FEMA's Financial Housing Assistance To Owners and Renters After Hurricane Harvey

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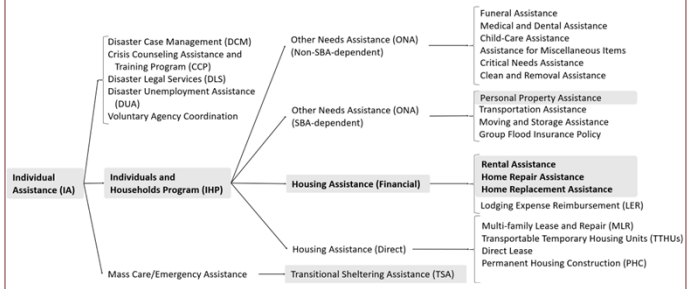
(1) Introduction

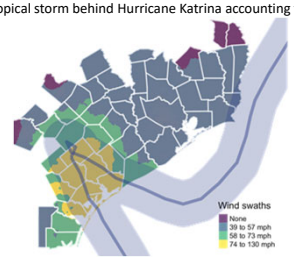
- In the aftermath of large natural disasters, sources of public funding to affected individuals and households are critical in facilitating housing recovery. FEMAs Individual Assistance (IA) is one such critical program. IA includes seven programs and services (listed in the figure below) available following a Major Disaster Declaration. The IA sub-program, Individual and Households Program (IHP), provides rental, repair, replacement, and other needs assistance (ONA) for eligible renter- and owner-occupied households.

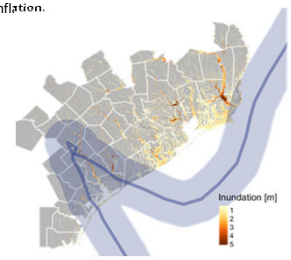


- In this research, we examine as a case-study IHP funding for Hurricane Harvey (2017) in Texas under the disaster designation DR-4332-TX. We leverage publicly available OpenFEMA data and integrate data from a variety of sources to identify hazard exposure, physical and social vulnerabilities including disaster-declared areas, flood inundation, wind swaths, storm track, housing characteristics, and socio-economic and -demographic characteristics. We model discrete stages of the application and funding process with independent variables motivated from eligibility requirements and hazard exposure and social factors that may correlate with procedural inequities. Our immediate goal is twofold: (1) to describe IHP funding with respect to Harvey and identify correlates of funding, and (2) to develop a set of predictive models that help identify areas and households more likely to need assistance in future disaster scenarios.

(2) Hurricane Harvey

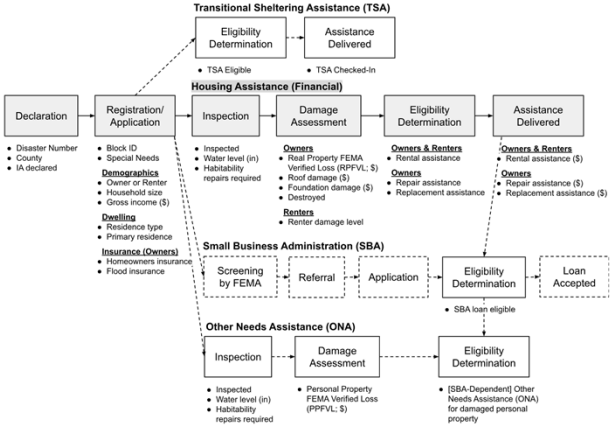
- Hurricane Harvey made landfall on August 25, 2017, near Port Aransas as a Category 4 hurricane with maximum sustained winds of 130 mph. After initial impact, Harvey's track led back out to the coast and though wind speed decreased, the storm remained fixed for four days releasing as much as 60 inches of rain over the Houston region. The storm made a second landfall in Southeast Texas and Western Louisiana on August 30, 2017. Over 200,000 homes and businesses were damaged or destroyed, over 30,000 people were displaced, and 89 people died according to the National Oceanic and Atmospheric Administration (NOAA). Predicted damage was $155 billion (inflation adjusted; $125.0 billion unadjusted) making it the 2nd most costly tropical storm behind Hurricane Katrina accounting for inflation.





(3) OpenFEMA Data

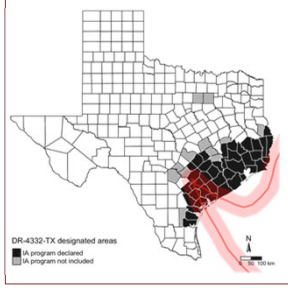
- Through the OpenFEMA data sharing program, FEMA has made various IHP datasets publicly available for openness, transparency, and better understanding of federal disaster assistance programs. For this research, we use (1) the Disaster Declarations Summaries file to identify Disaster Recovery (DR) disaster numbers for Hurricane Harvey and areas declared eligible for IA; and (2) the IHP - Large Disasters (IHP-LD) dataset which provides micro-level, deidentified data regarding household-applicants, spatially identifiable to Census block. The figure below depicts the ~40 variables available in the IHP-LD dataset organized by distinct stages in the IHP application and funding process.



