

The Role of Discrimination in Inequitable Exposure to Climate Risk

Christopher Timmins

Duke University

CLIMATE RISKS: THEORY AND PRACTICE

Federal Reserve Bank of San Francisco

November 4, 2022

Mechanisms → Climate Risk Exposure

- Siting
 - “urban renewal” projects
 - highway construction
 - flood control projects



https://www.bullcity150.org/uneven_ground/dismantling_hayti/

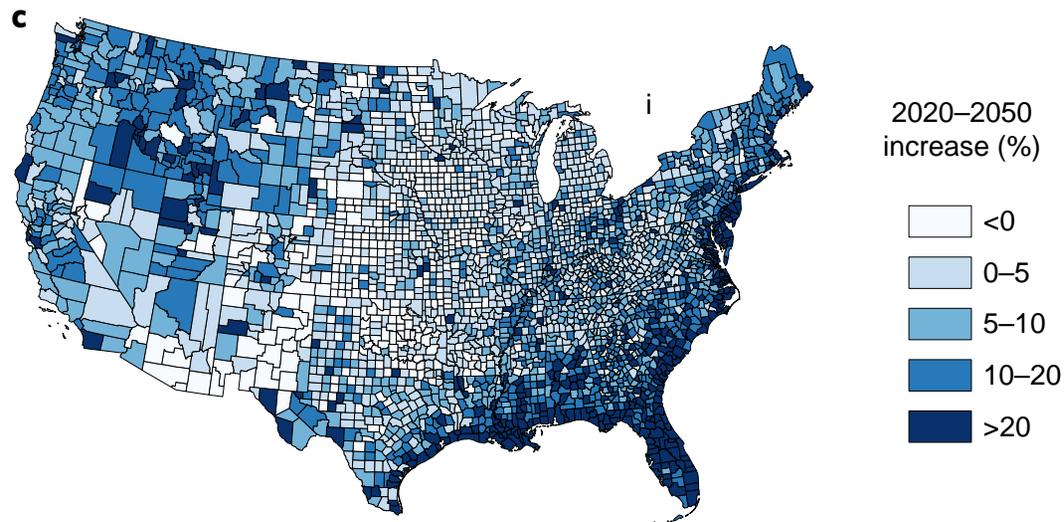


<https://archinect.com/features/article/150270301/trashing-the-community-backed-big-u-east-side-coastal-resilience-moves-forward-despite-local-opposition-will-nyc-miss-another-opportunity-to-lead-on-climate-and-environmental-justice>

Mechanisms → Climate Risk Exposure

- Siting
- Sorting
- Discrimination
 - Systemic discrimination in flood buyout programs (Jowers, Ma and Timmins, 2022)
 - Steering with respect to urban green space and rental housing (Timmins and Wang, 2022)

Motivation: *Increasing Flood Risk**



- 97.2% increase in population exposed to flood risk
- 26.4% increase in average annual flood losses, particularly in high %Black tracts

*Oliver E. J. Wing, William Lehman, Paul D. Bates, Christopher C. Sampson, Niall Quinn, Andrew M. Smith, Jeffrey C. Neal, Jeremy R. Porter and Carolyn Kousky. (2022) "Inequitable patterns of US flood risk in the Anthropocene." *Nature Climate Change*.

Climate Risk: *Adaptation*

- Strategies to adapt to increasing risk
 - flood-proofing infrastructure
 - risk-based flood insurance pricing
 - disaster assistance
 - managed retreat
- **Hazard Mitigation Grant Program (HMGP)** is primary source of federal funding for property acquisitions in the U.S.

