

# The Local Economic Impact of Natural Disasters

**Brigitte Roth Tran**<sup>1</sup>

Daniel J. Wilson<sup>2</sup>

FRB Richmond Climate Change Workshop

November 20, 2020

The views expressed in this presentation are those of the authors and do not necessarily represent the views or policies of the Board of Governors of the Federal Reserve System, the Federal Reserve Bank of San Francisco, or their staffs.

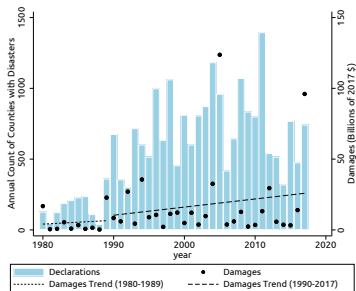
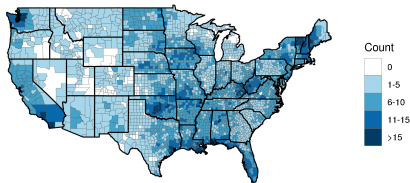
---

<sup>1</sup>Federal Reserve Board

<sup>2</sup>Federal Reserve Bank of San Francisco

# Natural disasters are widespread, with prevalence and costs having increased in recent decades

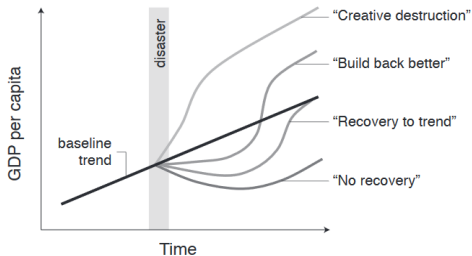
All Disaster Types



Source: FEMA, SHELDUS, Census

# Understanding Economic Impact of Disasters is Critical

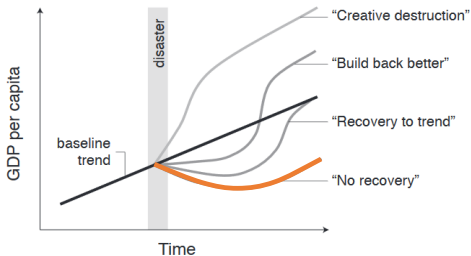
## Potential Paths Considered in the Literature:



Source: Hsiang and Jina (2014)

# Understanding Economic Impact of Disasters is Critical

## Potential Paths Considered in the Literature:



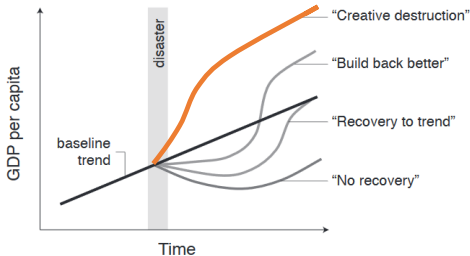
Source: Hsiang and Jina (2014)

## Key Prior Findings:

- Hsiang & Jina (2014): "No recovery" following cyclones in cross-country analysis

# Understanding Economic Impact of Disasters is Critical

## Potential Paths Considered in the Literature:



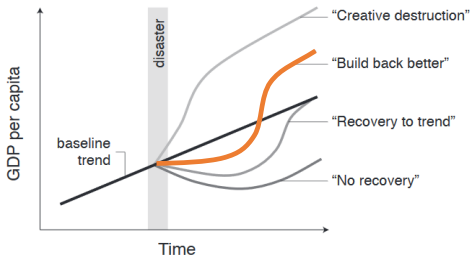
Source: Hsiang and Jina (2014)

## Key Prior Findings:

- Hsiang & Jina (2014): “No recovery” following cyclones in cross-country analysis
- Lackner (2019): “No recovery” following earthquakes for low/middle-income countries, but “Creative Destruction” for high-income countries

# Understanding Economic Impact of Disasters is Critical

## Potential Paths Considered in the Literature:



Source: Hsiang and Jina (2014)

## Key Prior Findings:

- Hsiang & Jina (2014): "No recovery" following cyclones in cross-country analysis
- Lackner (2019): "No recovery" following earthquakes for low/middle-income countries, but "Creative Destruction" for high-income countries
- Groen, et al. (2019): "Build back better" following Hurricanes Katrina and Rita in local earnings

## Our approach

- Estimate **dynamic impact** of disasters on U.S. **counties** from 1980-2017 using panel data
- Consider **broad range** of economic outcomes on comprehensive set of disasters using **common methodology and data sample** → unified picture of economic impact of disasters
- Examine **heterogeneous** impacts by severity, disaster type, pre-disaster income, and historical experience
- Estimate **spatial spillover** effects
- Analysis does **not** examine welfare effects