- The dataset is filtered to identify the 895,636 IA application records associated with the disaster number DR-4332-TX. Approximately 91% (814,139 total applicants: 415,796 owners and 398,343 renters) are retained in the modeling portion of analysis and 9% are omitted due to coding errors, non-sensical values, and Census blocks located outside of a declared county.

(4) IHP Applications, Eligibility, and Funding

- Approximately 30 percent of individuals and households in Texas were situated in IA designated counties. Out of ~2.85m households in these counties, over 895k applied for IHP. On average, funded homeowners received $2,367 in rental assistance and $10,320 in repair/replacement assistance. Renters received $2,202 in rental assistance.

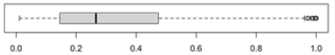


Count of individuals and occupied housing units

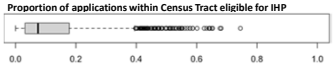
	Individuals in housing units	Occupied housing units		
		Total	Owner	Renter
In IA designated areas	8,117,295	2,853,287	1,763,364	1,089,923
In Texas	26,815,013	9,430,419	5,851,046	3,579,373

Source: 2013-2017 ACS 5-year

Proportion of households within Census Tract that applied for IHP



Proportion of applications within Census Tract eligible for IHP



Assistance amount received by assistance type and tenure

	Homeowner		Renter		Total	
	Mean	SD	Mean	SD	Mean	SD
Rental assistance	$2,367	$1,593	$2,202	$1,741	$2,313	$1,644
Repair/replacement assistance	$10,320	$8,590			$10,320	$8,590
Any assistance	$9,145	$8,874	$2,202	$1,741	$7,260	$8,230

(5) Models

- We model distinct stages in the IHP application process – specifically, inspection, rental assistance eligibility, and repair/replacement assistance eligibility as dichotomous outcomes using multilevel linear probability models. The amount of repair and rental assistance are modeled as continuous outcomes using multilevel regression models. Damage and structure type variables differ by tenure type, and initial, pooled models suggested structural differences in model estimates between owners and renters; therefore, we estimate separate models for owners and renters. The set of observations in each model is conditional on a prior stage in the IHP process. For example, those inspected had applied and those eligible were inspected. Variables are grouped conceptually and are included based on (1) a base set applicable for each outcome and based on stated eligibility requirements, (2) additional hazard exposure variables not in the OpenFEMA data, and (3) variables to test for procedural inequities, that is, social characteristics that may be associated with disproportionate allocation of funding by nature of program design, though potentially unintended. Variables are measured at the applicant level as acquired from OpenFEMA or at the Census Tract level for non-OpenFEMA data. See variable footnotes for data sources. HUD income thresholds standardize income levels relative to housing costs that vary geographically and by housing size. Census Tract random effects are included to control for unobservable factors that vary across and are correlated within Tracts.

