0.00112
	(0.09869)	(0.02754)	(0.11793)	(0.00166)
(26, 28]°C	0.50030***	0.09335***	0.59097***	0.00268
	(0.11724)	(0.03315)	(0.14046)	(0.00185)
>28°C	0.51113***	0.07591*	0.58322***	0.00382*
	(0.13324)	(0.04278)	(0.16168)	(0.00225)
Dry day	0.02388	-0.00187	0.02161	0.00041
	(0.01470)	(0.00541)	(0.01738)	(0.00041)
Precipitation (mm)	-0.00034	-0.00229***	-0.00263	0.00001
	(0.00241)	(0.00087)	(0.00285)	(0.00006)
Precipitation^2	-0.00125	0.00556**	0.00425	0.00005
	(0.00576)	(0.00242)	(0.00684)	(0.00017)
Precipitation^3	-0.00183	-0.00421***	-0.00600*	-0.00004
	(0.00271)	(0.00132)	(0.00326)	(0.00009)
Wind speed (m/s)	-0.03412	0.00082	-0.03217	-0.00113
	(0.03089)	(0.01395)	(0.03557)	(0.00102)
Wind speed^2	0.82667	-0.00891	0.79507	0.02268
	(0.74066)	(0.37404)	(0.91520)	(0.02311)
Wind speed^3	-3.52184	0.12988	-3.22241	-0.16955
	(5.01504)	(2.98666)	(6.50035)	(0.15516)
Avg. lag. temp.[(a)]	-0.00341	0.00143	-0.00190	-0.00008
	(0.00716)	(0.00187)	(0.00812)	(0.00012)
Avg. for. temp.[(b)]	0.00539	0.00167	0.00703	0.00003
	(0.00715)	(0.00213)	(0.00837)	(0.00011)
Avg. lag. wind[(a)]	0.01412	0.00170	0.01556	0.00026
	(0.01589)	(0.00273)	(0.01540)	(0.00019)
Avg. for. wind[(b)]	-0.00628	0.00170	-0.00469	0.00011
	(0.00619)	(0.00349)	(0.00827)	(0.00018)
Avg. lag. prec.[(a)]	-0.00136	-0.00237***	-0.00375*	0.00002
	(0.00170)	(0.00050)	(0.00195)	(0.00005)
Avg. for. prec.[(b)]	0.00289*	0.00010	0.00297	0.00002
	(0.00162)	(0.00064)	(0.00197)	(0.00004)
# of observations	481,946	481,946	481,946	481,946
# of calendar dates	4,624	4,624	4,624	4,624
# of provinces	106	106	106	106
Adj. R-Square	.723	.44056	.74398	.0084491

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.6: Estimation results by two-year periods used to draw Figure 8

