

Extreme Wildfires, Distant Air Pollution, and Household Financial Health

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Maui Wildfire Destroyed Local Communities



When paradise on Earth turns into hell. *Photographer: Patrick T. Fallon/AFP*

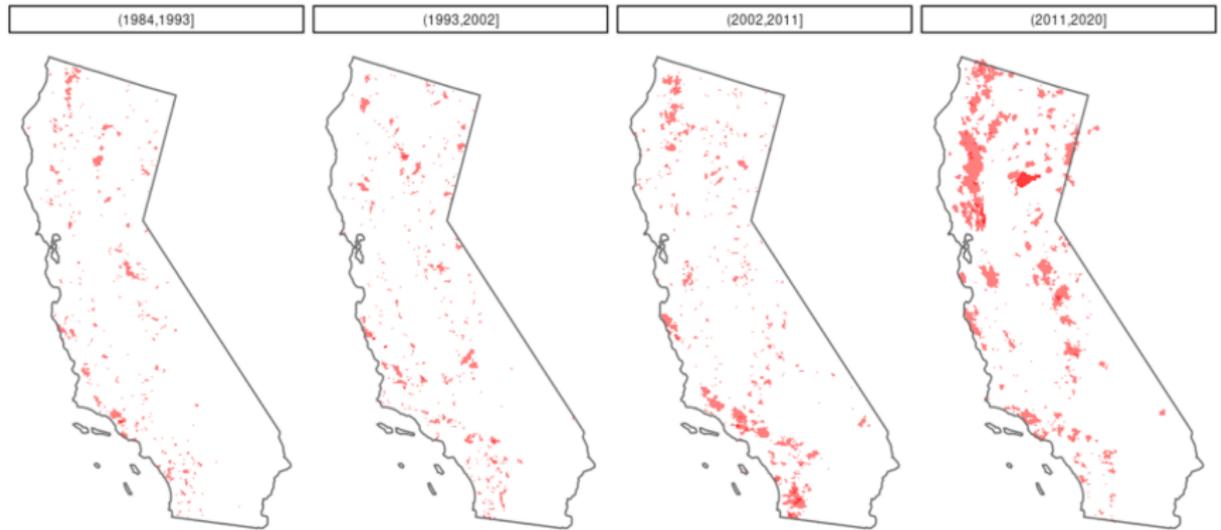
Source: Bloomberg, August 10, 2023.

Canadian Wildfire Smoke Hovers Over Philadelphia



Source: The Philadelphia Inquirer, June 7, 2023.

Wildfires Become More Frequent



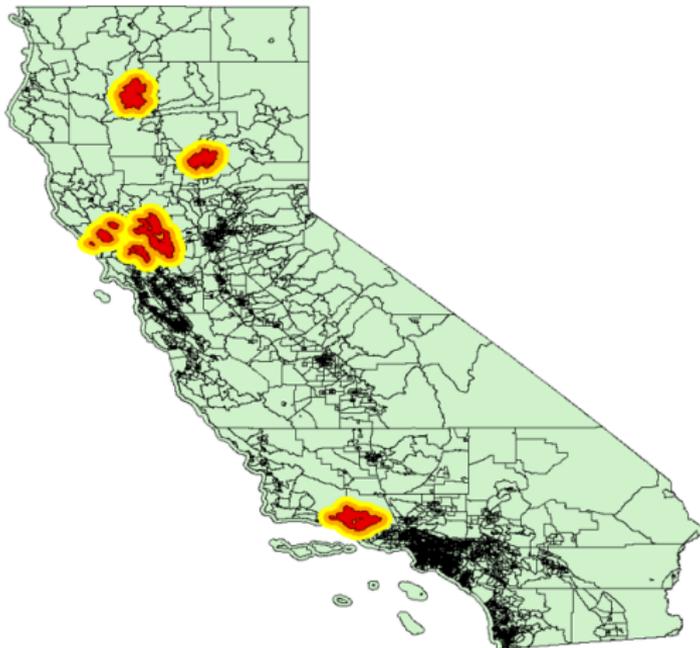
Source: CalFire.

This Paper

We try to understand the impact of wildfire and wildfire smoke on household financial health.