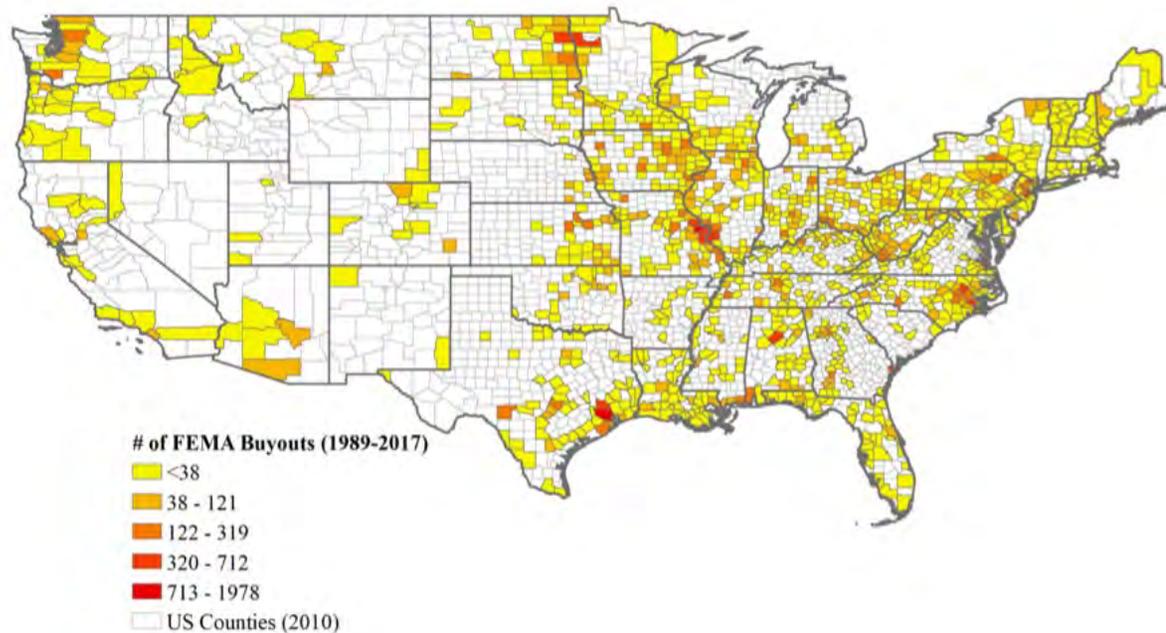
Hazard Mitigation Grant Program

- State or local government must submit an application (not individual) within 12 months of Presidential Disaster Declaration
- Applicant must demonstrate proposed acquisition satisfies CBA
- Property owners are given purchase offer based on pre-disaster market value of the property
- Property is demolished (or relocated)
- Land is deed-restricted in perpetuity to be maintained as area that can serve as floodplain (parks for outdoor recreational activities, wetlands management, nature reserves, cultivation, grazing, and camping).



BenDor, Todd K., David Salvesen, Christian Kamrath, and Brooke Ganser. "Floodplain buyouts and municipal finance." *Natural Hazards Review* 21, no. 3 (2020)

HMGP: *Where Do Buyouts Occur?*



43,633 buyouts of flood-prone properties across 1,148 counties in 44 states from 1989 to 2017

Buyouts: *Sources of Racial Bias*

- HMGP CBA requirements result in buyouts are more likely to be administered in areas of low socioeconomic status (Mach et al. 2019)
- Substantial Damage Declaration requires costly flood-proofing as a prerequisite for rebuilding if damage > 50% of home's pre-flood value.
- Temporary Rebuilding Moratoria make it difficult for owners without liquid assets to hold-out.
- Bargaining power and social capital with respect to deductions and additions to purchase offer

Data

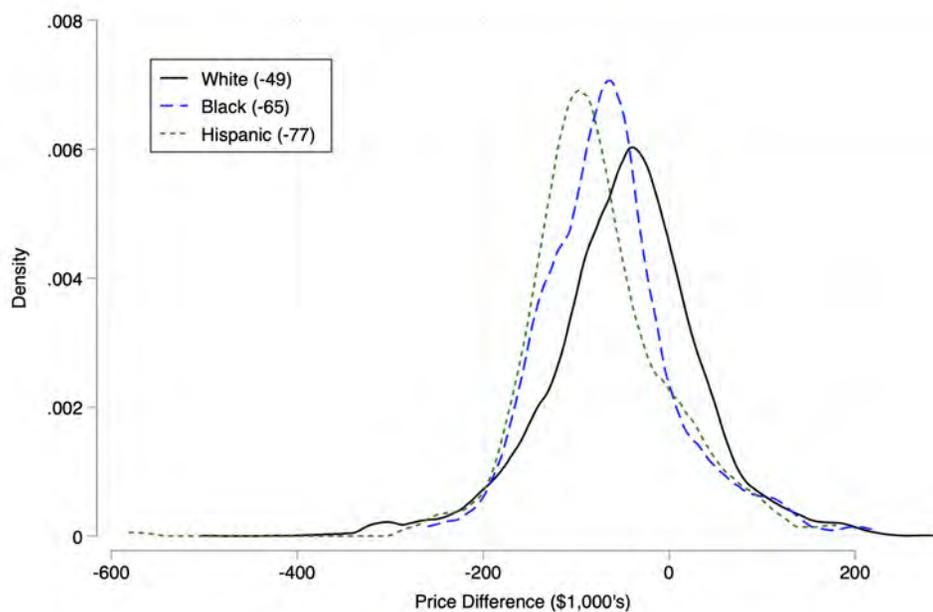
- FEMA Buyout Transactions
- Corelogic, Inc. (Property Sales Transactions Data)
- InfoUSA, Inc. (Household Mobility and WealthFinder Score)
- American Community Survey (Block Group Neighborhood Characteristics)