	OWNERS					RENTERS				
	INSPECTION	ELIGIBILITY	ELIGIBILITY	AMOUNT	AMOUNT	INSPECTION	ELIGIBILITY	ELIGIBILITY	AMOUNT	AMOUNT
		Repair/Replace	Rental	Repair/Replace	Rental		Repair/Replace	Rental	Repair/Replace	Rental
constant	0.7789***	0.2314***	0.1600***	4,337.60***	1,082.14***	0.5363***	0.0006		1,018.10***	
SOCIO-ECONOMIC										
household size	0.0276***	0.0121***	0.0069***	71.56***	309.11***	0.0283***	0.0060***		210.70***	
HUD INCOME THRESHOLDS (1.high=ref)										
2.medium	0.0210***	0.0014	-0.0001	-360.61***	97.55***	0.0024	-0.0053*		93.89***	
3.low	0.0413***	0.0060*	0.0036	-443.72***	123.25***	0.0171***	-0.0148***		176.59***	
4.very_low	0.0798***	0.0136***	0.0058*	-583.94***	113.99***	0.0954***	-0.0202***		220.01***	
5.extremely_low	0.0962***	0.0114***	0.0112***	-672.78***	141.47***	0.1545***	-0.0235***		143.10***	
9.unknown_income	0.0394***	-0.0323***	-0.0357***	-329.22***	48.32*	0.0874***	-0.0252***		83.04***	
RACE-ETHNICITY										
Hispanic, percent of owner (or renter) households in Tract	-0.0003*	-0.0001	-0.0005**	-20.03***	-2.17***	-0.0000	-0.0002***		-0.53	
Black, percent of owner (or renter) households in Tract	-0.0001	-0.0005***	-0.0003*	-12.01***	-0.77	0.0007***	-0.0001**		0.84	
RESIDENTIAL TYPES (1.house/duplex=ref)										
2.apartment	0.2047***	-0.0058	0.0118	-1,507.15***	25.92	-0.0683***	0.0318***		-193.68***	
3.townhome	-0.0851***	0.0110	0.0298*	-947.15***	-84.03	-0.0533***	0.0172***		-65.69	
4.condo	0.0036	0.0129	0.0799***	-1,375.13***	42.87	0.0104	0.0271***		83.54	
5.mobile_home	0.0966***	-0.0424***	-0.0325***	-680.33***	-103.66***	0.0194***	0.0054*		-140.48***	
6.travel_trailer	0.1520***	-0.1120***	0.0694***	-1,516.26***	-98.93***	0.0915***	0.0208**		-200.40***	
7.boat	0.1081*	-0.1694***	-0.0762	-9,790.39**	-207.37*	0.1415*	-0.0373		-61.28	
9.other	-0.4358***	-0.1792***	-0.1101***	-2,843.11*	110.51	-0.3541***	0.0026		-237.54***	
INSURANCE COVERAGE (0.none=ref)										
1.homeowners_only	-0.1770***	-0.0019	-0.0729***	987.08***	20.22					
2.flood_only	-0.0101***	-0.2984***	-0.0054	-8,278.44***	52.50*		Not Applicable			
3.homeowners_and_flood	-0.0849***	-0.4587***	-0.0278***	-10,279.44***	134.16***					
HAZARD EXPOSURE										
inundation (F; mean of Tract)	0.0221***					0.0208***				
wind field (mph; mean of Tract)	-0.0034***	-0.0007**	-0.0007***	-17.54***	-0.12	-0.0014***	0.0004**		-0.44	
in storm tract buffer (31 mi)	0.1278***	0.0627***	0.0331***	92.20*	-404.94***	0.1503***	0.0303**		-379.68***	
in coastal county	0.0294***	0.0075	0.0166*	670.57**	281.28***	0.0343***	0.0007		167.79***	
INSPECTION										
water level (ft)		0.0332***	0.0466***	711.30***	25.95***		0.0189***		30.46***	
OWNER DAMAGE										
Real property FEMA verified loss (RPFVL; in '000s of $)		0.0158***	0.0199***	573.46***	6.39***					
RENTER DAMAGE (0.LT Mod=ref)										
1.moderate									0.7430***	437.94***
2.major		Not Applicable					Not Applicable		0.6882***	404.37***
3.destroyed									0.6751***	472.81***
sd(Tract)	0.1177	0.0993	0.0932	0.00	219.29	0.0959	0.0277		369.25	
sd(Residual)	0.4034	0.3748	0.3572	4,340.55	1,454.99	0.4401	0.2152		1,632.76	
N	415,796	296,553	296,553	87,042	94,098	398,343	268,937		47,285	
p	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	
r2_w				0.623	0.106				0.055	
r2_b				0.892	0.180				0.103	
r2_o				0.726	0.130				0.073	
rmse				4,492.51	1,456.38				1,639.55	

Note: The LPMs are estimated using Stata -mixed- command with maximum likelihood and the Amount models using -xtreg, re- with GLS; all models have Census Tract random intercepts; clustered standard errors using -vce(cluster)-.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

(6) Findings on Probability of Inspection and Eligibility

- The **probability of inspection** increased with household size and hazard exposure and lower levels of income. Relative to house/duplex, townhomes were inspected at lower rates while most others residential types were higher. Property size differences for owner- and renter-occupied apartments (small vs large) can partially explain the contrasting inspection rates. The **probability of rental assistance** increased with household size, hazard exposure, and damage. Homeowner insurance decreased the probability, likely due to *loss of use* coverage. Lower income owners were more likely to receive rental assistance - but lower income renters, less likely. For owners and renters, the probability increased for multi-unit residential types (apartment, townhouse, condo) and travel trailers; whereas the probability increased (decreased) for mobile-home owners (renters). The **probability of repair or replacement assistance** increased with household size, lower income, and hazard exposure and decreased with more physically vulnerable residence types (mobile home, trailer, boat) and flood insurance. The effects of race are mixed across models, and when significant, are substantively small. The effects of wind contrast with other hazard exposure variables but are also substantively small. Effects must also be interpreted contextually with respect to housing values.

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Acknowledgements

- This research was supported by funding through NIST-funded Center for Risk-Based Community Resilience Planning (CoE), the Interdependent Networked Community Resilience Modeling Environment (IN-CORE), award numbers 70NANB15H044 and 70NANB20H008. More information at http://resilience.colostate.edu/
- The views expressed are those of the presenter and may not represent the position of the institutions.
- Analysis uses R, an open-source language and environment for statistical computing and graphics. Stata is also used.