Explanatory Memo for "The Loma Prieta Earthquake and the Cost of Voting in the 1989 San Francisco Municipal Election: Evidence from a Natural Experiment"

Heat Data

To generate the heat emissions data, we began by downloading raster images created by the Thermal Infrared (band B6) of the Landsat 5 Thematic Mapper. These values are available as raster images that can be downloaded either from USGS websites or Google Earth Engine Explorer

We used Google Earth Engine Explorer to find and download all cloud-free images of San Francisco taken from 1984 until November 1989:

https://explorer.earthengine.google.com/#workspace

GEE reports only the week the image was taken. Once we knew the approximate time period when the image was taken, we used LandsatLook Viewer to identify the exact date when the image was taken. We recorded the date, the sun elevation and its azimuth to use in the model of heat emissions of urban structures.

Each image has a spatial resolution of 30 meters -- that is, each pixel in the image represents the heat emissions from an area on the ground that is 30m x 30m. We overlaid each Landsat image on the 1989 precinct map and calculated the mean values of these pixels within each precinct.

To capture baseline heat emissions, we run a separate regression for each precinct using the data from the 31 pre-election thermal mapping images, with mean heat emissions as the dependent variable, and the maximum daily temperature in degrees Celsius (as measured by the National Oceanographic and Atmospheric Administration's automated weather station in downtown San Francisco), the sun's elevation and azimuth (included with the Landsat data), and a dummy variable for weekend observations as independent variables. These simple models captured 91-97% of the variance in heat emissions.

Then within each precinct we used the precinct-specific regression model to predict the heat emissions on November 8, 1989 - the day after the elections.

Finally, we calculated our measure of earthquake disruption as $100 \times (1 - (\text{observed}/\text{predicted}))$, where observed/predicted is the ratio of the observed heat emissions to the predicted heat emissions for each precinct. Larger numbers indicate greater disruption due to the earthquake.

Census Data

Demographic information was assigned to each precinct by overlaying a map of the 1990 U.S. Census tracts on the precinct map, and assigning the Census population to each precinct based on the percentage of each tract area that fell within the precinct boundaries.

The 1990 US census data was downloaded from:

https://www2.census.gov/census_1990/CD90_3A_07/

The shapefile for the 1990 US Census tracts in California was downloaded from:

https://www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.1990.html

For each precinct, information on voter turnout in 1987 and 1989 and consolidation was collected from San Francisco archival records. Information on relocated polling places was collected from an announcement in the *San Francisco Chronicle*.

Analysis

The statistical methods used in this manuscript are fairly straightforward – entropy weighting and linear regression with heteroskedasticity-corrected standard errors.

Figure 1

Figure 1 was created using QGIS 3.16.2. The required shapefile and the QGIS project file are included in the replication materials.

Replication Procedure

To replicate the results in the manuscript, set the appropriate working directory for each of the three provided R files, and run them in the following order:

1. heat_data.r – produces heat_data.csv
2. census_data.r – produces SF_ne_data.csv
3. analysis.r – produces results reported in the manuscript

All necessary data and some intermediate files are included in the replication folder. All analyses were conducted using R 4.0.3.