## Data

### Disaster Indicator / "Treatment" Variable

- Disasters: FEMA major disasters, conditional on damages  $> 0$ 
  - Damages: SHELDUS (ASU)

### Outcomes / Dependent Variables (monthly, quarterly, annual)

- Personal Income Per Capita (BEA)
- Employment: Total Nonfarm, Construction (BLS QCEW)
- Average Weekly Wages (BLS QCEW)
- House Prices (CoreLogic)
- Population (Census)
- Government Aid (BEA, FEMA, SBA)



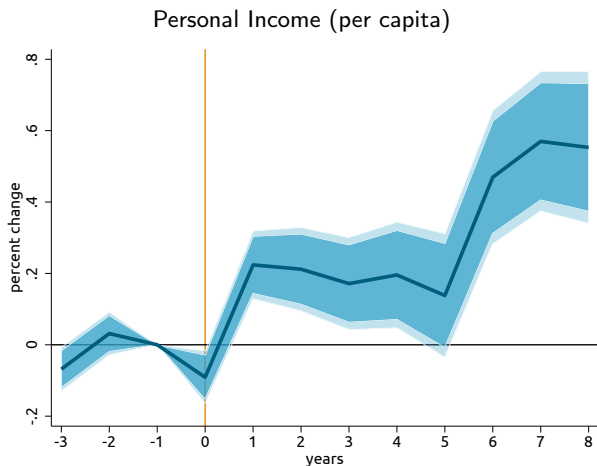
## Methodology: panel version of local projections (Jordà 2005)

Estimate separately for each horizon  $h$ , from 0 to 8 years after disaster:

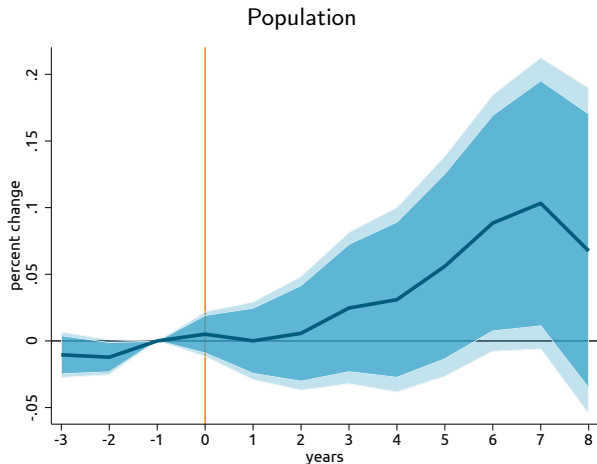
$$y_{c,t+h} - y_{c,t-1} = \beta^h D_{c,t} + \alpha_{r(c),t} + \alpha_{c,m(t)} + \mathbf{X}'_{ct} \boldsymbol{\gamma}^h + \varepsilon_{c,t+h}$$

- county  $c$ , time  $t$  (month, quarter, or year)
- $y_{c,t+h} - y_{c,t-1}$  : Cumulative change in dependent variable
- $D_{c,t}$ : Disaster treatment
- Controls: time-by-region fixed effects, county-by-month (or quarter) fixed effects, control vector ( $\mathbf{X}'_{ct}$ ) includes cumulative pretrend and intervening disasters