Analysis: *FMV Prediction*

$$P_{j,b,t} = \alpha_0 + \alpha_1 X_{j,t} + \eta_{b,t} + e_{j,b,t}$$

- Estimate hedonic model using ***non-buyout*** sales data
- 741 county-specific regressions
- Block-group x year fixed effects
- Predict price for ***buyout*** properties using model estimates

Figure 2: Price Discrepancy by Race



$$\frac{Actual - Predicted}{Predicted} = \beta_0 + \beta_1 Black_i + \beta_2 Hisp_i + \epsilon_i$$

Table 3: Percent Price Difference by Race

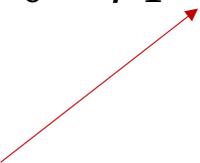
Panel A. Baseline Results				
Prediction	Tract & Yr	Blockgrp & Yr	Tract-by-Yr	Blockgrp-by-Yr
Black	-0.101*** (0.0217)	-0.0998*** (0.0215)	-0.106*** (0.0218)	-0.0966*** (0.0214)
Hispanic	-0.0851*** (0.0212)	-0.0837*** (0.0212)	-0.0856*** (0.0210)	-0.0814*** (0.0208)
Other	0.00866 (0.0959)	0.00944 (0.0954)	0.0151 (0.0912)	0.0291 (0.0856)
Observations	5,775	5,775	5,775	5,774
R-squared	0.155	0.159	0.133	0.157

Analysis: *Buyouts and Wealth*

Assess impacts on wealth before and after program participation by race:

$$\ln W_{i,t} = \beta_0 + \beta_1 \text{Post}_{i,t} + \beta_2 \text{Post}_{i,t} \times \text{Race}_i + \gamma_t + \eta_i + \epsilon_i$$

Post-buyout
indicator



Indicator for racial
group $i = \text{Black or}$
 Hispanic



Family fixed
effect

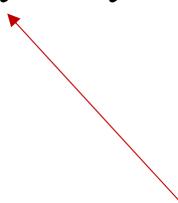
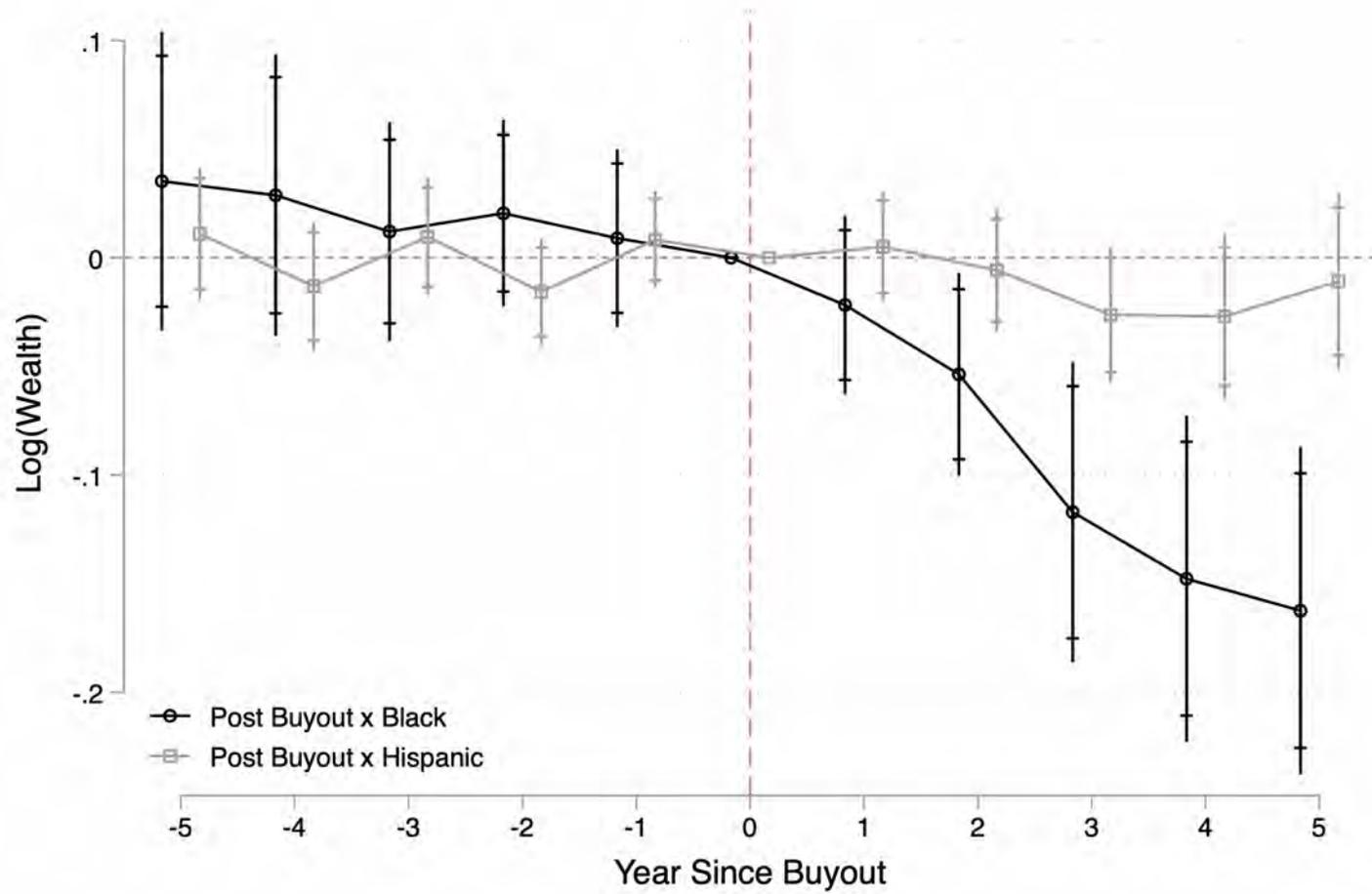


