

# Flood Insurance Market Penetration and Expectations of Disaster Assistance:

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# Motivation

- Participation in the NFIP is remarkably low.
- Uptake in high risk SFHA zones can be as low as 50% in some parts of the country.
  - Subsidized rates
  - Mandatory purchase requirements

# Motivation

- Empirical 'charity hazard' literature.

## In Support

- Davlasheridze & Miao (2017)
- Kousky, Michel-Kerjan, & Raschky (2017)

## In Opposition

- Browne & Hoyt (2000)
- Petrolia, Landry, & Coble (2013)
- Petrolia, Hwang, Landry, & Coble, (2015)

# Contribution

- We are the first to highlight the existence and degree of charity hazard in the NFIP using individual survey data.
- We reconcile some of the conflict in the empirical charity hazard literature.

# Preview of Results

- Once we correct for the endogeneity, we find that homeowners with strong expectations of government post disaster aid are **22% less likely** to hold a flood insurance policy.

# Data

- We use the same data set as Petrolia et al. (2013, 2015).
- Individual level survey data was obtained via an online survey in August - September 2010
- Property owners on the gulf coast: Florida, Alabama, Mississippi, Louisiana, & Texas.

# Model

$$I_i = 1[G_i + X_{i1}\beta_1 + \lambda_s + \epsilon_i > 0] \quad (1)$$

$$G_i = 1[Z_i\delta + X_{i2}\beta_2 + \mu_i > 0] \quad (2)$$

- $I_i = 1$  if respondent holds a flood insurance policy
- $G_i = 1$  if respondent is confident in federal post disaster aid
- $X_i$ : Demographic characteristics and survey responses
- $\lambda_s$ : State fixed effect
- $Z_i$ : instruments
- $(\epsilon, \mu | X_1 X_2) \sim N(0, 0, 1, 1, \rho)$

# Instruments

- History of FEMA payments: Count of the number of instances federal aid was given to the individuals county in a year that their home was damaged from flooding.
- Congressional Representation: The total number of representatives on Stafford Subcommittees that an individual had in years that their home was damaged.
  - Garrett & Sobel. (2003)
  - Sylves & Buzas. (2007)
  - Kousky, Michel-Kerjan, & Raschky. (2017)



## Results

	Probit	Probit	Bivariate Probit	
Gov't Confidence	0.26*		-0.87***	
	(0.13)		(0.27)	
Exp. of Fut. Hurr.	0.01	0.01	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)
Exp. Hurr. Damage	0.05**	0.05**	0.05**	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
SFHA	1.11***	1.12***	1.03***	0.20*
	(0.12)	(0.12)	(0.15)	(0.11)
Risk Averse (gain)	-0.01	-0.01	-0.01	0.01
	(0.03)	(0.04)	(0.03)	(0.03)
Risk Averse (loss)	0.08**	0.09**	0.07**	-0.00
	(0.04)	(0.04)	(0.03)	(0.03)
Insurer Confidence	0.20	0.25**	0.42***	0.64***
	(0.12)	(0.11)	(0.11)	(0.07)
Previous Flood Events	0.47***	0.41**	0.39***	0.15
	(0.14)	(0.17)	(0.13)	(0.11)
Coastal Tenure	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Distance from Coast (km)	-0.01**	-0.01***	-0.01**	0.00
	(0.00)	(0.00)	(0.00)	(0.00)

## Results

Mortgage	0.36*** (0.09)	0.38*** (0.11)	0.35*** (0.09)	0.10 (0.10)
Income	0.07*** (0.01)	0.06*** (0.01)	0.03 (0.02)	-0.08*** (0.01)
Male	0.05 (0.10)	0.07 (0.10)	0.11 (0.09)	0.19** (0.09)
Kids	-0.21* (0.12)	-0.21* (0.12)	-0.14 (0.13)	0.15 (0.10)
Alabama	0.02 (0.22)	0.01 (0.33)	0.11 (0.21)	0.43*** (0.10)
Louisiana	0.56** (0.25)	0.53*** (0.16)	0.41 (0.25)	-0.16 (0.16)
Texas	0.88*** (0.08)	0.84*** (0.13)	0.69*** (0.12)	-0.10 (0.12)
Mississippi	0.46 (0.39)	0.37 (0.41)	0.51 (0.36)	0.47*** (0.14)
PA Grants (Damage Years)		0.09 (0.10)		-0.16** (0.08)
Stafford Repts (Damage Years)		0.05 (0.11)		-0.16* (0.09)
Constant	-2.55*** (0.22)	-2.36*** (0.31)	-1.42*** (0.54)	0.60*** (0.23)
Observations	812	812	812	
$H_0 : \rho = 0$			0.012	
Rivers-Vuong Test for Exogeneity			0.073	

Notes: Cluster-corrected standard errors in parentheses.

# Results

- After instrumenting for government expectations of aid:
  - The estimated coefficient for expectations of government aid was more significant, larger in magnitude, and negative.
  - Individuals who are confident in government post disaster aid are 22% less likely to hold a flood insurance policy.