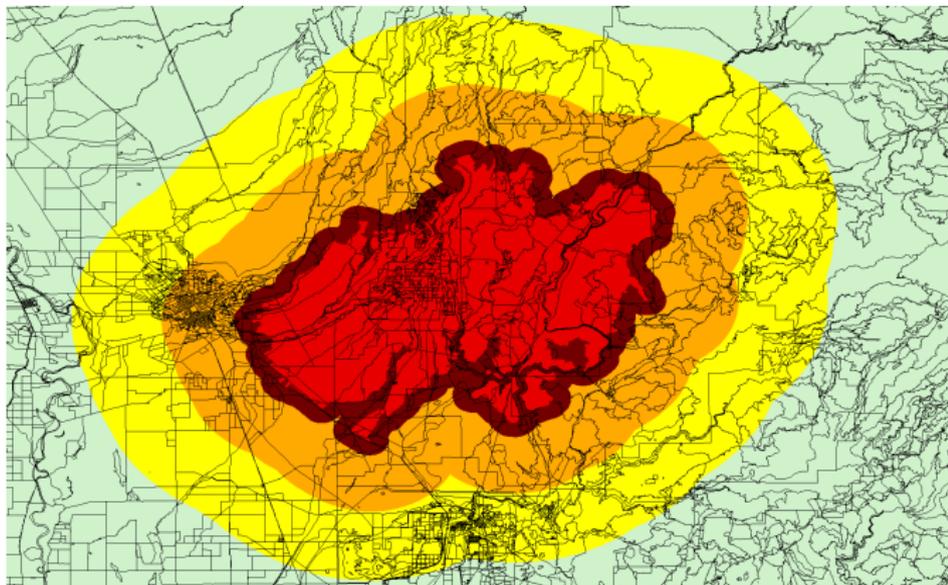
- ▶ Detailed wildfire burn, satellite smoke plume, and ground-level pollution data are linked to granular consumer credit data (e.g., CCP, Y-14M) to estimate the effects.
- ▶ Difference-in-differences (DID) and instrumental variable (IV) techniques are used to identify causal relations.

Extreme CA Wildfires We Study



Clockwise: Carr, Camp, Thomas, and Central LNU fires.

Fire Effect Identification Strategy



Red - Treated; Orange (and yellow) - Control.

Camp Fire Impact on Migration

| | 1 | 2 | 3 |
|------------------------------|---------|----------|---------------|
| | Move-in | Move-out | Net migration |
| <i>Treated</i> × <i>Post</i> | 1.97 | 19.2*** | 17.7*** |
| | (2.87) | (1.92) | (5.27) |
| Census tract FE | + | + | + |
| Year-qtr FE | + | + | + |
| Observations | 470 | 470 | 470 |
| R-squared | 0.49 | 0.47 | 0.15 |
| Depe. var. mean | 36.02 | 33.18 | 6.96 |

Camp Fire Impact on Housing

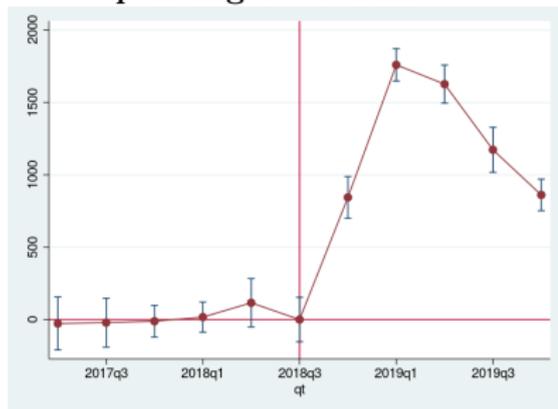
| | 1 | 2 | 3 | 4 |
|------------------------------|---------------------|------------------------|-----------------------------|--------------------------|
| | House Price Index | Number of Transactions | Repeated Sales Median Price | Residential Vacancy Rate |
| <i>Treated</i> × <i>Post</i> | -17.54*** (0.93) | -4.22*** (1.84) | -34,553.88*** (4,937.23) | 0.08*** (0.01) |
| Census tract FE | + | + | + | + |
| Year-qtr FE | + | + | + | + |
| Observations | 475 | 475 | 475 | 353 |
| R-squared | 0.84 | 0.80 | 0.75 | 0.56 |
| Dep. var. mean | 244.4 | 20.6 | 280,007 | 0.03 |

Camp Fire Impact on Credit Delinquency

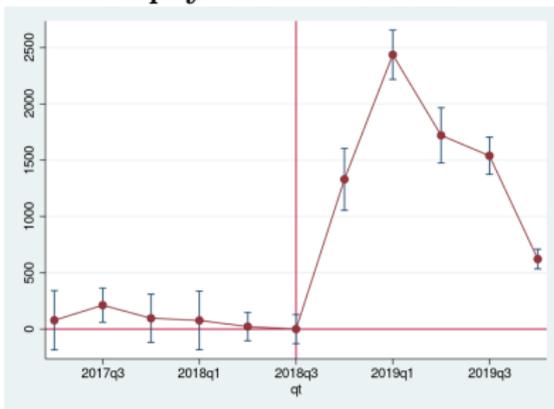
| | 1 | 2 | 3 | 4 |
|------------------------------|-------------------------|----------------------------|------------------------------|---------------------------|
| | Mortgage Delinquency | Credit Card Delinquency | Personal Loan Delinquency | Store Card Delinquency |
| <i>Treated</i> × <i>Post</i> | 0.02* (0.01) | 0.02*** (0.01) | 0.05* (0.03) | 0.02 (0.02) |
| Consumer FE | + | + | + | + |
| Year-qtr FE | + | + | + | + |
| Observations | 20,686 | 71,964 | 11,544 | 17,282 |
| R-squared | 0.54 | 0.77 | 0.74 | 0.73 |
| Dep. var. mean | 0.01 | 0.04 | 0.08 | 0.12 |