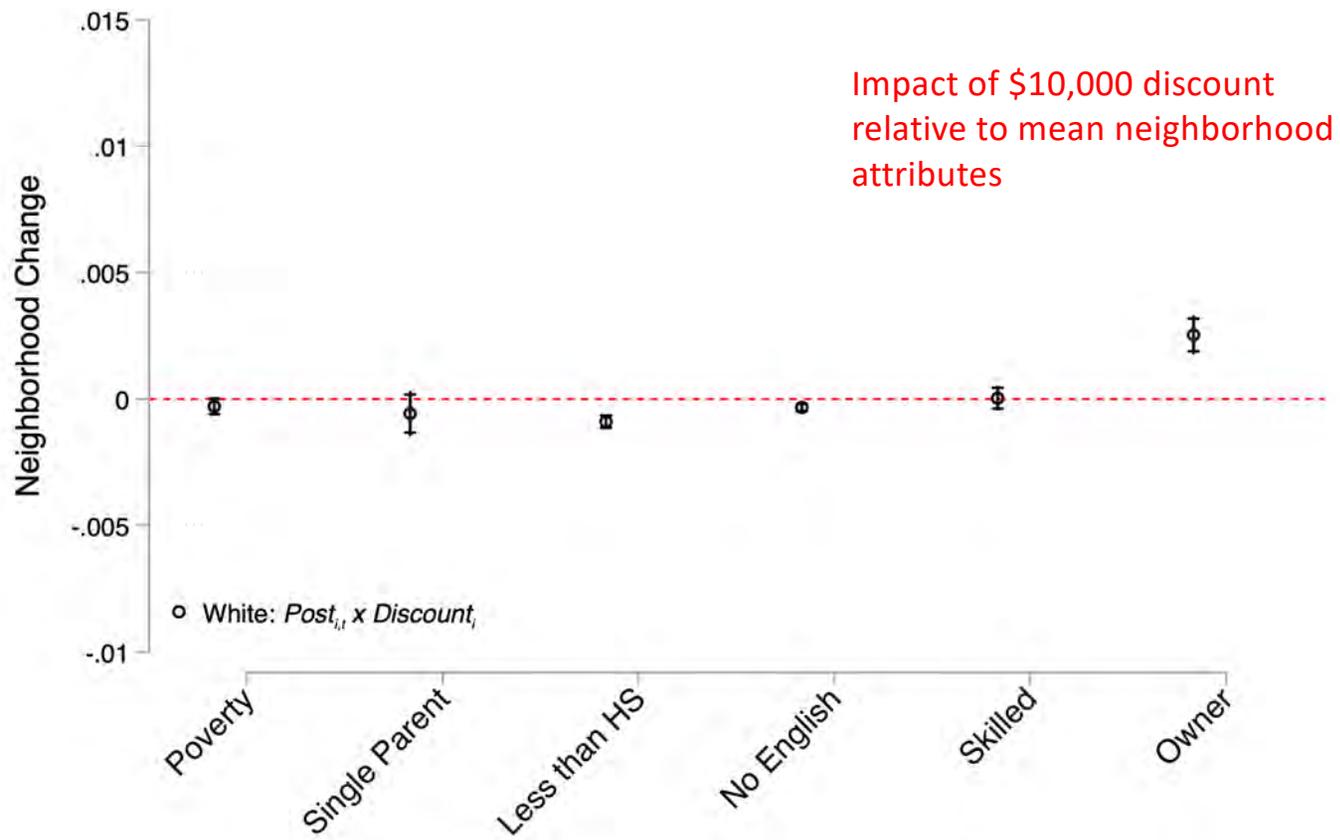
Figure 3: Event Study of Wealth Impact



