Opening a Cold Case

Investigating how Temperature Affects The Rate of Robberies

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1 Introduction and Objective

With the onset of winter in Chicago, the temperature drops, and residents must concern themselves with a range of new dangers. Roads can be icy and dangerous. Heavy snow can collapse power lines and buildings. And frostbite becomes a concern on exposed skin. However, it may be the case that cold weather mitigates other dangers. When its frigid out, do criminals stay inside as well?

To partially investigate this question I have endeavored to quantify how the rate at which robberies occur in the city of Chicago varies with temperature. Robbery, defined as taking property from a person, without their consent, by force or threat of force[1], includes what is probably the most common outdoor crime, mugging. It would seem natural then that the rate at which robberies occurred would be sensitive to the weather. The this rate is distinct from one's risk of being robbed should they go outside, since it may be the case crime drops when fewer people are outside to be robbed. However, a better understanding of the former should also provide intuition for the latter question.

2 Data

The Chicago city government publishes a data set of which includes every crime reported to the police in the city, going back to 2001[2]. I made use of the subset of this data which had a date recorded for the crime during 2011, 2012, or 2013, and which had a primary description of "Robbery", per the Illinois Uniform Crime Reporting Code. These crimes include both successful and attempted armed robbery, unarmed robbery, and vehicular hijacking. For each crime, the data set has additional information on where it occurred in the city, more detailed information about the crime, whether the crime was domestic, and if it resulted in an arrest. I, however, simply aggregated the total number of reported robberies that occurred anywhere in the city during each hour of each day during the time period.

I combined this hourly data with top of the hour weather data from O'Hare International Airport[3]. This data is a series of meteorological data, including temperature, accumulated precipitation, humidity, and wind speed, almost always measured once during a particular hour at 51 minutes after that hour. When there were multiple entries for an hour, I chose the first at 51 minutes which had the temperature recorded, or the first chronologically which had the temperature recorded if that was missing, discarding the rest. This was taken as the temperature for the city for a particular day and hour, and was matched with the hourly robbery counts. The small number (≈ 10) of hours for which there was no recorded temperature from O'Hare were excluded. The end result was $26,263$ hourly observations of temperature and reported robbery count, covering almost all of 2011-2013.

Examining this data, it is obvious that the most important feature in determining the number of robberies is the time of day, to a lesser extent, time of week. Figure 1 speaks to this effect, displaying an average by hour of the day for different temperature ranges and workday versus holiday/weekend. The mean number of robberies

[1] As opposed to theft, which is the taking property without consent but not necessarily by violent means, and burglary, which is breaking into a structure so as to commit a crime (whether or not a crime such as theft is committed)

[2] City of Chicago. (2014). *Crimes - 2001 to present.* Retrieved from https://data.cityofchicago.org/Public-Safety/Crimes-2001-to-present/ijzp-q8t2

[3] Midwest Regional Climate Center. (2014). *Unedited Hourly Data - Top of the Hour Observations - O'Hare International Airport.* Retrieved from mrcc.isws.illinois.edu/CLIMATE/ucld/ucld_hrlyTop_getdata1.jsp?WBAN=94846