Disruptive Effects of Natural Disasters: The 1906 San Francisco Fire

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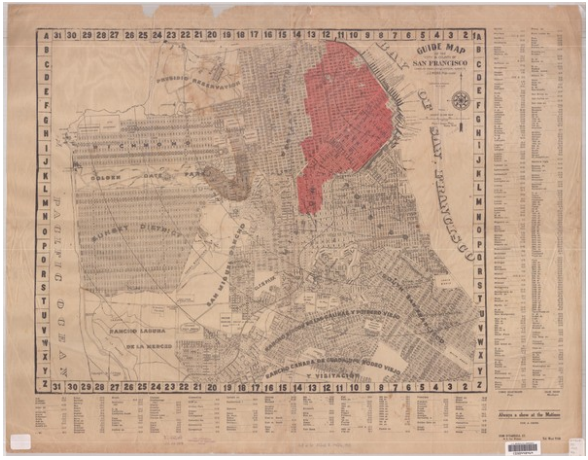
- One of the worst natural disasters in US history
- A useful setting to study the effects of natural disasters
  1. Directly compare affected and unaffected individuals who lived in same city
     - Fire boundary plausibly exogenous → spatial regression discontinuity design
  2. Historical natural disaster: long-run and intergenerational effects
     - Linked US Census data: follow SF residents and their children from 1900 to 1940
- Literature on long-run impacts mostly studies places: population, migration, rebuilding (Boustan et al., 2019; Siodla, 2015, 2017, 2021; Hornbeck and Naidu, 2014)
- Growing work on individuals in recent disasters, *reversal of fortune* (Deryugina et al., 2018; Sacerdote, 2012; Nakamura et al., 2022)

1906 San Francisco Earthquake and Fire

- Earthquake struck coast of Northern California at 5.12am on April 18, 1906
- All major water pipes were damaged by the earthquake
- Fire burned for 4 days
- 490 city blocks (4+ square miles) destroyed
- 250k out of 420k had to evacuate
- 95% of buildings insured, but most of the affected were renters
- Destroyed area rebuilt quickly



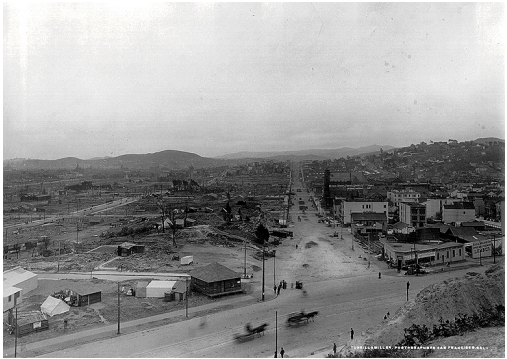
The Razed Area

Follow SF Residents With US Census Data Over Time

- 1900 San Francisco residents
  - Adult sample (born 1846 - 1890)
  - Children sample (born 1891 - 1920)
- Link to 1910, 1920, 1930, 1940 Census (via The Census Tree Project, Buckles et al., 2023)
  - Innovation: Possible to link (married) women
- Treatment status: Household location, coordinates constructed from address
- Outcomes:
  - Location decisions (within and outside SF)
  - Labor market outcomes, e.g. occupational earnings, self-employment
  - Children: Education, intergenerational mobility

Spatial Regression Discontinuity Design

$$y_{i,t} = \alpha + \beta \, \text{inside}_i + \lambda_1 \text{distance}_i + \lambda_2 \text{inside}_i \times \text{distance}_i + u_i \tag{1}$$



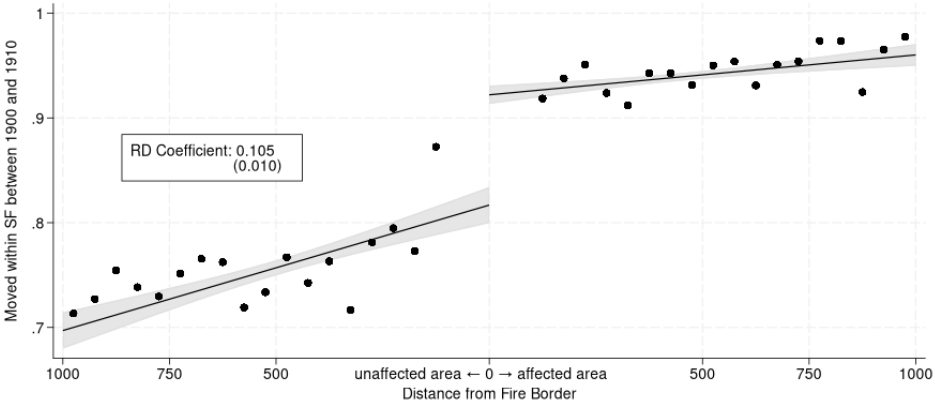
Part of the Fire Border: Dolores Street

- Identify the effect of destroyed homes
- Running variable: distance to border
- β: Causal treatment effect
- Weighted using a triangular kernel:

$$w_i = \left(1 - \frac{|\text{distance}_i|}{h}\right) \cdot \mathbf{1}\left\{|\text{distance}_i| \leq h\right\},$$