## Per capita personal income response is consistent with “Build back better” scenario

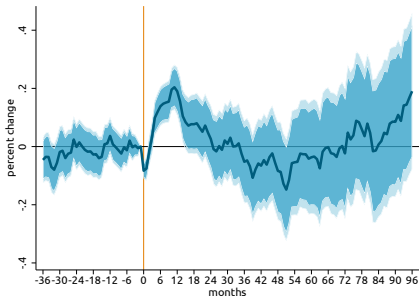


## Higher Income per capita not due to population loss

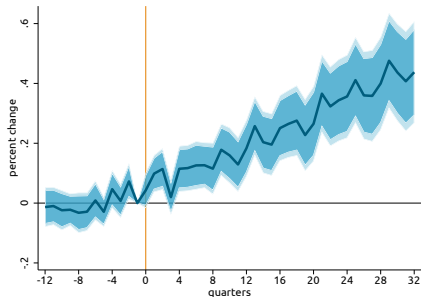


# Short-run personal income increase due to employment, longer-run due to higher average wages

## Total Nonfarm Employment



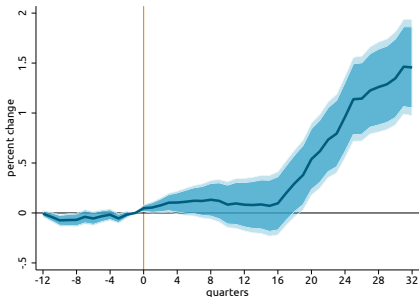
## Average Weekly Wages



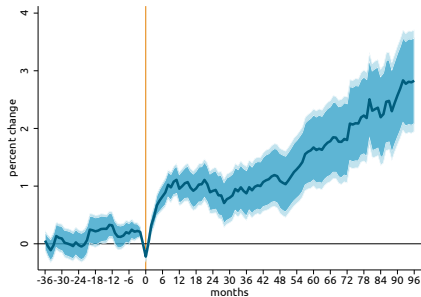
Source: BLS QCEW, FEMA, SHELDUS

# Higher home prices and construction employment consistent with build back better model

## Home Prices

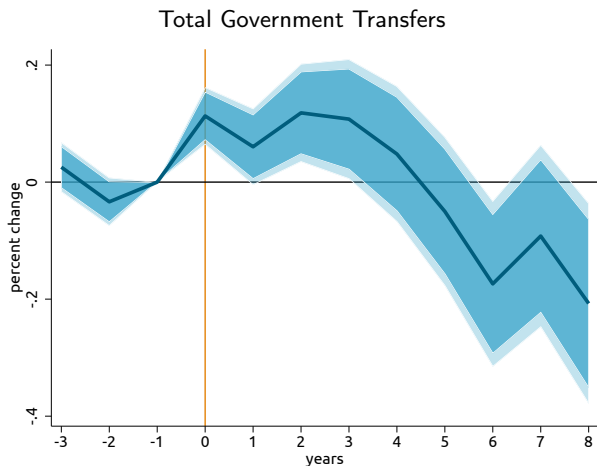


## Construction Employment

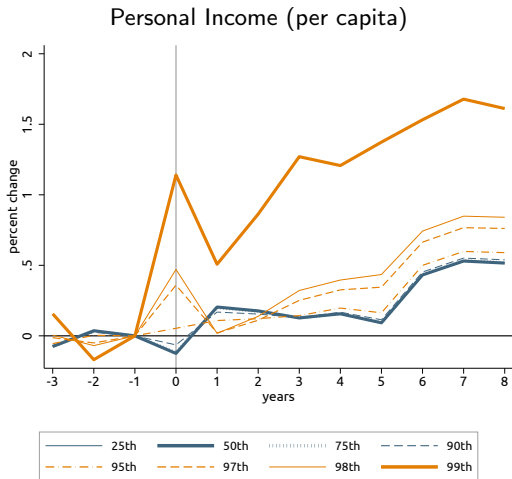


Source: Corelogic, BLS, FEMA, SHELDUS

## Transfer income from federal, state, & local government increases in near-term but decreases over longer run



## Most severe disasters: larger effects



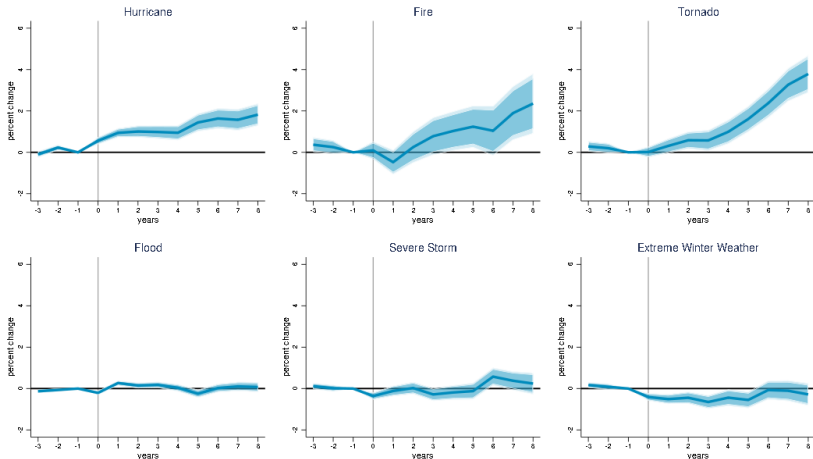
Most severe disasters  $\Rightarrow$  different equilibria as population & home prices fall in medium- to longer-run