Camp Fire Impact on Credit Card Spending and Repayment

Spending Over Time



Repayment Over Time



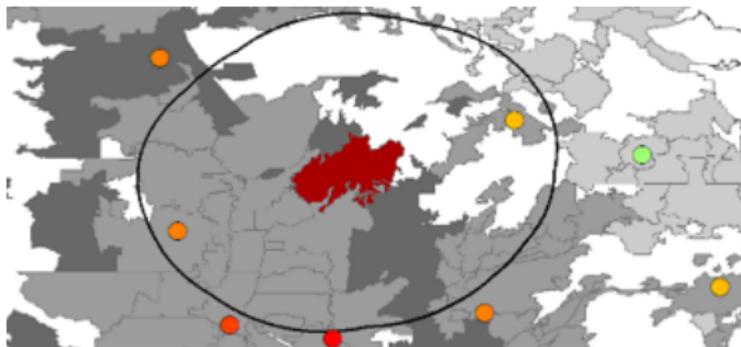
- ▶ Results also show a decline in the number of credit card accounts.

Camp Fire Impact on Credit Card Balance and Delinquency

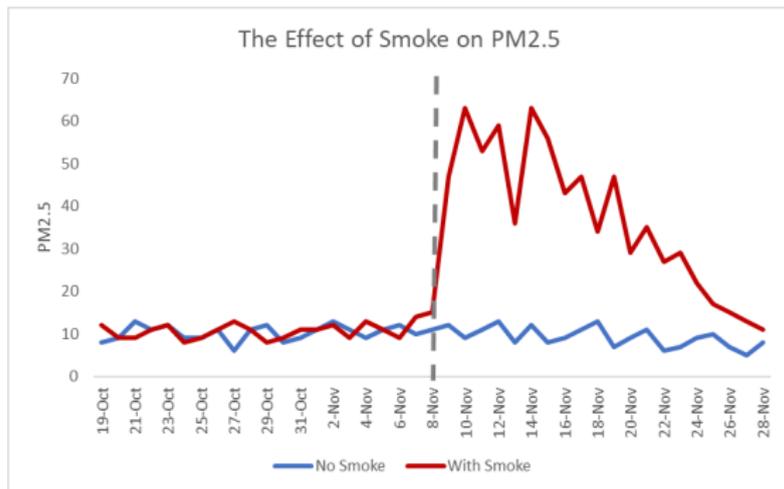
| Panel A: Balance | Homeowners | | Renters | |
|-----------------------------------------|--------------------------------|-------------------------------|----------------------------|---------------------------|
| | 1 CScore \leq 720 | 2 CScore $>$ 720 | 3 CScore \leq 720 | 4 CScore $>$ 720 |
| <i>Treated \times Post</i> | -3,195.09 (3,797.26) | -1,404.54* (745.91) | -866.16 (995.98) | 108.21 (436.06) |
| Two-way FEs | ✓ | ✓ | ✓ | ✓ |
| Dep. variable mean | 7,382.2 | 3,674.5 | 3,125.1 | 2,114.1 |
| Panel B: Delq. | CScore \leq 720 | CScore $>$ 720 | CScore \leq 720 | CScore $>$ 720 |
| <i>Treated \times Post</i> | 0.00 (0.01) | 0.00 (0.00) | 0.06*** (0.02) | 0.00 (0.00) |
| Two-way FEs | ✓ | ✓ | ✓ | ✓ |
| Dep. variable mean | 0.01 | 0.00 | 0.11 | 0.00 |

