

Race, Government Assistance, and Recovery from Natural Disasters

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Introduction

- High profile natural disasters in the United States are often accompanied by accusations of racial bias of government organizations and aid workers
- Small-scale surveys and journalistic investigations suggest that minorities are more likely to be affected by natural disasters and recover more slowly
- I use high-resolution (500m^2) nighttime light data to investigate the relationship between race and disaster recovery at the census tract level
- Data covers all federally declared natural disasters in the United States from 2012 to 2018

Disaster Declarations

- The Federal Emergency Management Agency (FEMA) declares “major disasters” at the county level
- FEMA assumes bureaucratic control of public and private disaster relief efforts after a declaration
- Cash grants made available to aid organizations and people directly affected by the disaster
- Little oversight or accountability of aid organizations after grants are dispersed

Motivating Example

- Households can apply directly to FEMA for cash grants
- Damage must be assessed by a FEMA investigator
- FEMA tracks applications, investigations, and grants at the zip-code level
- Regress household grants on zip-code demographics from the 2010 US Census
- Household grants are a small part of overall disaster relief efforts

Zip-Code Level Determinants of FEMA Housing Assistance

	<i>Dependent variable:</i>		
	Inspected (1)	Damage reported (2)	Grant received (3)
%Hispanic/100	0.013 (0.029)	0.069* (0.040)	-0.279*** (0.097)
%Black/100	0.011 (0.020)	0.055 (0.065)	-0.021 (0.099)
Observations	22,998	22,998	14,956
R ²	0.207	0.212	0.233

Note: *p<0.1; **p<0.05; ***p<0.01

All regressions include disaster fixed effects. Standard errors are clustered at the disaster level. All regressions include controls for female-headed households, rental properties, median age, and male population.

Data

- Census tract demographic characteristics from the 2010 US Census
- County major disaster declarations from FEMA
 - ▶ Restrict sample to large-scale disasters: Hurricanes, severe storms, floods, snow, and ice storms
- Nighttime light luminosity data from Visible Infrared Imaging Radiometer Suite (VIIRS) onboard the Suomi National Polar-Orbiting Partnership spacecraft
 - ▶ Monthly observations aggregated to the census tract level
- Monthly observations for each census tract from April 2012 to May 2018

Summary Statistics

Statistic	Mean	St. Dev.	Min	Max
%Black/100	0.14	0.22	0.00	1.00
%Hispanic/100	0.14	0.20	0.00	1.00
Population	4,310.61	1,994.48	102	37,452
Male population	2,119.45	1,001.27	3	26,093
Median age	38.97	7.18	12.70	82.90
%Under 18/100	0.23	0.06	0.00	0.91
%Over 65/100	0.14	0.07	0.00	0.89
%Female headed households/100	0.13	0.08	0.00	1.00
%Rental properties/100	0.34	0.22	0.00	1.00
Population density	1,637.56	3,694.24	0.01	196,409.20
Log luminosity	107.19	23.85	9.41	201.03

Note: Census tracts with population less than 100 are excluded.

Estimating Equation

$$y_{id}(t) - y_{id}(0) = \beta_1(\%Hispanic_i/100) + \beta_2(\%black_i/100) + \\ + \delta[y_{id}(0) - y_{id}(-1)] + \theta' X_i + \mu_{cd} + \varepsilon_{cd}$$

- $y_{id}(t)$: Log luminosity in tract i , t months after disaster d
- $y_{id}(0) - y_{id}(-1)$: Decrease in luminosity immediately following disaster d
- X_i : Census tract level controls
- μ_{cd} : County \times disaster fixed effects
- ε_{cd} : County \times disaster clustered errors
- Restrict sample to census tracts in counties that have been declared a major disaster by FEMA
- Estimating the within-county effect of race on recovery

► Theoretical Model

Census Tract Demographics and Disaster Recovery

	<i>Dependent variable:</i>		
	$y(3) - y(0)$	$y(6) - y(0)$	$y(12) - y(0)$
	(1)	(2)	(3)
%Hispanic/100	-0.224*** (0.033)	-0.017 (0.017)	0.030*** (0.011)
%Black/100	-0.120*** (0.023)	0.026 (0.025)	-0.036*** (0.012)
Observations	90,891	88,519	86,069
R ²	0.636	0.702	0.745

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

► Time Heterogeneity

Census Tract Recovery by Disaster Type

	Disaster Type				
	Hurricanes	Severe Storms	Floods	Snow	Ice Storms
	(1)	(2)	(3)	(4)	(5)
%Hispanic/100	-0.343*** (0.038)	0.018 (0.030)	-0.031 (0.035)	-0.059 (0.049)	0.667** (0.315)
%Black/100	-0.196*** (0.030)	-0.023 (0.024)	0.002 (0.025)	0.117*** (0.024)	0.061 (0.318)
Observations	39,901	24,422	17,012	4,532	4,951
R ²	0.386	0.754	0.651	0.861	0.551

Note:

*p<0.1; **p<0.05; ***p<0.01

Disaster Type

- Results primarily driven by hurricanes
- Minority tracts do better following snow and ice storms
- Non-random geographic distribution of hurricanes vs winter weather may be driving these results