	Workplace accident rate (2008-2009) (1)	Workplace accident rate (2010-2011) (2)	Workplace accident rate (2012-2013) (3)	Workplace accident rate (2014-2015) (4)	Workplace accident rate (2016-2017) (5)	Workplace accident rate (2018-2019) (6)	Workplace accident rate (2020-2021) (7)
Temperature - Reference: (10,12]°C							
≤0°C	0.71720*	0.25604	0.37625	0.72022*	0.17047	0.12282	0.09104
	(0.38835)	(0.29967)	(0.25512)	(0.40115)	(0.22185)	(0.27921)	(0.32573)
(0, 2]°C	0.19549	-0.11660	0.09809	0.15361	0.17457	0.02030	0.05762
	(0.27200)	(0.23726)	(0.21746)	(0.17479)	(0.25881)	(0.18976)	(0.22723)
(2, 4]°C	0.08292	-0.13120	-0.10117	-0.00580	0.13338	0.04184	-0.02216
	(0.23193)	(0.19151)	(0.18157)	(0.14701)	(0.18017)	(0.15763)	(0.17163)
(4, 6]°C	0.07931	-0.27513*	-0.26573*	-0.13685	0.12025	0.02365	-0.18366
	(0.19005)	(0.15499)	(0.15496)	(0.13028)	(0.14441)	(0.12354)	(0.14789)
(6, 8]°C	0.00465	-0.18188	-0.26083**	-0.05359	-0.01242	0.02079	-0.19125*
	(0.14232)	(0.12116)	(0.11118)	(0.08724)	(0.11087)	(0.09227)	(0.09789)
(8, 10]°C	0.01830	-0.15794*	-0.15585**	0.01776	0.06131	0.02378	-0.17645***
	(0.08457)	(0.08451)	(0.06694)	(0.05463)	(0.07442)	(0.06440)	(0.06062)
(12, 14]°C	-0.04712	0.04438	0.08245	0.04267	0.12198*	0.07767	0.04570
	(0.07854)	(0.07453)	(0.07612)	(0.06176)	(0.06474)	(0.06147)	(0.08407)
(14, 16]°C	-0.00412	0.13157	0.22278*	0.05973	0.17287*	0.21212**	-0.03221
	(0.12993)	(0.12795)	(0.11436)	(0.09944)	(0.08900)	(0.09920)	(0.13791)
(16, 18]°C	0.13596	0.23818	0.39859***	0.12994	0.18142*	0.38653***	0.07750
	(0.17558)	(0.16332)	(0.15091)	(0.11140)	(0.10727)	(0.12311)	(0.16714)
(18, 20]°C	0.39539*	0.19502	0.52927***	0.16727	0.19692	0.52086***	0.15653
	(0.21957)	(0.19825)	(0.18962)	(0.13042)	(0.13426)	(0.16215)	(0.18936)
(20, 22]°C	0.45676*	0.24278	0.71064***	0.21223	0.39959**	0.66562***	0.14403
	(0.25509)	(0.22954)	(0.22386)	(0.15224)	(0.18162)	(0.19289)	(0.21058)
(22, 24]°C	0.41994	0.38122	0.68614***	0.30013*	0.29582	0.70893***	0.17782
	(0.28100)	(0.25930)	(0.23853)	(0.17164)	(0.18684)	(0.22664)	(0.24153)
(24, 26]°C	0.38604	0.48356*	0.76377***	0.33158*	0.34643	0.79830***	0.09812
	(0.31803)	(0.28997)	(0.26682)	(0.19353)	(0.22272)	(0.24608)	(0.25205)
(26, 28]°C	0.53067	0.59665*	0.95784***	0.47624**	0.50169*	0.89173***	0.12718
	(0.34771)	(0.33457)	(0.31601)	(0.22015)	(0.26418)	(0.27956)	(0.29943)