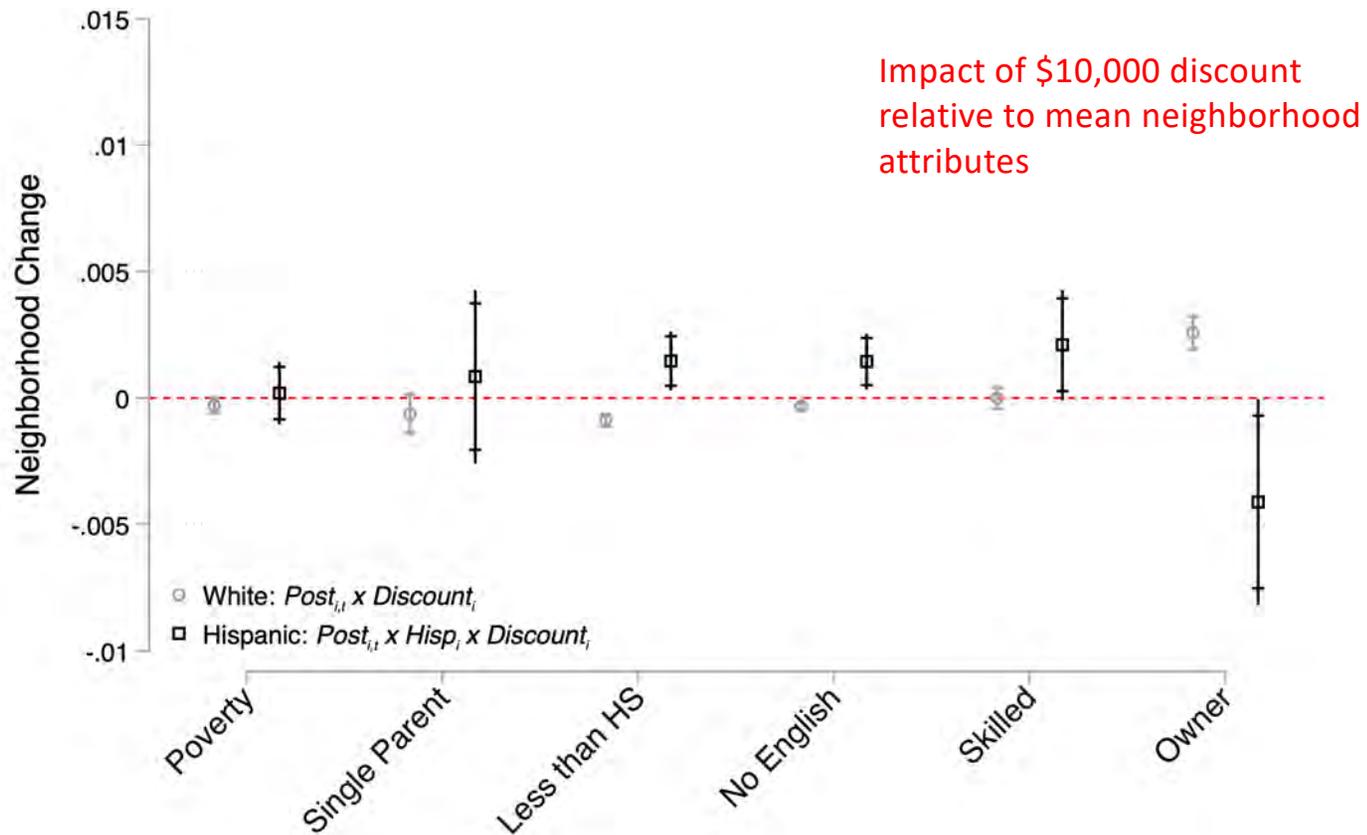
Buyouts and Wealth: *Impact of Discount*