Smoke Effect Identification Strategy

Camp Fire smoke and air pollution



PM2.5 After the Camp Fire



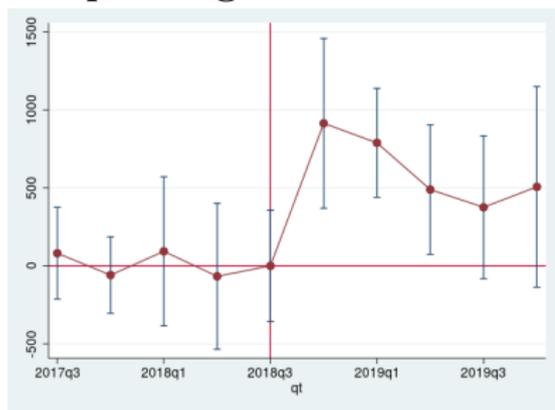
$$PM_{2.5cd} = \sum_{\tau=-20}^{20} \beta_{\tau} * SmokeDay_{c,d+\tau} + \alpha_c \times day-of-year + \alpha_{state} \times year + \varepsilon_{ct}, \quad (1)$$

Effects of Smoke on Credit Delinquency

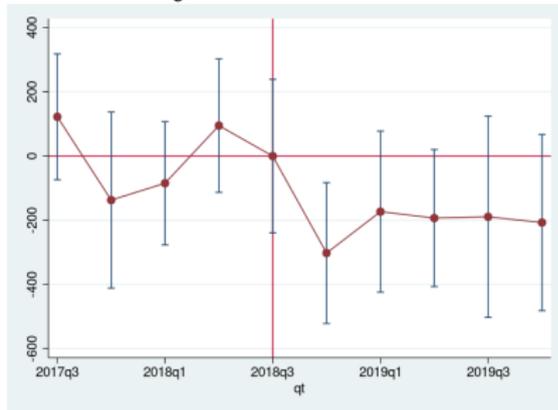
| Panel A | 1 | 2 | 3 | 4 |
|-----------------------|-------------------|----------------------|------------------------|---------------------|
| | Mortgage Delq. | Credit Card Delq. | Personal Loan Delq. | Store Card Delq. |
| <i>Treated × Post</i> | 0.01*** (0.00) | 0.02*** (0.00) | 0.05** (0.00) | 0.02*** (0.00) |
| Two-way FEs | ✓ | ✓ | ✓ | ✓ |
| Dep. var. mean | 0.01 | 0.04 | 0.13 | 0.10 |
| Panel B: IV | Mortgage Delq. | Credit Card Delq. | Personal Loan Delq. | Store Card Delq. |
| <i>Treated × Post</i> | 0.01 (0.01) | 0.02* (0.01) | 0.01 (0.01) | 0.02* (0.01) |
| Two-way FEs | ✓ | ✓ | ✓ | ✓ |
| Dep. var. mean | 0.02 | 0.04 | 0.11 | 0.11 |

Effects of Smoke on Credit Card Spending and Repayment

Spending Over Time



Payment Over Time



Effects of Smoke on Credit Card Spending and Repayment (cont'd)

| Panel A: Δ Spending | 1 Credit Score \leq 720 | 2 Credit Score $>$ 720 |
|----------------------------------------------|------------------------------|---------------------------|
| <i>Treated \times Post</i> | 140.061 (107.843) | 535.442*** (88.154) |
| Time-varying borrower attributes | ✓ | ✓ |
| Account FE | + | + |
| Year-month FE | + | + |
| Observations | 249,317 | 449,846 |
| R-squared | 0.131 | 0.076 |
| Dependent variable mean | -1,048.704 | -36.189 |
| Panel B: Δ Payment | Credit Score \leq 720 | Credit Score $>$ 720 |
| <i>Treated \times Post</i> | -445.491*** (89.364) | -26.773 (70.242) |
| Time-varying borrower attributes | ✓ | ✓ |
| Account FE | + | + |
| Year-Month FE | + | + |
| Observations | 249,317 | 449,846 |
| R-squared | 0.093 | 0.052 |
| Dependent variable mean | 489.834 | 394.592 |

Summary of Major Findings

- ▶ Out-migration, as well as declines in house values are evidenced in wildfire burn area.
- ▶ Higher levels of financial distress seen among burn area renters, especially those with lower credit scores, while the fire effects on homeowners are less salient possibly due to insurance coverage.
- ▶ Elevated spending, indebtedness, and loan delinquencies among households distant from the burn perimeter but exposed to high levels of wildfire-attributed smoke and air pollution.

1816: The Year without a Summer

“The financial and economic difficulties...were exacerbated by extremely cold, dark weather across northern Europe and the northeastern United States in 1816.”

“The poor weather was caused by the eruption in the Dutch East Indies (Indonesia) of Mount Tambora, which spewed smoke and ash into the atmosphere, obscuring the sun.”

“The cold and dark caused widespread crop failures and severe famine across the Northern Hemisphere... People were observed eating “bread” of sawdust and straw.”

– Jim Narron and Donald P. Morgan,
“The Crisis of 1816, the Year without a Summer,
and Sunspot Equilibria,” *Liberty Street Economics*.