>28°C	1.10171**	0.52748	0.89441**	0.42395	0.35073	0.93693***	0.09683
	(0.54526)	(0.41681)	(0.36429)	(0.25624)	(0.30708)	(0.31434)	(0.32166)
Dry day	0.01972	0.09677*	-0.00438	0.01636	0.02513	0.00342	0.03310
	(0.05594)	(0.05182)	(0.04708)	(0.03900)	(0.04259)	(0.04037)	(0.05581)
Precipitation (mm)	0.00181	0.00672	-0.00950	-0.00129	-0.01116	-0.00120	0.00264
	(0.00868)	(0.00810)	(0.00789)	(0.00510)	(0.00679)	(0.00717)	(0.01249)
Precipitation^2	-0.01635	-0.02249	0.02783	0.00770	0.02482	-0.00408	-0.00935
	(0.02316)	(0.02376)	(0.02486)	(0.01353)	(0.01681)	(0.02493)	(0.04548)
Precipitation^3	0.00555	0.01335	-0.02047	-0.00940	-0.01327**	0.00256	-0.00365
	(0.01454)	(0.01605)	(0.01930)	(0.00673)	(0.00624)	(0.01738)	(0.03143)
Wind speed (m/s)	0.05192	-0.03395	-0.04124	0.03227	-0.09133	0.10901	-0.01958
	(0.12074)	(0.12450)	(0.11132)	(0.07685)	(0.08374)	(0.07500)	(0.11315)
Wind speed^2	-1.40264	0.42371	-1.67940	-0.24373	3.28489	-1.79321	0.99077
	(2.89405)	(3.38881)	(3.59624)	(1.84998)	(2.49508)	(1.40435)	(2.31882)
Wind speed^3	15.43665	3.26965	32.42301	1.26686	-28.23603	7.87884	-3.64957
	(21.76732)	(27.06391)	(30.33102)	(15.22553)	(22.22871)	(7.73894)	(14.27792)
Avg. lag. temp.[(a)]	0.00525	-0.00463	-0.03833*	0.02481	0.01914	-0.00973	0.00237
	(0.02466)	(0.02284)	(0.01972)	(0.01751)	(0.01667)	(0.01834)	(0.02408)
Avg. for. temp.[(b)]	0.01860	-0.01969	0.00536	0.01397	0.00132	-0.00121	0.03866*
	(0.02592)	(0.02411)	(0.02017)	(0.01739)	(0.01833)	(0.02093)	(0.02315)
Avg. lag. wind[(a)]	0.05948**	-0.00104	-0.01589	-0.00131	-0.00879	0.00615	-0.00145
	(0.02360)	(0.02922)	(0.02434)	(0.01681)	(0.02594)	(0.01596)	(0.03148)
Avg. for. wind[(b)]	0.00902	0.01673	0.01525	0.00594	-0.03965	-0.02175	-0.04670
	(0.01021)	(0.04145)	(0.02276)	(0.01275)	(0.02904)	(0.02018)	(0.02848)
Avg. lag. prec.[(a)]	0.00093	-0.00782*	-0.00474	0.00137	0.00223	-0.00947**	-0.01091
	(0.00610)	(0.00415)	(0.00467)	(0.00403)	(0.00465)	(0.00467)	(0.00713)
Avg. for. prec.[(b)]	0.00790	0.00266	0.00156	-0.00212	-0.00351	0.00847*	0.00827
	(0.00653)	(0.00515)	(0.00508)	(0.00334)	(0.00496)	(0.00462)	(0.00671)
# of observations	68,073	69,960	70,062	69,512	67,749	69,948	57,102
# of calendar dates	661	660	661	660	661	660	571
# of provinces	103	106	106	106	106	106	106
Adj. R-Square	.76879	.74418	.71318	.70281	.69663	.69962	.70285