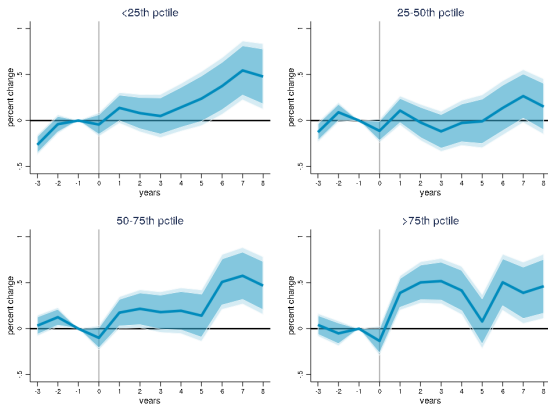
# Not all disaster types yield above-baseline trend outcomes

## Personal Income (Per Capita)



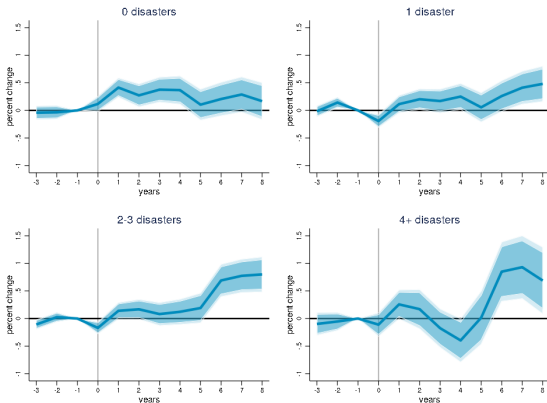
# Longer run above-baseline trend personal income outcomes independent of pre-disaster income quartile

## Personal Income (Per Capita)



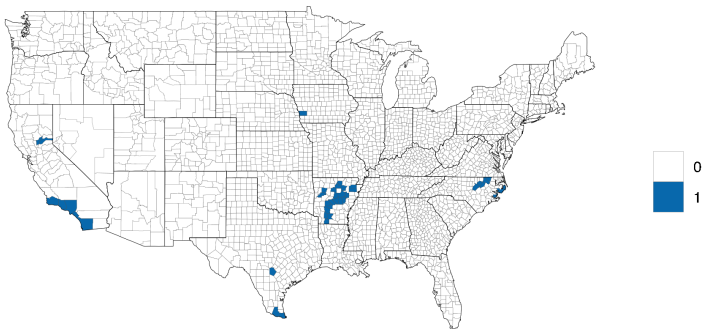
# Longer run above-baseline trend personal income outcome not significant for counties with no disasters in previous 10 years

## Personal Income (Per Capita)



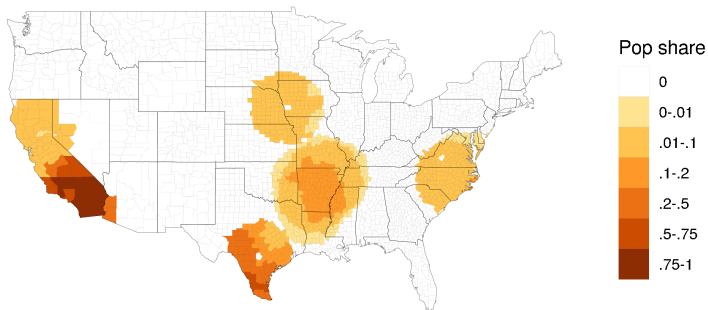
# Spatial lag analysis: additional treatment is share of population in donuts surrounding a county that has been affected by disasters

Counties with disasters in 1988



# Spatial lag analysis: additional treatment is share of population in donuts surrounding a county that has been affected by disasters

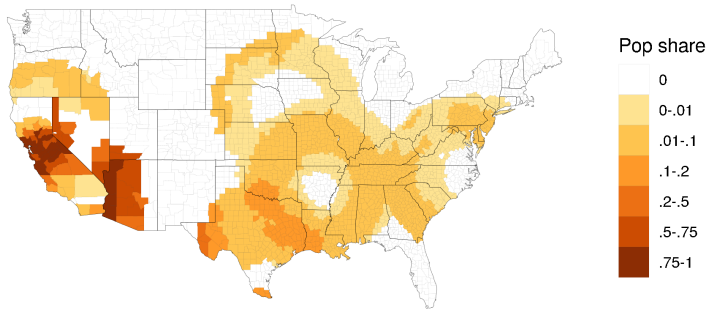
0 - 199 mile population share with disasters in 1988



Source: FEMA, SHELDUS, Census

# Spatial lag analysis: additional treatment is share of population in donuts surrounding a county that has been affected by disasters