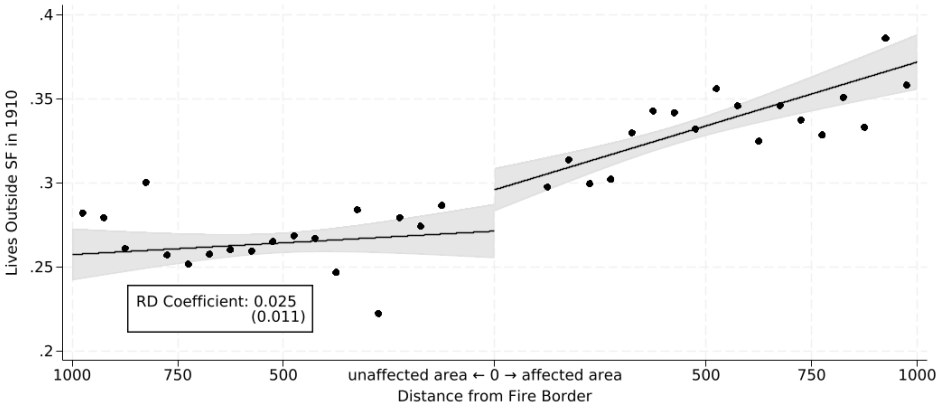
  where h denotes the bandwidth
- Donut design

Affected Individuals Moved Within San Francisco (1910)



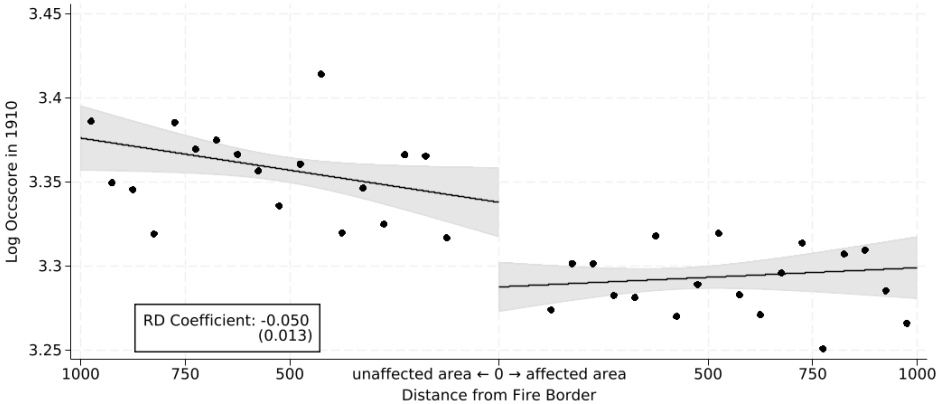
Conditional on staying in SF. *Moving*: Street name in 1910 different to 1900

Affected Individuals More Likely to Leave San Francisco (1910)



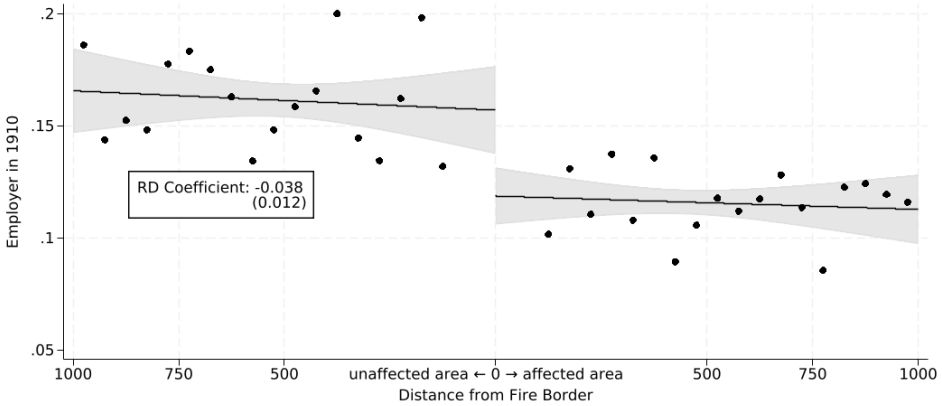
Migrants 8.2 ppts more likely to live in Bay Area, less likely to leave California