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.7: Estimation results by geographical area used to draw Figure 9

	Workplace accident rate (Centre-North) (1)	Fatal workplace accident rate (Centre-North) (2)	Workplace accident rate (South) (3)	Fatal workplace accident (South) (4)
Temperature - Reference: (10,12]°C				
≤0°C	0.28352***	-0.00146	0.10462	-0.01144**
	(0.09836)	(0.00169)	(0.19532)	(0.00555)
(0, 2]°C	0.06150	0.00057	-0.11737	-0.00374
	(0.07529)	(0.00168)	(0.10772)	(0.00324)
(2, 4]°C	-0.03196	-0.00060	-0.04951	-0.00175
	(0.05739)	(0.00127)	(0.09853)	(0.00328)
(4, 6]°C	-0.08326*	-0.00016	-0.06490	-0.00103
	(0.04889)	(0.00107)	(0.05810)	(0.00225)
(6, 8]°C	-0.09539**	0.00027	-0.06613	-0.00040
	(0.03911)	(0.00075)	(0.04727)	(0.00212)
(8, 10]°C	-0.03676	-0.00054	-0.02320	-0.00099
	(0.02575)	(0.00052)	(0.02015)	(0.00115)
(12, 14]°C	0.05259	0.00087	0.00509	-0.00007
	(0.04048)	(0.00064)	(0.02302)	(0.00106)
(14, 16]°C	0.11446**	0.00177**	0.03030	0.00062
	(0.05074)	(0.00086)	(0.03752)	(0.00131)
(16, 18]°C	0.17725**	0.00122	0.07886*	0.00081
	(0.08124)	(0.00107)	(0.04435)	(0.00155)
(18, 20]°C	0.24448**	0.00180	0.10474*	0.00132
	(0.10624)	(0.00131)	(0.05814)	(0.00188)
(20, 22]°C	0.31051**	0.00207	0.13618**	0.00363*
	(0.12331)	(0.00157)	(0.06179)	(0.00206)
(22, 24]°C	0.35521**	0.00256	0.05929	0.00209
	(0.14313)	(0.00180)	(0.07407)	(0.00285)
(24, 26]°C	0.37588**	0.00219	0.03948	-0.00053
	(0.14381)	(0.00209)	(0.08069)	(0.00313)
(26, 28]°C	0.49342***	0.00373	0.05736	-0.00103
	(0.16393)	(0.00254)	(0.08788)	(0.00360)
>28°C	0.46414***	0.00335	0.02335	-0.00067
	(0.17142)	(0.00249)	(0.11341)	(0.00557)
Dry day	0.00024	-0.00027	-0.00490	0.00137
	(0.01951)	(0.00041)	(0.02115)	(0.00119)
Precipitation (mm)	0.00201	-0.00006	-0.00280	0.00013
	(0.00267)	(0.00006)	(0.00256)	(0.00022)
Precipitation^2	-0.00185	0.00010	0.00676	0.00031
	(0.00723)	(0.00016)	(0.00816)	(0.00065)
Precipitation^3	-0.00342	-0.00001	-0.00708*	-0.00027
	(0.00348)	(0.00011)	(0.00380)	(0.00032)
Wind speed (m/s)	-0.06330	-0.00109	-0.01043	0.00243
	(0.05610)	(0.00089)	(0.03148)	(0.00212)
Wind speed^2	1.46054	0.02212	0.07139	-0.04363
	(1.85507)	(0.02103)	(0.55737)	(0.04726)
Wind speed^3	-7.67466	-0.16370	1.09160	0.15832
	(15.00842)	(0.16594)	(3.01506)	(0.28704)
Avg. lag. temp.$^{(a)}$	-0.00562	-0.00015	0.01633**	0.00006
	(0.00730)	(0.00014)	(0.00748)	(0.00037)
Avg. for. temp.$^{(b)}$	0.02132***	-0.00008	0.01455**	-0.00008
	(0.00746)	(0.00014)	(0.00637)	(0.00024)
Avg. lag. wind$^{(a)}$	0.01571	0.00030*	0.01198	0.00030
	(0.01721)	(0.00017)	(0.01194)	(0.00059)
Avg. for. wind$^{(b)}$	0.00030	-0.00015	-0.00458	0.00063
	(0.00697)	(0.00022)	(0.01219)	(0.00038)
Avg. lag. prec.$^{(a)}$	-0.00390*	0.00003	-0.00478***	0.00016
	(0.00204)	(0.00004)	(0.00172)	(0.00012)
Avg. for. prec.$^{(b)}$	0.00322*	-0.00000	0.00339	0.00001
	(0.00170)	(0.00004)	(0.00230)	(0.00010)
# of observations	317,686	317,686	164,260	164,260
# of calendar dates	4,624	4,624	4,624	4,624
# of provinces	69	69	37	37
Adj. R-Square	.76854	.0080836	.60688	.0006026