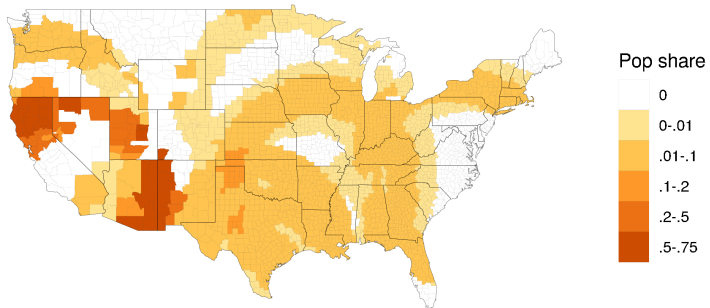
200 - 399 mile population share with disasters in 1988



Source: FEMA, SHELDUS, Census

# Spatial lag analysis: additional treatment is share of population in donuts surrounding a county that has been affected by disasters

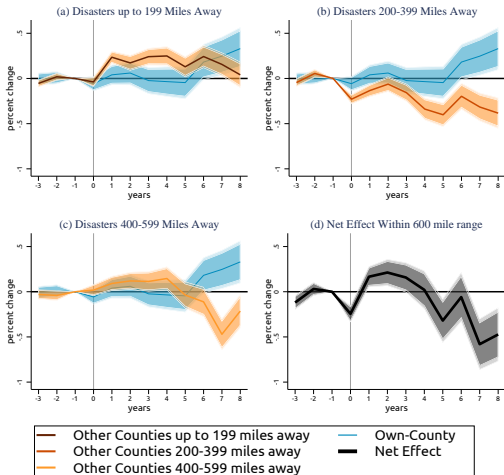
400 - 599 mile population share with disasters in 1988



Source: FEMA, SHELDUS, Census

# Negative longer run personal income outcomes in counties over 200 miles away suggests net effect on region may be negative

## Personal Income (Per Capita)





## Potential Explanations

- Disasters typically a negative shock to productive capital stock and household wealth
  - similar to war destruction
- Long-lasting recovery and rebuilding process can lead to higher income p.c.
  - Possible productivity gains from improved local capital stock
  - This hypothesis supported by higher longer-run house price finding
- Composition shift to higher income individuals choosing to live in areas built back better after disasters
- Reallocation of resources from other counties in region

## Summary of Results

In U.S. counties, after natural disasters...

- Local per capita personal income ↑
  - Driven first by increased employment, then by higher average wages

## Summary of Results

In U.S. counties, after natural disasters...

- Local per capita personal income ↑
  - Driven first by increased employment, then by higher average wages
- Responses are heterogeneous, requiring care in extrapolating results
  - Magnitude of income response increases with disaster severity
  - But most severe disasters  $\Rightarrow$  long-run declines in home prices & population
  - Income boost primarily due to Hurricanes, Fires, & Tornados
  - Longer run above-baseline trend personal income outcomes independent of pre-disaster income quartile
  - Counties inexperienced w/ disasters  $\rightarrow$  no long-term increase in income

## Summary of Results

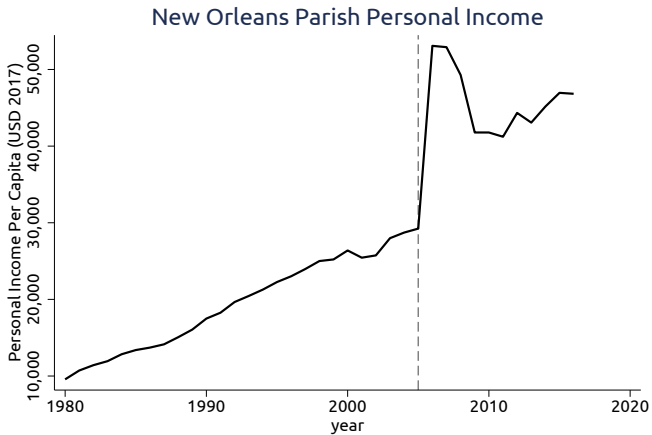
In U.S. counties, after natural disasters...

- Local per capita personal income  $\uparrow$ 
  - Driven first by increased employment, then by higher average wages
- Responses are heterogeneous, requiring care in extrapolating results
  - Magnitude of income response increases with disaster severity
  - But most severe disasters  $\Rightarrow$  long-run declines in home prices & population
  - Income boost primarily due to Hurricanes, Fires, & Tornados
  - Longer run above-baseline trend personal income outcomes independent of pre-disaster income quartile
  - Counties inexperienced w/ disasters  $\rightarrow$  no long-term increase in income
- Regional net longer-run personal income per capita effect may be negative due to spatial spillovers

Thank you!

@rothtran

## Example of Hurricane Katrina



Source: BEA, Census.

Source: BEA and Census.

Note: Vertical red line indicates 2005, the year of Hurricane Katrina.