	Race = Black		Race = Hispanic	
	(1)	(2)	(3)	(4)
Post	-0.00941** (0.00439)	-0.00658 (0.00452)	-0.0117*** (0.00437)	-0.00912** (0.00450)
Post x Race	-0.128*** (0.0248)	-0.0957*** (0.0252)	0.00486 (0.0148)	0.0139 (0.0155)
Post x Discount		-0.000996*** (0.000326)		-0.000938*** (0.000327)
Post x Race x Discount		-0.00814*** (0.00273)		-0.00263* (0.00148)
Observations	22,096	22,096	22,640	22,640
R-squared	0.821	0.821	0.817	0.817

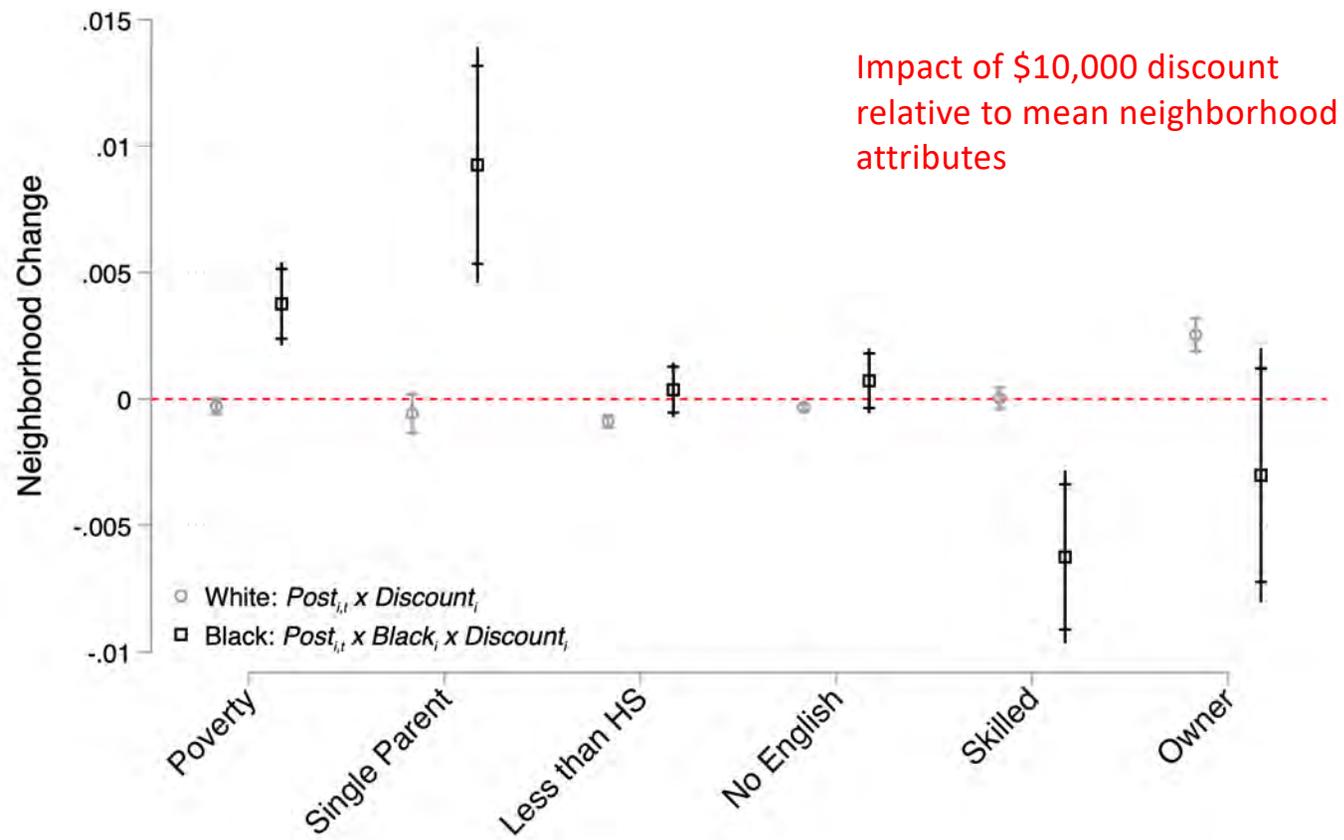
Neighborhood Change: *White*



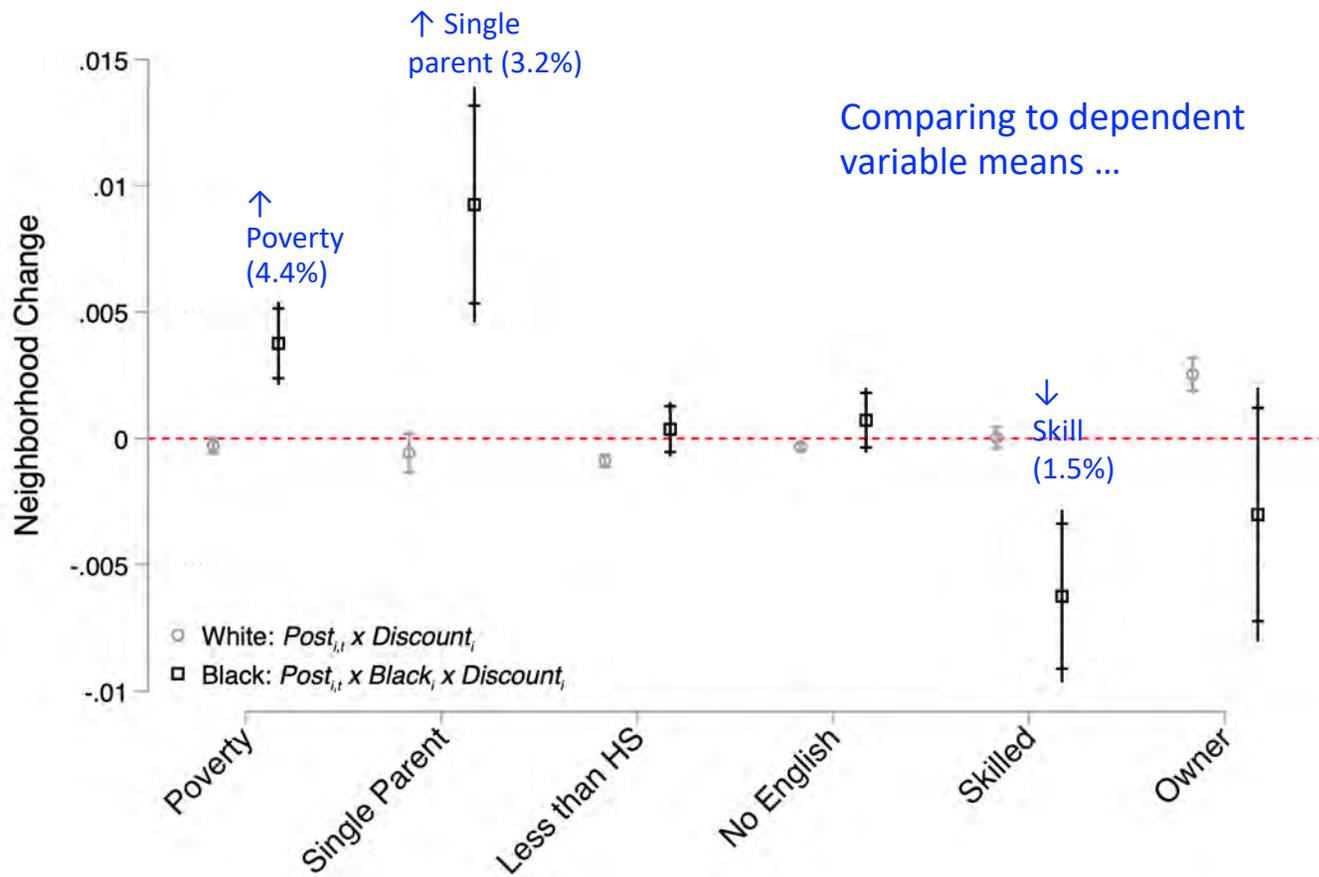
Neighborhood Change: *Hispanic*



Neighborhood Change: *Black*



Neighborhood Change: *Black*



Summary: *Key Results*

- Buyout compensations are systematically lower for Black and Hispanic property owners relative to white owners when compared to the pre-disaster fair market values
- Buyout discounts lead to
 - reductions in future wealth and income
 - relocation in neighborhoods with higher social vulnerability
- Compensation discount is more damaging for people of color in terms of wealth accumulation and neighborhood change