* p-value$<$0.10, ** p-value$<$0.05, *** p-value$<$0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

(a) Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

(b) Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.8: Estimation results by climate area used to draw Figure 10

	Workplace accident rate (Oceanic climates) (1)	Workplace accident rate (Humid subtropical climates) (2)	Workplace accident rate (Hot mediterranean climates) (3)
Temperature - Reference: (10,12]°C			
≤0°C	-0.20315	0.28792***	0.15902
	(0.16468)	(0.10562)	(0.19224)
(0, 2]°C	-0.36732**	0.06749	0.14804
	(0.16089)	(0.07994)	(0.12273)
(2, 4]°C	-0.29202**	-0.01324	0.01678
	(0.10625)	(0.06302)	(0.08328)
(4, 6]°C	-0.30550**	-0.05465	-0.04862
	(0.13670)	(0.05337)	(0.05440)
(6, 8]°C	-0.25614**	-0.07531	-0.04746
	(0.09412)	(0.05101)	(0.03923)
(8, 10]°C	-0.09926	-0.05714*	-0.02228
	(0.05562)	(0.03271)	(0.02190)
(12, 14]°C	0.09126	0.01370	0.02881
	(0.07265)	(0.03400)	(0.02183)
(14, 16]°C	0.14739*	0.10172*	0.07382*
	(0.08197)	(0.05991)	(0.03883)
(16, 18]°C	0.32753	0.10817	0.12757***
	(0.19517)	(0.08388)	(0.04554)
(18, 20]°C	0.34598	0.17346*	0.17857***
	(0.22728)	(0.09482)	(0.05970)
(20, 22]°C	0.39791	0.23022*	0.22854***
	(0.31275)	(0.11589)	(0.06281)
(22, 24]°C	0.35337	0.24396*	0.22821***
	(0.32278)	(0.12539)	(0.06987)
(24, 26]°C	0.29123	0.29718*	0.20649**
	(0.30613)	(0.14819)	(0.07797)
(26, 28]°C	0.25263	0.46661**	0.20772**
	(0.34473)	(0.18583)	(0.09034)
>28°C	0.08716	0.41713**	0.19816*
	(0.36435)	(0.18535)	(0.10960)
Dry day	0.05289	-0.02326	0.01424
	(0.03480)	(0.02137)	(0.01806)
Precipitation (mm)	0.00908	-0.00152	-0.00350
	(0.00593)	(0.00467)	(0.00304)
Precipitation^2	-0.01186	0.00641	0.00857
	(0.01590)	(0.01644)	(0.00794)
Precipitation^3	-0.00184	-0.01197	-0.00688
	(0.00655)	(0.01360)	(0.00474)
Wind speed (m/s)	0.10461	-0.03901	-0.03141
	(0.09511)	(0.04893)	(0.03109)
Wind speed^2	-4.28112*	0.05055	0.98018
	(2.28368)	(1.27962)	(0.72807)
Wind speed^3	32.04887	5.10207	-5.04864
	(19.95491)	(11.04687)	(4.76611)
Avg. lag. temp.[(a)]	-0.00832	0.00138	0.00967
	(0.01557)	(0.00786)	(0.00667)
Avg. for. temp.[(b)]	0.01272	0.01779*	0.00524
	(0.01404)	(0.00987)	(0.00720)
Avg. lag. wind[(a)]	0.03848	0.01620	0.00054
	(0.02288)	(0.01891)	(0.01053)
Avg. for. wind[(b)]	-0.00084	0.00223	-0.01060
	(0.00583)	(0.01710)	(0.01165)
Avg. lag. prec.[(a)]	-0.00129	-0.00538**	-0.00538***
	(0.00468)	(0.00245)	(0.00174)
Avg. for. prec.[(b)]	0.00025	0.00505**	0.00080
	(0.00446)	(0.00234)	(0.00225)
# of observations	50,700	219,967	211,169
# of calendar dates	4,624	4,624	4,624
# of provinces	12	48	48
Adj. R-Square	0.75297	0.77716	0.65915

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.9: Estimation results by exploiting the deviation in the daily temperature from the average temperature in the same day of the year-province and used to draw Figure 11