Affected Men Worked in Lower Paying Occupations (1910)



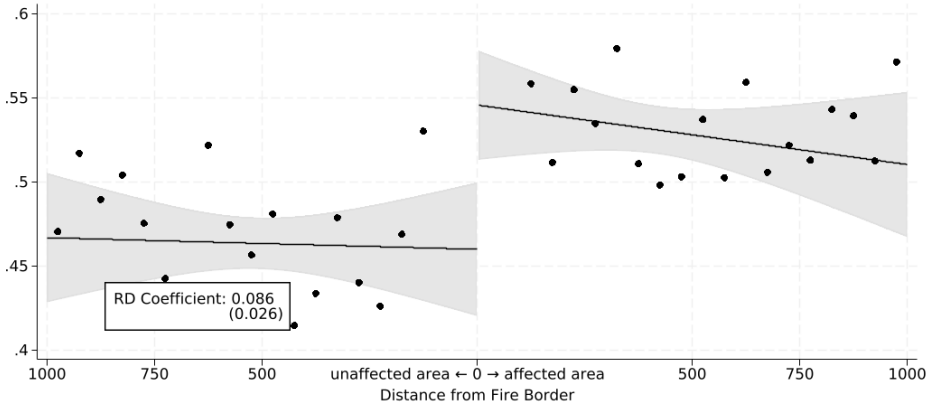
4 percentage points more occupational down grading, 3 ppts less upgrading

Affected Men Less Likely to Have Employees (1910)



At least one employee: OECD definition of "Employer Enterprises"

Increased Labor Force Participation For Umarried Women (1910)



1.9 ppt increase for all women

The Long Run: 1910-1940

- How persistent are these effects? Is there a "reversal of fortune"?
- Estimate the effect of the fire in 1910, 1920, 1930, 1940
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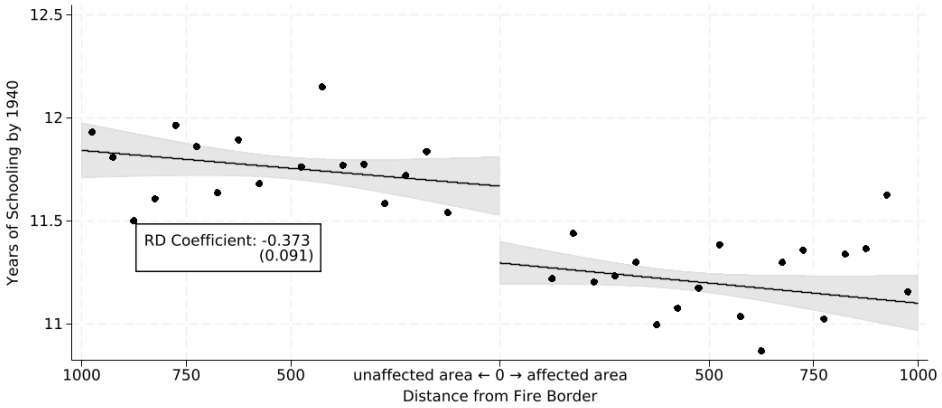
Findings:

- The effect on migration attenuates
  - Difference in migration status very small by 1920
  - Women are persistently less likely to leave CA
- Labor market effects for men are very persistent
  - With stable magnitude for occupational earnings and business ownership
- Women's LFP increase temporary

Intergenerational Effects: Children

- Those who were young during the fire might be affected differently
- Study children of 1900 SF residents, born between 1891 and 1920 (age 20-49 in 1940)

Affected Children Lost 5 Months of Education



Effect stronger for boys than for girls, and for directly affected

Conclusion: Disruptive Effects of Natural Disasters

- The 1906 Fire destroyed half of San Francisco and displaced 250k people
  - The disaster hit a prosperous and growing city
- I document lasting impacts on its victims
  - Affected men forced into lower-paying occupations and out of self-employment
  - (Unmarried) women get pulled into the labor market
  - Increase in migration is temporary, labor market effects are persistent for men
  - Affected children have lower educational attainment
  - Increase in downward intergenerational mobility
- Underlines the importance of initial conditions

Thanks!

Feedback: hschwank@uni-bonn.de

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