Heat Risk and Urban Green Space

Relationship between impervious surface, urban green space, and the urban heat island effect:

- B. M. Jesdale, R. Morello-Frosch, L. Cushing, The racial/ ethnic distribution of heat risk-related land cover in relation to residential segregation. *Env. Health Persp.* 121, 811–817 (2013).
- Ziter, C. D., E. J. Pedersen, C. J. Kucharik, and M. G. Turner. "Scale-dependent interactions between tree canopy cover and impervious surfaces reduce daytime urban heat during summer." *PNAS*. 116, no. 15 (2019): 7575-7580.



<https://grist.org/cities/who-gets-a-park-cities-parkscore-equity/>

Housing Discrimination and Climate Risk*

Combine results from correspondence study of racial discrimination in rental housing markets with geocoded data on urban trees.

- Sample frame: Census tracts selected randomly from 50 largest MSA's
- Racialized identities (Gaddis 2017) request access to view apartments listed on major online rental platform
- Each listed rental unit receives 1 inquiry from an identity within each race group (random sequence and timing).

*"Racial Discrimination and Housing Outcomes in the United States Rental Market," with Peter Christensen and Ignacio Sarmiento-Barbieri. NBER WP #29516

Housing Discrimination and Climate Risk



Overlap between experimental and tree data.

Correspondence Study: *Analysis*

$$\begin{aligned} \text{Response}_{ij} = & \beta_A \text{African American}_j + \beta_L \text{Hispanic} + \\ & \gamma_A \text{African American}_j \times \text{Tree}_i + \\ & \gamma_L \text{Hispanic} \times \text{Tree}_i + \\ & \theta X_j + \delta_i + \varepsilon_{ij} \end{aligned}$$

- $\text{Tree}_i = 1/\text{distance weighted tree count within distance buffer}^*$
- $X_j =$ identity characteristics (education, gender) and inquiry sequence
- $\delta_i =$ property fixed effect
- $\text{Response}_{ij} = 1$ if identity j receives a positive response from property i

*<https://datadryad.org/stash/dataset/doi:10.5061/dryad.2jm63xsrf>

Determinants of Response to Request to View Rental

Dep. Var.: Response	Baseline	50m	100m	150m	200m
Hispanic/LatinX	-0.029** (0.012)	-0.023 (0.015)	-0.022 (0.016)	-0.020 (0.017)	-0.019 (0.017)
African American	-0.057*** (0.014)	-0.046*** (0.016)	-0.033** (0.015)	-0.034** (0.016)	-0.031* (0.016)
Hispanic/LatinX x Tree		-0.021 (0.027)	-0.012 (0.012)	-0.010 (0.009)	-0.008 (0.007)
African American x Tree		-0.039* (0.021)	-0.038*** (0.008)	-0.024*** (0.006)	-0.020*** (0.005)
1[Inquiry Order = 2]	-0.037*** (0.008)	-0.037*** (0.008)	-0.036*** (0.008)	-0.036*** (0.008)	-0.036*** (0.008)
1[Inquiry Order = 3]	-0.061*** (0.010)	-0.061*** (0.010)	-0.061*** (0.010)	-0.060*** (0.010)	-0.060*** (0.010)
1[Male]	-0.043*** (0.008)	-0.043*** (0.008)	-0.043*** (0.008)	-0.043*** (0.008)	-0.043*** (0.008)
1[Low Education]	0.001 (0.014)	0.001 (0.014)	0.001 (0.013)	0.001 (0.013)	0.001 (0.013)
1[Medium Education]	-0.021 (0.014)	-0.021 (0.014)	-0.021 (0.014)	-0.021 (0.014)	-0.021 (0.014)
Constant	0.699*** (0.013)	0.656*** (0.011)	0.656*** (0.011)	0.656*** (0.011)	0.656*** (0.011)
Property FE	Y	Y	Y	Y	Y
Observations	7,041	7,041	7,041	7,041	7,041

% Reduction in Response Probability Relative to White Identity by Tree Exposure at 200m

	African American	Hispanic
Baseline	-0.082	-0.041
No Trees	-0.047	-0.029
Mean	-0.087	-0.044
75th Pct	-0.108	-0.053
90th Pct	-0.131	-0.063