	Accident rate (1)	Workplace accident rate (2)	Commuting accident rate (3)	Fatal accident rate (4)	Fatal workplace accident rate (5)	Fatal commuting accident rate (6)
Temperature - Reference: (10,12]°C						
≤0°C	1.08768***	0.49738***	0.59030***	-0.00070	-0.00051	-0.00019
	(0.20675)	(0.14408)	(0.08904)	(0.00170)	(0.00158)	(0.00077)
(0, 2]°C	0.61265***	0.17489*	0.43776***	0.00157	0.00138	0.00018
	(0.14652)	(0.10149)	(0.07229)	(0.00152)	(0.00144)	(0.00067)
(2, 4]°C	0.27986***	0.05967	0.22019***	-0.00008	-0.00004	-0.00004
	(0.09666)	(0.07740)	(0.03780)	(0.00115)	(0.00107)	(0.00049)
(4, 6]°C	0.08492	-0.03765	0.12257***	0.00053	0.00032	0.00021
	(0.07545)	(0.06441)	(0.02429)	(0.00098)	(0.00092)	(0.00042)
(6, 8]°C	-0.03044	-0.08792*	0.05748***	0.00069	0.00031	0.00038
	(0.05534)	(0.04759)	(0.01986)	(0.00073)	(0.00066)	(0.00038)
(8, 10]°C	-0.03779	-0.06422**	0.02643**	-0.00009	-0.00041	0.00033
	(0.03336)	(0.02772)	(0.01081)	(0.00057)	(0.00049)	(0.00028)
(12, 14]°C	0.06029	0.06803*	-0.00774	0.00073	0.00049	0.00025
	(0.03852)	(0.03516)	(0.00864)	(0.00058)	(0.00052)	(0.00026)
(14, 16]°C	0.17806***	0.17738***	0.00067	0.00173**	0.00128**	0.00045
	(0.05980)	(0.05147)	(0.01397)	(0.00077)	(0.00064)	(0.00036)
(16, 18]°C	0.29562***	0.28135***	0.01427	0.00133	0.00072	0.00061
	(0.08481)	(0.07733)	(0.01905)	(0.00084)	(0.00073)	(0.00042)
(18, 20]°C	0.41935***	0.39483***	0.02453	0.00156	0.00098	0.00058
	(0.10401)	(0.09146)	(0.02400)	(0.00104)	(0.00091)	(0.00055)
(20, 22]°C	0.57938***	0.53551***	0.04387	0.00231*	0.00178*	0.00053
	(0.12980)	(0.11659)	(0.02780)	(0.00121)	(0.00107)	(0.00055)
(22, 24]°C	0.62591***	0.58607***	0.03984	0.00218	0.00174	0.00045
	(0.14889)	(0.13077)	(0.03378)	(0.00139)	(0.00123)	(0.00062)
(24, 26]°C	0.70805***	0.65099***	0.05706	0.00093	0.00116	-0.00023
	(0.17120)	(0.15023)	(0.03790)	(0.00165)	(0.00139)	(0.00071)
(26, 28]°C	0.83462***	0.75654***	0.07808*	0.00301	0.00192	0.00109
	(0.20223)	(0.17940)	(0.04124)	(0.00191)	(0.00163)	(0.00080)
>28°C	0.85511***	0.78357***	0.07154	0.00483**	0.00326*	0.00157
	(0.22990)	(0.19790)	(0.05045)	(0.00231)	(0.00192)	(0.00120)
Dry day	-0.00073	0.02369	-0.02442***	0.00006	0.00014	-0.00008
	(0.02568)	(0.02197)	(0.00926)	(0.00052)	(0.00041)	(0.00024)
Precipitation (mm)	0.00892**	-0.00135	0.01027***	-0.00005	-0.00001	-0.00004
	(0.00384)	(0.00299)	(0.00147)	(0.00009)	(0.00006)	(0.00006)
Precipitation^2	-0.01143	0.00112	-0.01254***	0.00025	0.00012	0.00012
	(0.00884)	(0.00689)	(0.00381)	(0.00028)	(0.00017)	(0.00020)
Precipitation^3	0.00217	-0.00323	0.00540*	0.00002	-0.00007	0.00008
	(0.00504)	(0.00333)	(0.00274)	(0.00015)	(0.00009)	(0.00012)
Wind speed (m/s)	-0.03957	-0.06446	0.02489	-0.00079	-0.00095	0.00015
	(0.07557)	(0.07951)	(0.02250)	(0.00093)	(0.00080)	(0.00043)
Wind speed^2	1.58836	2.13122	-0.54286	0.01825	0.02334	-0.00510
	(1.56467)	(1.69597)	(0.51516)	(0.02157)	(0.01754)	(0.01051)
Wind speed^3	-10.86249	-14.58801	3.72551	-0.18733	-0.19675*	0.00942
	(9.15577)	(10.30889)	(3.56506)	(0.13696)	(0.11050)	(0.06416)
Avg. lag. temp.$^{(a)}$	0.01043	0.00970	0.00073	0.00004	0.00004	-0.00001
	(0.01279)	(0.01100)	(0.00364)	(0.00011)	(0.00010)	(0.00005)
Avg. for. temp.$^{(b)}$	0.02699**	0.02057**	0.00642**	0.00002	0.00004	-0.00002
	(0.01195)	(0.01037)	(0.00312)	(0.00010)	(0.00010)	(0.00005)
Avg. lag. wind$^{(a)}$	0.02723	0.02602	0.00122	0.00026*	0.00021	0.00005
	(0.01770)	(0.01814)	(0.00355)	(0.00015)	(0.00014)	(0.00008)
Avg. for. wind$^{(b)}$	0.00645	0.00627	0.00018	-0.00008	-0.00003	-0.00005
	(0.01648)	(0.01557)	(0.00298)	(0.00021)	(0.00022)	(0.00009)
Avg. lag. prec.$^{(a)}$	-0.00319	-0.00249	-0.00070	0.00001	0.00004	-0.00002
	(0.00229)	(0.00202)	(0.00069)	(0.00004)	(0.00004)	(0.00002)
Avg. for. prec.$^{(b)}$	0.00485*	0.00341	0.00144	0.00001	0.00002	-0.00001
	(0.00263)	(0.00217)	(0.00088)	(0.00004)	(0.00003)	(0.00002)
# of observations	481,946	481,946	481,946	481,946	481,946	481,946
# of calendar dates	4,624	4,624	4,624	4,624	4,624	4,624
# of provinces	106	106	106	106	106	106
Adj. R-Square	.7188	.70778	.3666	.0043291	.0032003	.0001758