## Appendix

Table 2: Descriptive Statistics

	mean	sd	min	max
Policy	0.36	0.48	0	1
Gov't Confidence	0.58	0.49	0	1
PA Grants (Damage Years)	0.33	0.60	0	3
Stafford Reps (Damage Years)	0.21	0.57	0	6
Exp. of Fut. Hurr.	6.90	10.46	0	90
Exp. Hurr. Damage	3.37	2.25	0	10
SFHA	0.22	0.41	0	1
Risk Averse (gain)	2.95	1.44	0	5
Risk Averse (loss)	2.92	1.36	0	5
Isurer Confidence	0.67	0.47	0	1
Previous Flood Events	0.09	0.47	0	7
Coastal Tenure	28.58	18.67	0	93
Distance from Coast (km)	16.29	18.20	0	172
Mortgage	0.64	0.48	0	1
Income	12.20	3.94	1	19
Male	0.45	0.50	0	1
Kids	0.26	0.44	0	1
Alabama	0.02	0.16	0	1
Louisiana	0.12	0.33	0	1
Texas	0.23	0.42	0	1
Mississippi	0.01	0.12	0	1
Observations	812			

## Appendix

	OLS	2SLS		
		Reduced Form	First Stage	Second Stage
Gov't Confidence	0.08** (0.04)			-0.33* (0.18)
Exp. of Fut. Hurr.	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Exp. Hurr. Damage	0.02** (0.01)	0.02** (0.01)	0.01 (0.01)	0.02*** (0.01)
SFHA	0.37*** (0.04)	0.37*** (0.04)	0.07* (0.04)	0.40*** (0.04)
Risk Averse (gain)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)	-0.00 (0.01)
Risk Averse (loss)	0.02** (0.01)	0.02** (0.01)	-0.00 (0.01)	0.02* (0.01)
Isurer Confidence	0.05 (0.04)	0.07** (0.03)	0.23*** (0.03)	0.15*** (0.06)
Previous Flood Events	0.11*** (0.03)	0.10*** (0.03)	0.05 (0.04)	0.12*** (0.03)
Coastal Tenure	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Distance from Coast (km)	-0.00**	-0.00***	-0.00	-0.00**

## Appendix

Mortgage	0.11*** (0.03)	0.12*** (0.03)	0.03 (0.03)	0.12*** (0.03)
Income	0.02*** (0.00)	0.02*** (0.00)	-0.03*** (0.00)	0.01 (0.01)
Male	0.02 (0.03)	0.02 (0.03)	0.06* (0.03)	0.04 (0.03)
Kids	-0.06* (0.04)	-0.06 (0.04)	0.05 (0.04)	-0.05 (0.04)
Alabama	-0.02 (0.07)	-0.02 (0.10)	0.14*** (0.03)	0.03 (0.06)
Louisiana	0.16* (0.08)	0.15*** (0.05)	-0.06 (0.06)	0.13 (0.09)
Texas	0.28*** (0.02)	0.27*** (0.04)	-0.04 (0.05)	0.25*** (0.03)
Mississippi	0.12 (0.13)	0.09 (0.13)	0.18*** (0.05)	0.18 (0.14)
PA Grants (Damage Years)		0.04 (0.03)	-0.05 (0.03)	
Stafford Reps (Damage Years)		0.01 (0.03)	-0.06* (0.03)	
Constant	-0.28*** (0.06)	-0.23*** (0.09)	0.72*** (0.08)	0.01 (0.16)
Observations	812	812	812	812
Wu-Hausman Test				0.047
Sargan Over ID Test				0.606
First Stage F-Stat				33.734

Notes: Cluster-corrected standard errors in parentheses.

## Appendix

	Probit			Bivariate Probit		
	Coeff.	Std. Err.	Marg. Eff.	Coeff.	Std. Err.	Marg. Eff.
Government Confidence	.256	.133	.075	-.869	.268	-.228
Future Hurricanes	.005	.005	.002	.007	.005	.003
Future Damage	.047	.023	.014	.05	.021	.016
Risk Averse (gain)	1.106	.12	.326	1.032	.148	.292
Risk Averse (loss)	-.006	.028	-.002	-.005	.026	-.001
Insurer Confidence	.085	.037	.025	.071	.034	.019
Previous Flood Events	.199	.122	.059	.424	.114	.168
Mortgage	.465	.139	.137	.39	.13	.121
Coastal Tenure	-.002	.003	-.001	-.003	.003	-.001
Distance from Coast (km)	-.008	.003	-.002	-.008	.003	-.002
Required	.357	.094	.105	.348	.089	.104
Income	.069	.014	.02	.029	.021	0
Male	.047	.096	.014	.114	.087	.049
Kids	-.215	.119	-.063	-.136	.128	-.026
Alabama	.021	.219	.006	.111	.206	.067
Louisiana	.56	.253	.165	.406	.253	.082
Texas	.88	.084	.259	.69	.122	.161
Mississippi	.456	.388	.134	.51	.363	.2