Identification Threats

- Hispanic and black census tracts may have unobservable characteristics that are correlated with growth but are unrelated to government aid
- Structural and behavioral parameters are assumed constant across tracts within counties
 - ▶ Investment rates, capital intensity, productivity, migration preference, etc
- Within-county estimates cannot separately identify the effects of government aid vs structural and behavioral differences correlated with race

Border Discontinuity

- Compare census tracts in major disaster counties to neighboring census tracts in non major disaster counties:

$$\begin{aligned} y_{id}(t) - y_{id}(0) = & \beta_1(\%Hispanic_i/100) + \beta_2(\%black_i/100) + \beta_3 D_i^F \\ & + \beta_4 D_i^F (\%Hispanic_i/100) + \beta_5 D_i^F (\%black_i/100) + \\ & + \delta[y_{id}(0) - y_{id}(-1)] + \theta' X_i + \rho' D_F X_i + \mu_{cd} + \varepsilon_{cd} \end{aligned}$$

- $D_i^F = 1$ if tract i is in a county declared a major disaster
- Conceptually similar to a “triple difference” estimation
- Identification assumption: Disaster declaration uncorrelated with unobserved structural parameters and disaster intensity
- Shortcoming: border tracts experience less damage from natural disasters

The Effect of Race on Disaster Recovery in Border Tracts

	<i>Dependent variable:</i>		
	$y(3) - y(0)$	$y(6) - y(0)$	$y(12) - y(0)$
	(1)	(2)	(3)
%Hispanic/100	0.358*** (0.008)	0.492*** (0.003)	0.398*** (0.004)
%Black/100	0.063** (0.025)	0.363*** (0.004)	0.313*** (0.004)
FEMA tract (D_i^F)	0.595 (0.632)	0.635** (0.255)	0.519*** (0.188)
$D_i^F \times (\% \text{Hispanic}/100)$	-0.284** (0.129)	-0.512*** (0.081)	-0.426*** (0.090)
$D_i^F \times (\% \text{Black}/100)$	-0.085 (0.124)	-0.395*** (0.081)	-0.375*** (0.067)
Observations	16,518	16,183	18,217
R ²	0.300	0.434	0.467

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Border Tracts

- Tracts in FEMA-declared disaster counties grow significantly faster following a natural disaster
- Marginal effect of moving from tract with no Hispanic/black population to all Hispanic/black population entirely erases the benefit ($p = 0.57, 0.52$)
- Tracts with 2-3 times the median Hispanic or black population show no significant benefit from being in a FEMA-declared disaster county

Discussion

- Following a natural disaster, Hispanic and black census tracts grow more slowly than white tracts within the same county
- Hispanic and black tracts in counties with a major disaster declaration do not grow faster than similar tracts in counties where no disaster was declared
- The causal mechanism cannot be identified at present
 - ▶ Results consistent with a model where state and federal investment is lower in minority areas
- Results suggest that regions with large nonwhite populations would benefit from additional focus and oversight from policymakers

The End

Thank you!

A Model of Disaster Recovery

- Steady-state convergence in neoclassical growth models:

$$\ln Y(t) - \ln Y(0) = (1 - e^{-\lambda t}) [\ln Y(-1) - \ln Y(0)]$$

- ▶ $Y(t)$: Output t months after a natural disaster
 - ▶ $Y(0)$: Output contemporaneous with natural disaster
 - ▶ $Y(-1)$: Pre-disaster level of output (steady-state)
 - ▶ $\ln Y(-1) - \ln Y(0)$: Decrease in output caused by disaster
 - ▶ λ : Rate of convergence
- If public investment depends on demographic characteristics X , then

$$\lambda = \lambda(X)$$

- If $x \in X$ is negatively associated with public investment, then x is negatively associated with growth: $\ln Y(t) - \ln Y(0)$

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Timing of Recovery

- Hispanic and black tracts recover more slowly in the short run (<3 months)
- Hispanic tracts grow faster in the long run (12 months)
- Black tracts appear worse off in long run
- Timing of public assistance may be important
- Alternative specification:

$$y_{id}(t+3) - y_{id}(t) = \beta_1(\%Hispanic_i/100) + \beta_2(\%black_i/100) + \\ + \delta[y_{id}(t) - y_{id}(-1)] + \theta'X_i + \mu_{cd} + \varepsilon_{cd}$$

Census Tract Growth Rate, Varying Time Frames

	<i>Dependent variable:</i>			
	$y(3) - y(0)$	$y(6) - y(3)$	$y(9) - y(6)$	$y(12) - y(9)$
	(1)	(2)	(3)	(4)
%Hispanic/100	-0.224*** (0.033)	0.007 (0.020)	0.025 (0.018)	0.038*** (0.013)
%Black/100	-0.120*** (0.023)	0.047* (0.027)	-0.018 (0.021)	-0.003 (0.011)
Observations	90,891	81,897	61,623	67,551
R ²	0.636	0.747	0.813	0.837

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

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