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

(a) Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

(b) Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.10: Estimation results of the main model exploiting Agri4Cast data and used to draw Figure 12

	Accident rate (1)	Workplace accident rate (2)	Commuting accident rate (3)	Fatal accident rate (4)	Fatal workplace accident rate (5)	Fatal commuting accident rate (6)
Temperature - Reference: (10,12]°C						
≤0°C	1.19681***	0.56659***	0.63022***	0.00016	-0.00063	0.00079
	(0.20456)	(0.12013)	(0.11162)	(0.00184)	(0.00162)	(0.00083)
(0, 2]°C	0.57659***	0.15378*	0.42281***	-0.00024	-0.00057	0.00033
	(0.13779)	(0.08667)	(0.07131)	(0.00139)	(0.00126)	(0.00059)
(2, 4]°C	0.27688***	0.03750	0.23937***	-0.00030	-0.00069	0.00039
	(0.09113)	(0.06205)	(0.04492)	(0.00088)	(0.00075)	(0.00048)
(4, 6]°C	0.09748	-0.03941	0.13689***	0.00022	-0.00002	0.00025
	(0.06698)	(0.04923)	(0.02930)	(0.00086)	(0.00076)	(0.00041)
(6, 8]°C	0.01508	-0.06004	0.07512***	-0.00026	-0.00081	0.00055*
	(0.04843)	(0.03759)	(0.01978)	(0.00058)	(0.00052)	(0.00030)
(8, 10]°C	-0.02721	-0.04951*	0.02229**	-0.00018	-0.00047	0.00030
	(0.02920)	(0.02540)	(0.01003)	(0.00059)	(0.00048)	(0.00028)
(12, 14]°C	0.02763	0.04811*	-0.02048***	0.00027	0.00002	0.00025
	(0.02962)	(0.02634)	(0.00687)	(0.00056)	(0.00049)	(0.00026)
(14, 16]°C	0.05800	0.09163**	-0.03363***	0.00076	0.00060	0.00015
	(0.04589)	(0.04061)	(0.01078)	(0.00084)	(0.00072)	(0.00034)
(16, 18]°C	0.11862**	0.16935***	-0.05073***	0.00278***	0.00237***	0.00041
	(0.05810)	(0.05251)	(0.01369)	(0.00080)	(0.00070)	(0.00041)
(18, 20]°C	0.17947**	0.24188***	-0.06241***	0.00167	0.00135	0.00032
	(0.07271)	(0.06641)	(0.01787)	(0.00105)	(0.00087)	(0.00055)
(20, 22]°C	0.21342***	0.28691***	-0.07349***	0.00137	0.00151	-0.00014
	(0.08097)	(0.07298)	(0.02017)	(0.00105)	(0.00095)	(0.00056)
(22, 24]°C	0.27670***	0.35746***	-0.08076***	0.00141	0.00162	-0.00021
	(0.09324)	(0.08372)	(0.02304)	(0.00124)	(0.00111)	(0.00067)
(24, 26]°C	0.31751***	0.39145***	-0.07394***	0.00012	0.00045	-0.00033
	(0.10568)	(0.09409)	(0.02519)	(0.00145)	(0.00130)	(0.00071)
(26, 28]°C	0.41845***	0.50012***	-0.08167***	0.00088	0.00090	-0.00002
	(0.12591)	(0.11460)	(0.02906)	(0.00163)	(0.00146)	(0.00080)
>28°C	0.43811***	0.51903***	-0.08092**	-0.00058	0.00063	-0.00121
	(0.14654)	(0.13070)	(0.03159)	(0.00229)	(0.00190)	(0.00125)
Dry day	-0.00513	0.00501	-0.01014	0.00049	0.00040	0.00009
	(0.01737)	(0.01482)	(0.00636)	(0.00030)	(0.00028)	(0.00014)
Precipitation (mm)	0.00522	-0.00890***	0.01412***	0.00001	0.00004	-0.00003
	(0.00392)	(0.00311)	(0.00144)	(0.00008)	(0.00006)	(0.00005)
Precipitation^2	0.00344	0.02441***	-0.02097***	0.00012	-0.00003	0.00015
	(0.01018)	(0.00885)	(0.00324)	(0.00025)	(0.00016)	(0.00019)
Precipitation^3	-0.00444	-0.01303***	0.00858***	0.00001	0.00000	0.00001
	(0.00508)	(0.00448)	(0.00166)	(0.00012)	(0.00008)	(0.00009)
Wind speed (m/s)	0.06269*	0.03476	0.02793*	0.00006	-0.00024	0.00030
	(0.03438)	(0.02300)	(0.01612)	(0.00053)	(0.00049)	(0.00023)
Wind speed^2	-0.98643	-0.44307	-0.54336*	-0.00762	-0.00105	-0.00657
	(0.67893)	(0.45616)	(0.32165)	(0.01291)	(0.01215)	(0.00428)
Wind speed^3	5.91201*	2.99365	2.91836*	0.05288	0.03109	0.02179
	(3.53053)	(2.34737)	(1.67564)	(0.09158)	(0.08731)	(0.02113)
Avg. lag. temp.[(a)]	-0.00008	0.00369	-0.00377	-0.00017*	-0.00019**	0.00002
	(0.00850)	(0.00708)	(0.00242)	(0.00010)	(0.00009)	(0.00005)
Avg. for. temp.[(b)]	0.00891	0.00738	0.00152	0.00009	0.00009	0.00000
	(0.00948)	(0.00719)	(0.00367)	(0.00012)	(0.00010)	(0.00006)
Avg. lag. wind[(a)]	-0.00798	-0.01077	0.00279	-0.00012	-0.00016	0.00004
	(0.01000)	(0.00825)	(0.00329)	(0.00020)	(0.00016)	(0.00007)
Avg. for. wind[(b)]	-0.00052	-0.00369	0.00316	0.00006	0.00001	0.00005
	(0.00963)	(0.00821)	(0.00265)	(0.00020)	(0.00019)	(0.00008)
Avg. lag. prec.[(a)]	-0.00112	-0.00329*	0.00216***	0.00002	0.00002	-0.00001
	(0.00229)	(0.00193)	(0.00070)	(0.00006)	(0.00006)	(0.00002)
Avg. for. prec.[(b)]	0.00298	0.00332	-0.00034	0.00000	0.00004	-0.00004**
	(0.00243)	(0.00204)	(0.00064)	(0.00004)	(0.00004)	(0.00002)
# of observations	474,881	474,881	474,881	474,881	474,881	474,881
# of calendar dates	4,456	4,456	4,456	4,456	4,456	4,456
# of provinces	107	107	107	107	107	107
Adj. R-Square	.75023	.74315	.38337	.0067374	.0056434	.0046862

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects.

(a) Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

(b) Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.

Table A.11: Estimation results of the main model with the HI and used to draw Figure 13

	Accident rate (1)	Workplace accident rate (2)	Commuting accident rate (3)	Fatal accident rate (4)	Fatal workplace accident rate (5)	Fatal commuting accident rate (6)
Temperature - Reference: (10,12]°C						
≤0°C	0.79244***	0.33081***	0.46162***	-0.00031	-0.00127	0.00095
	(0.16796)	(0.11188)	(0.07924)	(0.00170)	(0.00148)	(0.00089)
(0, 2]°C	0.45549***	0.08155	0.37394***	0.00195	0.00058	0.00137*
	(0.13047)	(0.08351)	(0.06960)	(0.00161)	(0.00141)	(0.00078)
(2, 4]°C	0.19590**	-0.00550	0.20139***	-0.00019	-0.00073	0.00054
	(0.09220)	(0.06588)	(0.04230)	(0.00116)	(0.00103)	(0.00051)
(4, 6]°C	0.03600	-0.08330	0.11929***	0.00016	-0.00022	0.00038
	(0.06853)	(0.05360)	(0.02751)	(0.00097)	(0.00086)	(0.00046)
(6, 8]°C	-0.03392	-0.09853**	0.06461***	0.00080	0.00012	0.00068*
	(0.05296)	(0.04249)	(0.02007)	(0.00069)	(0.00063)	(0.00038)
(8, 10]°C	-0.00364	-0.03564	0.03200***	-0.00001	-0.00043	0.00042
	(0.03173)	(0.02641)	(0.01146)	(0.00055)	(0.00047)	(0.00028)
(12, 14]°C	0.04417	0.06188**	-0.01771**	0.00080	0.00074	0.00006
	(0.03321)	(0.02993)	(0.00842)	(0.00059)	(0.00054)	(0.00026)
(14, 16]°C	0.11019**	0.13058***	-0.02039	0.00239***	0.00192***	0.00048
	(0.05399)	(0.04575)	(0.01282)	(0.00082)	(0.00067)	(0.00039)
(16, 18]°C	0.19759***	0.22001***	-0.02242	0.00198**	0.00156**	0.00042
	(0.07291)	(0.06700)	(0.01748)	(0.00091)	(0.00076)	(0.00048)
(18, 20]°C	0.25773***	0.28977***	-0.03204	0.00244**	0.00201**	0.00043
	(0.09052)	(0.08314)	(0.02141)	(0.00119)	(0.00098)	(0.00061)
(20, 22]°C	0.34861***	0.38282***	-0.03421	0.00077	0.00141	-0.00063
	(0.11678)	(0.10819)	(0.02755)	(0.00161)	(0.00141)	(0.00071)
(22, 24]°C	0.32822***	0.36524***	-0.03702	0.00328**	0.00291**	0.00037
	(0.10898)	(0.10153)	(0.02504)	(0.00136)	(0.00113)	(0.00063)
(24, 26]°C	0.37604***	0.40184***	-0.02580	0.00269*	0.00241*	0.00028
	(0.11758)	(0.10748)	(0.02702)	(0.00147)	(0.00123)	(0.00068)
(26, 28]°C	0.44305***	0.46720***	-0.02415	0.00376**	0.00335**	0.00041
	(0.13031)	(0.11914)	(0.02885)	(0.00177)	(0.00143)	(0.00086)
>28°C	0.47080***	0.50214***	-0.03134	0.00609***	0.00520***	0.00089
	(0.15222)	(0.13829)	(0.03346)	(0.00198)	(0.00178)	(0.00096)
Dry day	0.00279	0.02015	-0.01735*	-0.00039	-0.00030	-0.00009
	(0.02249)	(0.01751)	(0.00947)	(0.00051)	(0.00039)	(0.00028)
Precipitation (mm)	0.00805**	-0.00265	0.01070***	-0.00009	-0.00005	-0.00004
	(0.00380)	(0.00297)	(0.00157)	(0.00009)	(0.00006)	(0.00006)
Precipitation^2	-0.00783	0.00500	-0.01283***	0.00033	0.00020	0.00013
	(0.00796)	(0.00696)	(0.00348)	(0.00030)	(0.00017)	(0.00022)
Precipitation^3	-0.00129	-0.00644*	0.00515**	-0.00000	-0.00009	0.00008
	(0.00382)	(0.00332)	(0.00236)	(0.00017)	(0.00009)	(0.00013)
Wind speed (m/s)	-0.01023	-0.03585	0.02562	0.00018	-0.00055	0.00072
	(0.03794)	(0.03591)	(0.01800)	(0.00113)	(0.00089)	(0.00046)
Wind speed^2	0.38000	0.92655	-0.54654	-0.01066	0.00764	-0.01830*
	(0.93149)	(0.95453)	(0.40573)	(0.02717)	(0.02121)	(0.01101)
Wind speed^3	-1.28927	-4.60643	3.31717	0.01988	-0.06960	0.08948
	(6.36457)	(6.70370)	(2.76646)	(0.16995)	(0.14392)	(0.06202)
Avg. lag. temp.[(a)]	-0.00203	-0.00051	-0.00152	-0.00009	-0.00006	-0.00002
	(0.00837)	(0.00677)	(0.00278)	(0.00011)	(0.00010)	(0.00005)
Avg. for. temp.[(b)]	0.01159	0.00949	0.00209	0.00001	-0.00003	0.00004
	(0.00893)	(0.00679)	(0.00318)	(0.00011)	(0.00010)	(0.00006)
Avg. lag. wind[(a)]	0.01912	0.01633	0.00279	0.00035*	0.00023	0.00012
	(0.01664)	(0.01592)	(0.00321)	(0.00018)	(0.00018)	(0.00009)
Avg. for. wind[(b)]	-0.00323	-0.00654	0.00331	-0.00013	-0.00011	-0.00002
	(0.00979)	(0.00838)	(0.00339)	(0.00024)	(0.00021)	(0.00010)
Avg. lag. prec.[(a)]	-0.00339	-0.00350*	0.00011	0.00003	0.00003	-0.00001
	(0.00218)	(0.00195)	(0.00076)	(0.00005)	(0.00004)	(0.00002)
Avg. for. prec.[(b)]	0.00538**	0.00311	0.00227**	0.00000	0.00000	-0.00000
	(0.00252)	(0.00199)	(0.00096)	(0.00004)	(0.00003)	(0.00002)
# of observations	428,806	428,806	428,806	428,806	428,806	428,806
# of calendar dates	4,624	4,624	4,624	4,624	4,624	4,624
# of provinces	95	95	95	95	95	95
Adj. R-Square	.75752	.75069	.39101	.0083392	.0068974	.0059761

* p-value<0.10, ** p-value<0.05, *** p-value<0.01. Two-way clustered standard errors are in parenthesis; clusters are at the level of calendar dates and of provinces. All the models contain calendar date fixed effects and month-year-province fixed effects. The number of observations and the number of provinces is lower than in the benchmark estimates because humidity, which is used to calculate the HI, is not available in 12 Italian provinces.

[(a)] Avg. lag. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the previous 3 days.

[(b)] Avg. for. temp./wind/prec. stands for the average of the daily temperature/wind/precipitation in the next 3 days.